

Title

**Summary of the Literature Review for GMB151 soybean  
July 1, 2022 – June 30, 2023**

**Final 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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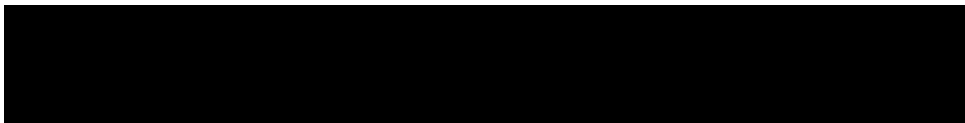
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Report	

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## SUMMARY

GMB151 soybean was developed through *Agrobacterium*-mediated transformation using the vector pSZ8832 containing the *Cry14Ab.1b* and *hppdPf-4Pa* gene cassettes. GMB151 soybean produces the Cry14Ab-1 protein, a crystal protein derived from *Bacillus thuringiensis*, which confers resistance to soybean cyst nematode. GMB151 also produces a modified 4-hydroxyphenylpyruvate dioxygenase (HPPD-4), derived from *Pseudomonas fluorescens*, which confers tolerance to HPPD inhibitor herbicides such as isoxaflutole. The OECD identifier of GMB151 soybean is BCS-GM151-6.

A scoping review was performed for the GMB151 soybean and its newly expressed proteins, HPPD-4 and Cry14Ab-1. The objective of this scoping review was to determine if there were studies about the molecular characterization of GMB151 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 July 1, 2022 to June 30, 2023. 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 146 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of four publications were progressed for detailed assessment.

One of the four publications was determined to be relevant after detailed review. The relevant article did not constitute new data on molecular characterization of GMB151 soybean, or the HPPD-4 and Cry14Ab-1 proteins, nor did it suggest any potential adverse effects on human and animal health or on the environment. No evidence was identified that would warrant conducting a systematic review.

## 1. INTRODUCTION

GMB151 soybean was developed through *Agrobacterium*-mediated transformation using the vector pSZ8832 containing the *Cry14Ab.1b* and *hppdPf-4Pa* gene cassettes. GMB151 soybean produces the Cry14Ab-1 protein, a crystal protein derived from *Bacillus thuringiensis*, which confers resistance to soybean cyst nematode. GMB151 also produces a modified 4-hydroxyphenylpyruvate dioxygenase (HPPD-4), derived from *Pseudomonas fluorescens*, which confers tolerance to HPPD inhibitor herbicides such as isoxaflutole. The OECD identifier of GMB151 soybean is BCS-GM151-6.

The objective of the literature searches described here was to determine if there were publications published between July 1, 2022 and June 30, 2023 that mention the molecular characterization of the GMB151 soybean, and/or any adverse effect of GMB151 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)<sup>1</sup> applications and post-market environmental monitoring activities (2019).

The literature searches were performed for the GMB151 soybean and its newly expressed proteins, HPPD-4 and Cry14Ab-1. The search terms also included relevant synonyms, the trade name and intended trait. When needed, plant species and general GMO terms were used to limit the search results (described in section 3.3).

## 2. OVERALL METHODS

### 2.1. Objective of the scoping review

The objective of the scoping review was to survey the evidence base for the GMB151 soybean and its newly expressed proteins, HPPD-4 and Cry14Ab-1, 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 note<sup>1</sup>.

**Question 1:** Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the GMB151 soybean and its newly expressed proteins HPPD-4 and Cry14Ab-1?

**Key elements:**

**Population:** Human health; animal health; environmental safety

**Exposure:** GMB151 soybean, derived food/feed products, newly expressed proteins in GMB151 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 GMB151 soybean and its newly expressed proteins HPPD-4 and Cry14Ab-1 in soybean?



**Key elements:**

**Population:** GMB151 soybean and newly expressed proteins in GMB151 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<sup>1</sup> 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
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

Concepts	Criteria	Comment
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

Concepts	Criteria	Comment
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 were used to test and validate the search profile:

- Dreesen R, Capt A, Oberdoerfer R, Coats I, Pallett KE. 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-FGØ72-2 soybean; Regulatory Toxicology and Pharmacology **97** (2018) 170 – 185
- Dreesen R, Capt A, Oberdoerfer R, Coats I, Pallett KE. 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 **21** (2018) 111 – 121

Although these articles are not directly relevant for GMB151 soybean, they were selected as reference publications because they mention a closely related protein (HPPD W336), the crop (soybean) and one of the intended traits (herbicide tolerance). Since these references were published before the current search period, the search profile was tested without applying the time limit used in the final search profile (UP>=20220701 and UP<=20230630).

### 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<sup>1</sup>. 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 July 10, 2023. Only documents updated between July 1, 2022 and June 30, 2023, 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, newly expressed proteins and intended traits. Since the 'newly expressed proteins' profiles and the 'intended trait' profiles produced too many results when used on their own, they were combined with additional profiles: the 'newly expressed proteins' profiles were combined with a 'plant species' profile while the 'intended trait' profiles were combined with a 'general GMO' profile as well as with the '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	Profile	Concept/key element
1	GMB151 or GMB(w)151 or BCS(w)GM151(w)6 or BCS-GM151-6 or BCS(w)GMB151?	Event
2	None	Trade name
3	HPPD(w)4 or HPPD4 or hppd(w)Pf(w)4Pa or hppdPf(w)4Pa 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?) or Cry14Ab-1 or Cry14Ab(w)1 or Cry(w)14Ab(w)1 or Cry(w)14(w)Ab(w)1 or Cry14(w)Ab1 or Cry(w)14Ab1 or Cry14Ab1 or Cry14Ab-1 or Cry14Ab(w)1 or Cry(w)14Ab(w)1 or Cry(w)14(w)Ab(w)1 or Cry14(w)Ab1 or Cry(w)14Ab1 or Cry14Ab1 or Cry14Ab-I or Cry14Ab(w)I or Cry(w)14Ab(w)I or Cry(w)14(w)Ab(w)I or Cry14(w)AbI or Cry(w)14AbI or Cry14AbI or cry14Ab-1.b or cry14Ab(w)1(w)b or cry14Ab(w)1b or cry(w)14Ab(w)1(w)b or cry(w)14Ab(w)1(w)b or cry(w)14(w)Ab(w)1(w)b or cry(w)14Ab(w)1b or cry(w)14Ab1(w)b or cry14Ab1b or cry14Ab-1.b or cry14Ab(w)1(w)b or cry14Ab(w)1b or cry(w)14Ab(w)1(w)b or cry(w)14Ab(w)1(w)b or cry(w)14(w)Ab(w)1(w)b or cry(w)14Ab(w)1b or cry(w)14Ab1(w)b or cry14Ab1b or cry14Ab-I.b or cry14Ab(w)I(w)b or cry14Ab(w)Ib or cry(w)14Ab(w)I(w)b or cry(w)14Ab(w)I(w)b or cry(w)14(w)Ab(w)I(w)b or cry(w)14Ab(w)Ib or cry(w)14AbI(w)b or cry14AbIb	Newly expressed proteins

Set	Profile	Concept/key element
4	((herbicid? or HPPD(w)inhibitor# or diketonitrile# or pyrazolone# or triketone# or isoxaflutol## or IFT) (5a) (resist? or toleran? or protect?)) or ((nematode# or soybean(w)cyst(w)nematode# or SCN or Heterodera(w)glycines or H(w)glycines) (5a) (resist? or toleran? or protect? or control))	Intended traits
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?(3w) (modif? OR transform? OR manipul? OR improv? OR engineer?))	GMO general
7	4 and 5 and 6	Intended trait AND Plant species AND GMO general
8	1 or 3 or 7	Event name OR Newly expressed proteins OR (Intended trait 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 (GMB151)	New proteins (HPPD-4 and Cry14Ab-1)	Traits (herbicide resistance and nematode resistance)	Plant species (soybean)	GM plants (general terms)
<b>Agricola</b>	no CT	no CT	"HERBICIDE RESISTANCE"/CT "NEMATODE CONTROL"/CT	"GLYCINE MAX"/CT	"TRANSGENIC PLANTS"/CT
<b>Biosis</b>	no CT	no CT	no CT	no CT	no CT
<b>CABA</b>	no CT	no CT	"HERBICIDE RESISTANCE"/CT "NEMATODE CONTROL"/CT	SOYABEANS/CT	"TRANSGENIC PLANTS"/CT
<b>CAS</b>	no CT	no CT	"HERBICIDE RESISTANCE"/CT No CT for nematode resistance	"GLYCINE MAX"/CT	"GENETICALLY MODIFIED PLANTS"/CT
<b>Medline</b>	no CT	no CT	"HERBICIDE RESISTANCE"/CT No CT for nematode resistance	SOYBEANS/CT	"PLANTS, GENETICALLY MODIFIED"/CT

The search results were limited to documents updated between July 1, 2022 and June 30, 2023 (UP>=20220701 and UP<=20230630), 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	CABA	CA-Plus	Medline
<b>Database Provider</b>	STN International	STN International	STN International	STN International	STN International
<b>Coverage</b>	1970-present	1926-present	1973-present	1907-present	1946-present
<b>Date of search</b>	10 Jul 2023	10 Jul 2023	10 Jul 2023	10 Jul 2023	10 Jul 2023
<b>Datespan of the search</b>	1 Jul 2022 – 30 Jun 2023	1 Jul 2022 – 30 Jun 2023	1 Jul 2022 – 30 Jun 2023	1 Jul 2022 – 30 Jun 2023	1 Jul 2022 – 30 Jun 2023
<b>Latest database update</b>	7 Jun 2023	5 Jul 2023	27 Jun 2023	9 Jul 2023	9 Jul 2023
<b>Number of records retrieved</b>	17	35	56	43	41
<b>Number of records after duplicate removal</b>	17	29	38	21	41
<b>Number of relevant records after rapid assessment</b>	0	1	1	0	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: July 1, 2022 to June 30, 2023) 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 note<sup>1</sup>. Of the 13 key organisations cited in the EFSA 2019 explanatory note<sup>1</sup>, 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 GEAC website was excluded, since this agency has only regulated GM cotton products. Therefore, the internet search was limited to 10 key organisations relevant for GMB151 soybean. Search terms consisted of GMB151 or BCS-GM151-6 or Cry14Ab-1 or HPPD-4 or HPPDPF-4Pa or modified-(w)hydroxyphenylpyruvate (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
US Environmental Protection Agency (EPA)	<a href="https://www.epa.gov/">https://www.epa.gov/</a>	July 25, 2023	July 25, 2023	0
US Department of Agriculture (USDA)	<a href="https://www.usda.gov/">https://www.usda.gov/</a>	July 25, 2023	July 28, 2023	0
US Food and Drug Administration (FDA)	<a href="https://www.fda.gov/">https://www.fda.gov/</a>	July 25, 2023	July 28, 2023	0
Health Canada	<a href="https://www.canada.ca/en/health-canada.html">https://www.canada.ca/en/health-canada.html</a>	June 26, 2023	July 10, 2023	0
Canadian Food Inspection Agency (CFIA)	<a href="https://www.canada.ca/en/food-inspection-agency.html">https://www.canada.ca/en/food-inspection-agency.html</a>	June 26, 2023	July 20, 2023	0
Food Standards Australia New Zealand (FSANZ)	<a href="http://www.foodstandards.gov.au/Pages/default.aspx">http://www.foodstandards.gov.au/Pages/default.aspx</a>	June 30, 2023	July 10, 2023	0
Office of the Gene Technology Regulator (OGTR) Australia	<a href="http://www.ogtr.gov.au/">http://www.ogtr.gov.au/</a>	April 6, 2023	July 10, 2023	0
National Technical Commission on Biosafety (CTNBio) Brazil	<a href="http://ctnbio.mcti.gov.br/en">http://ctnbio.mcti.gov.br/en</a>	July 24, 2023	July 17, 2023 to July 24, 2023	0

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
National Advisory Commission on Agricultural Biotechnology (CONABIA) Argentina	<a href="https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia">https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia</a>	July 17, 2023	July 17, 2023	0
Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan	<a href="http://www.maff.go.jp/">http://www.maff.go.jp/</a>	July 27, 2023	July 27, 2023	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 July 1, 2022 and June 30, 2023. 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	Bhattacharjee S, Bhowmick R, Kant L, Paul K. 2023	Strategic transgene-free approaches of CRISPR-based genome editing in plants.	Mol Genet Genomics. 2023 May;298(3):507-520	0
2	Cermakova E, Lencova S, Mukherjee S, Horka P, Vobruba S, Demnerova K, Zdenkova K. 2023	Identification of Fish Species and Targeted Genetic Modifications Based on DNA Analysis: State of the Art.	Foods. 2023 Jan 3;12(1):228.	0
3	Connolly JB, Romeis J, Devos Y, Glandorf DCM, Turner G, Coulibaly MB. 2023	Gene drive in species complexes: defining target organisms.	Trends Biotechnol. 2023 Feb;41(2):154-164.	0
4	Eckerstorfer MF, Dolezel M, Engelhard M, Giovannelli V, Grabowski M, Heissenberger A, Lener M, Reichenbecher	Recommendations for the Assessment of Potential Environmental Effects of Genome-Editing Applications in Plants in the EU.	Plants (Basel). 2023 Apr 25;12(9):1764.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
	W, Simon S, Staiano G, Wüst Saucy AG, Zünd J, Lüthi C. 2023			
5	Ghidoli M, Ponzoni E, Araniti F, Miglio D, Pilu R. 2023	Genetic Improvement of <i>Camelina sativa</i> (L.) Crantz: Opportunities and Challenges.	Plants (Basel). 2023 Jan 27;12(3):570.	0
6	Krasnodębski C, Sawuła A, Kaźmierczak U, Żuk M. 2023	Oligo-Not Only for Silencing: Overlooked Potential for Multidirectional Action in Plants.	Int J Mol Sci. 2023 Feb 24;24(5):4466.	0
7	Křížková B, Viktorová J, Lipov J. 2022	Approved Genetically Modified Potatoes ( <i>Solanum tuberosum</i> ) for Improved Stress Resistance and Food Safety.	J Agric Food Chem. 2022 Sep 28;70(38):11833-11843.	0
8	Liang J, Yang X, Jiao Y, Wang D, Zhao Q, Sun Y, Li Y, Wu K. 2022	The evolution of China's regulation of agricultural biotechnology.	aBIOTECH. 2022 Dec 5;3(4):237-249.	0
9	Platani M, Sokefun O, Bassil E, Apidianakis Y. 2023	Genetic engineering and genome editing in plants, animals, and humans: Facts and myths. Gene.	2023 Mar 10; 856:147141.	0
10	Pott A, Bundschuh M, Otto M, Schulz R. 2023	Assessing Effects of Genetically Modified Plant Material on the Aquatic Environment Using higher-tier Studies.	Bull Environ Contam Toxicol. 2023 Jan 2;110(1):35.	0
11	Rai GK, Kumar P, Choudhary SM, Kosser R, Khanday DM, Choudhary S, Kumar B, Magotra I, Kumar RR, Ram C, Roupheal Y, Corrado G, Behera TK. 2022	Biomimetic Strategies for Developing Abiotic Stress-Tolerant Tomato Cultivars:	An Overview. Plants (Basel). 2022 Dec 23;12(1):86	0
12	Rozas P, Kessi-Pérez EI, Martínez C. 2022	Genetically modified organisms: adapting regulatory frameworks for evolving genome editing technologies.	Biol Res. 2022 Oct 20;55(1):31.	0
13				0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
	Spök A, Sprink T, Allan AC, Yamaguchi T, Dayé C. 2022	Towards social acceptability of genome-edited plants in industrialised countries? Emerging evidence from Europe, United States, Canada, Australia, New Zealand, and Japan.	Front Genome Ed. 2022 Aug 31;4:899331.	
14	Tatineni S, Hein GL. 2023	Plant Viruses of Agricultural Importance: Current and Future Perspectives of Virus Disease Management Strategies.	Phytopathology. 2023 Feb;113(2):117-141.	0
15	Tripathi S, Purchase D, Chandra R, Nadda AK, Bhargava PC. 2022	Mitigation of hazards and risks of emerging pollutants through innovative treatment techniques of post methanated distillery effluent - A review.	Chemosphere. 2022 Aug;300:134586. doi: 10.1016/j.chemosphere.2022.134586.	0
16	Wang M, Wang H, Li K, Li X, Wang X, Wang Z. 2023	Review of CRISPR/Cas Systems on Detection of Nucleotide Sequences.	Foods. 2023 Jan 19;12(3):477.	0
17	Zimny T. 2023	Regulation of GMO field trials in the EU and new genomic techniques: will the planned reform facilitate experimenting with gene-edited plants?	BioTechnologia (Pozn). 2023 Mar 27;104(1):75-83.	0

## 5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS

The database searches ([Section 3](#)) identified a total of 192 references, which were reduced to 146 references 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 discussion was transferred to Stage 2 for detailed evaluation by the experts. In this search, both evaluators 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 tolerant 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 GMB151 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)	146
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	142
Total number of full-text documents assessed in detail	4
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	3
Total number of unobtainable/unclear publications	0
Total number of relevant publications	1

[Table 8](#) lists the publications determined to be relevant based on the 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.

**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
Environmental safety	McCarville Michael Daum Julia Moser Hal Xing Liqun 2023	Soybean Cyst Nematode Management is Improved by Combining Native and Transgenic Resistance.	Plant disease, (2023 Mar 01) . Electronic Publication Date: 1 Mar 2023 Journal code: 9882809. ISSN: 0191-2917. L- ISSN: 0191-2917.

**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
Varunjikar, M. S. Bohn, T. Sanden, M. Belghit, I. Pineda-Pampliega, J. Palmlblad, M. Broll, H. Braeuning, A. Rasinger, J. D. 2023	Proteomics analyses of herbicide -tolerant genetically modified , conventionally, and organically farmed soybean seeds.	Food Control, (SEP 2023 ) Vol. 151, pp. Article No.: 109795. <a href="http://www.journals.elsevier.com/food-control/#description">http://www.journals.elsevier.com/food-control/#description</a> . ISSN: 0956-7135. E-ISSN: 1873-7129.	GMB151 soybean was not considered in this publication.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Liang Rong Ji Xueqin Sheng Zewen Liu Jinyue Qiang Sheng Song Xiaoling 2022	Fitness and Rhizobacteria of F2, F3 Hybrids of Herbicide - Tolerant Transgenic Soybean and Wild Soybean .	Plants (Basel, Switzerland), (2022 Nov 21) Vol. 11, No. 22. Electronic Publication Date: 21 Nov 2022 Journal code: 101596181. ISSN: 2223-7747. L-ISSN: 2223-7747. Report No.: PMC-PMC9693618.	GMB151 soybean was not considered in this publication.
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: <a href="https://doi.org/10.1016/S2095-3119(20)63385-8">https://doi.org/10.1016/S2095-3119(20)63385-8</a> Published by: Elsevier B.V., Amsterdam	GMB151 soybean was not considered in this publication.

**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.			



## 6. NARRATIVE SYNTHESIS/SUMMARY OF RELEVANT STUDIES

A total of 4 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 1 publications were relevant for the safety assessment of the GMB151 soybean and its newly expressed proteins, HPPD-4 and Cry14Ab-1.

In the publication identified as relevant, McCarvill *et al.* 2023, the benefit of combining a transgenic soybean cyst nematode (SCN) resistance trait, Cry14Ab-1 expressed by the event GMB151, with the native resistance allele rhg1b from PI 88788 was assessed. The data and knowledge generated from this study does not impact the safety assessment of GMB151 soybean.

Table 11 lists the relevant publication along with a summary of any adverse effects reported.

**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
Environmental safety	McCarville Michael Daum Julia Moser Hal Xing Liquan 2023	GMB151	None	Not applicable	None, because no new hazards, modified exposure, or scientific uncertainties are reported.

## 7. CONCLUSION

The literature searches performed for the GMB151 soybean and its newly expressed proteins, HPPD-4 and Cry14Ab-1, for the period from July 1, 2022 to June 30, 2023, identified a total of 146 unique publications (after duplicate removal). A total of 4 publication(s) were progressed for detailed assessment after excluding 142 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract).

The four 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. One of the four publications was determined to be relevant after detailed review. The relevant article did not constitute new data on molecular characterization of GMB151 soybean, or the HPPD-4 and Cry14Ab-1 proteins, nor did it suggest any potential adverse effects on human and animal health or on the environment. No evidence was identified that would warrant conducting a systematic review.

## 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	<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/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 17:33:20 ON 10 JUL 2023
L1      2 SEA GMB151 OR GMB(W)151 OR BCS(W)GM151(W)6 OR BCS-GM151-6 OR
        BCS(W)GMB151?
L2      8 SEA HPPD(W)4 OR HPPD4 OR HPPD(W)PF(W)4PA OR HPPDPF(W)4PA
L3      47 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?)
L4      2 SEA CRY14AB-1 OR CRY14AB(W)1 OR CRY(W)14AB(W)1 OR CRY(W)14(W)AB
        (W)1 OR CRY14(W)AB1 OR CRY(W)14AB1 OR CRY14AB1
L5      0 SEA CRY14AB-L OR CRY14AB(W)L OR CRY(W)14AB(W)L OR CRY(W)14(W)AB
        (W)L OR CRY14(W)ABL OR CRY(W)14ABL OR CRY14ABL
L6      0 SEA CRY14AB-I OR CRY14AB(W)I OR CRY(W)14AB(W)I OR CRY(W)14(W)AB
        (W)I OR CRY14(W)ABI OR CRY(W)14ABI OR CRY14ABI
L7      0 SEA CRY14AB-1.B OR CRY14AB(W)1(W)B OR CRY14AB(W)1B OR CRY(W)14A
        B(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)1(W)B OR
        CRY(W)14AB(W)1B OR CRY(W)14AB1(W)B OR CRY14AB1B
L8      0 SEA CRY14AB-L.B OR CRY14AB(W)L(W)B OR CRY14AB(W)1B OR CRY(W)14A
        B(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)L(W)B OR
        CRY(W)14AB(W)LB OR CRY(W)14ABL(W)B OR CRY14ABLB
L9      0 SEA CRY14AB-1.B OR CRY14AB(W)I(W)B OR CRY14AB(W)IB OR CRY(W)14A
        B(W)I(W)B OR CRY(W)14AB(W)I(W)B OR CRY(W)14(W)AB(W)I(W)B OR
        CRY(W)14AB(W)IB OR CRY(W)14ABI(W)B OR CRY14ABIB
L10     54 SEA (L2 OR L3 OR L4 OR L5 OR L6 OR L7 OR L8 OR L9)
L11     3550 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR DIKETONITRILE# OR
        PYRAZOLONE# OR TRIKETONE# OR ISOXAFLUTOL## OR IFT) (5A) (RESIST?
        OR TOLERAN? OR PROTECT?)
L12     5327 SEA (NEMATODE# OR SOYBEAN(W)CYST(W)NEMATODE# OR SCN OR
        HETERODERA(W)GLYCINES OR H(W)GLYCINES) (5A) (RESIST? OR TOLERAN?
        OR PROTECT? OR CONTROL)
L13     8871 SEA (L11 OR L12)
L14     73975 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
        OR GLYCINE(W)MAX OR G(W)MAX
L15     4171994 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?))
L16     489 SEA L13 AND L14 AND L15
L17     537 SEA L1 OR L10 OR L16
L18     63 SEA L17 AND PY>=2022
L19     41 SEA L18 AND UP>=20220701 AND UP<=20230630

FILE 'BIOSIS' ENTERED AT 17:33:27 ON 10 JUL 2023
L20     0 SEA GMB151 OR GMB(W)151 OR BCS(W)GM151(W)6 OR BCS-GM151-6 OR
        BCS(W)GMB151?
L21     5 SEA HPPD(W)4 OR HPPD4 OR HPPD(W)PF(W)4PA OR HPPDPF(W)4PA
L22     69 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?)
L23     0 SEA CRY14AB-1 OR CRY14AB(W)1 OR CRY(W)14AB(W)1 OR CRY(W)14(W)AB
        (W)1 OR CRY14(W)AB1 OR CRY(W)14AB1 OR CRY14AB1
L24     0 SEA CRY14AB-L OR CRY14AB(W)L OR CRY(W)14AB(W)L OR CRY(W)14(W)AB
        (W)L OR CRY14(W)ABL OR CRY(W)14ABL OR CRY14ABL
L25     0 SEA CRY14AB-I OR CRY14AB(W)I OR CRY(W)14AB(W)I OR CRY(W)14(W)AB
        (W)I OR CRY14(W)ABI OR CRY(W)14ABI OR CRY14ABI
L26     0 SEA CRY14AB-1.B OR CRY14AB(W)1(W)B OR CRY14AB(W)1B OR CRY(W)14A
        B(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)1(W)B OR
        CRY(W)14AB(W)1B OR CRY(W)14AB1(W)B OR CRY14AB1B
L27     0 SEA CRY14AB-L.B OR CRY14AB(W)L(W)B OR CRY14AB(W)1B OR CRY(W)14A
        B(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)L(W)B OR
        CRY(W)14AB(W)LB OR CRY(W)14ABL(W)B OR CRY14ABLB

```

L28 0 SEA CRY14AB-I.B OR CRY14AB(W)I(W)B OR CRY14AB(W)IB OR CRY(W)14A  
B(W)I(W)B OR CRY(W)14AB(W)I(W)B OR CRY(W)14(W)AB(W)I(W)B OR  
CRY(W)14AB(W)IB OR CRY(W)14ABI(W)B OR CRY14ABIB  
L29 73 SEA (L21 OR L22 OR L23 OR L24 OR L25 OR L26 OR L27 OR L28)  
L30 10137 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR DIKETONITRILE# OR  
PYRAZOLONE# OR TRIKETONE# OR ISOXAFLUTOL## OR IFT) (5A) (RESIST?  
OR TOLERAN? OR PROTECT?)  
L31 13866 SEA (NEMATODE# OR SOYBEAN(W)CYST(W)NEMATODE# OR SCN OR  
HETERODERA(W)GLYCINES OR H(W)GLYCINES) (5A) (RESIST? OR TOLERAN?  
OR PROTECT? OR CONTROL)  
L32 23968 SEA (L30 OR L31)  
L33 178274 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX  
L34 472361 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?))  
L35 534 SEA L32 AND L33 AND L34  
L36 602 SEA L20 OR L29 OR L35  
L37 538 SEA L36 NOT P/DT  
L38 0 SEA L36 AND (P/DT AND AR/DT)  
L39 538 SEA L37 OR L38  
L40 45 SEA L39 AND PY>=2022  
L41 35 SEA L40 AND UP>=20220701 AND UP<=20230630

FILE 'AGRICOLA' ENTERED AT 17:33:33 ON 10 JUL 2023

L42 0 SEA GMB151 OR GMB(W)151 OR BCS(W)GM151(W)6 OR BCS-GM151-6 OR  
BCS(W)GMB151?  
L43 2 SEA HPPD(W)4 OR HPPD4 OR HPPD(W)PF(W)4PA OR HPPDPF(W)4PA  
L44 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?)  
L45 0 SEA CRY14AB-1 OR CRY14AB(W)1 OR CRY(W)14AB(W)1 OR CRY(W)14(W)AB  
(W)1 OR CRY14(W)AB1 OR CRY(W)14AB1 OR CRY14AB1  
L46 0 SEA CRY14AB-L OR CRY14AB(W)L OR CRY(W)14AB(W)L OR CRY(W)14(W)AB  
(W)L OR CRY14(W)ABL OR CRY(W)14ABL OR CRY14ABL  
L47 0 SEA CRY14AB-I OR CRY14AB(W)I OR CRY(W)14AB(W)I OR CRY(W)14(W)AB  
(W)I OR CRY14(W)ABI OR CRY(W)14ABI OR CRY14ABI  
L48 0 SEA CRY14AB-1.B OR CRY14AB(W)1(W)B OR CRY14AB(W)1B OR CRY(W)14A  
B(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)1(W)B OR  
CRY(W)14AB(W)1B OR CRY(W)14AB1(W)B OR CRY14AB1B  
L49 0 SEA CRY14AB-L.B OR CRY14AB(W)L(W)B OR CRY14AB(W)1B OR CRY(W)14A  
B(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)L(W)B OR  
CRY(W)14AB(W)LB OR CRY(W)14ABL(W)B OR CRY14ABLB  
L50 0 SEA CRY14AB-I.B OR CRY14AB(W)I(W)B OR CRY14AB(W)IB OR CRY(W)14A  
B(W)I(W)B OR CRY(W)14AB(W)I(W)B OR CRY(W)14(W)AB(W)I(W)B OR  
CRY(W)14AB(W)IB OR CRY(W)14ABI(W)B OR CRY14ABIB  
L51 47 SEA (L43 OR L44 OR L45 OR L46 OR L47 OR L48 OR L49 OR L50)  
L52 8660 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR DIKETONITRILE# OR  
PYRAZOLONE# OR TRIKETONE# OR ISOXAFLUTOL## OR IFT) (5A) (RESIST?  
OR TOLERAN? OR PROTECT?)  
L53 9607 SEA (NEMATODE# OR SOYBEAN(W)CYST(W)NEMATODE# OR SCN OR  
HETERODERA(W)GLYCINES OR H(W)GLYCINES) (5A) (RESIST? OR TOLERAN?  
OR PROTECT? OR CONTROL)  
L54 18258 SEA (L52 OR L53)  
L55 100481 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX  
L56 111037 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?))  
L57 469 SEA L54 AND L55 AND L56  
L58 514 SEA L42 OR L51 OR L57  
L59 26 SEA L58 AND PY>=2022

L60 17 SEA L59 AND UP>=20220701 AND UP<=20230630

FILE 'CABA' ENTERED AT 17:33:39 ON 10 JUL 2023

L61 1 SEA GMB151 OR GMB(W)151 OR BCS(W)GM151(W)6 OR BCS-GM151-6 OR BCS(W)GMB151?

L62 5 SEA HPPD(W)4 OR HPPD4 OR HPPD(W)PF(W)4PA OR HPPDPF(W)4PA

L63 75 SEA ((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?)

L64 1 SEA CRY14AB-1 OR CRY14AB(W)1 OR CRY(W)14AB(W)1 OR CRY(W)14(W)AB(W)1 OR CRY14(W)AB1 OR CRY(W)14AB1 OR CRY14AB1

L65 0 SEA CRY14AB-L OR CRY14AB(W)L OR CRY(W)14AB(W)L OR CRY(W)14(W)AB(W)L OR CRY14(W)ABL OR CRY(W)14ABL OR CRY14ABL

L66 0 SEA CRY14AB-I OR CRY14AB(W)I OR CRY(W)14AB(W)I OR CRY(W)14(W)AB(W)I OR CRY14(W)ABI OR CRY(W)14ABI OR CRY14ABI

L67 0 SEA CRY14AB-1.B OR CRY14AB(W)1(W)B OR CRY14AB(W)1B OR CRY(W)14AB(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)1(W)B OR CRY(W)14AB(W)1B OR CRY(W)14AB1(W)B OR CRY14AB1B

L68 0 SEA CRY14AB-L.B OR CRY14AB(W)L(W)B OR CRY14AB(W)1B OR CRY(W)14AB(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)L(W)B OR CRY(W)14AB(W)LB OR CRY(W)14ABL(W)B OR CRY14ABLB

L69 0 SEA CRY14AB-I.B OR CRY14AB(W)I(W)B OR CRY14AB(W)IB OR CRY(W)14AB(W)I(W)B OR CRY(W)14AB(W)I(W)B OR CRY(W)14(W)AB(W)I(W)B OR CRY(W)14AB(W)IB OR CRY(W)14ABI(W)B OR CRY14ABIB

L70 79 SEA (L62 OR L63 OR L64 OR L65 OR L66 OR L67 OR L68 OR L69)

L71 19337 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR DIKETONITRILE# OR PYRAZOLONE# OR TRIKETONE# OR ISOXAFLUTOL## OR IFT) (5A) (RESIST? OR TOLERAN? OR PROTECT?)

L72 25084 SEA (NEMATODE# OR SOYBEAN(W)CYST(W)NEMATODE# OR SCN OR HETERODERA(W)GLYCINES OR H(W)GLYCINES) (5A) (RESIST? OR TOLERAN? OR PROTECT? OR CONTROL)

L73 44346 SEA (L71 OR L72)

L74 208812 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN# OR GLYCINE(W)MAX OR G(W)MAX

L75 200312 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?))

L76 928 SEA L73 AND L74 AND L75

L77 1000 SEA L61 OR L70 OR L76

L78 1000 SEA L77 NOT P/DT

L79 0 SEA L77 AND (P/DT AND J/DT)

L80 1000 SEA L78 OR L79

L81 72 SEA L80 AND PY>=2022

L82 56 SEA L81 AND UP>=20220701 AND UP<=20230630

FILE 'HCAPLUS' ENTERED AT 17:33:49 ON 10 JUL 2023

L83 1 SEA GMB151 OR GMB(W)151 OR BCS(W)GM151(W)6 OR BCS-GM151-6 OR BCS(W)GMB151?

L84 15 SEA HPPD(W)4 OR HPPD4 OR HPPD(W)PF(W)4PA OR HPPDPF(W)4PA

L85 232 SEA ((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?)

L86 4 SEA CRY14AB-1 OR CRY14AB(W)1 OR CRY(W)14AB(W)1 OR CRY(W)14(W)AB(W)1 OR CRY14(W)AB1 OR CRY(W)14AB1 OR CRY14AB1

L87 0 SEA CRY14AB-L OR CRY14AB(W)L OR CRY(W)14AB(W)L OR CRY(W)14(W)AB(W)L OR CRY14(W)ABL OR CRY(W)14ABL OR CRY14ABL

L88 0 SEA CRY14AB-I OR CRY14AB(W)I OR CRY(W)14AB(W)I OR CRY(W)14(W)AB(W)I OR CRY14(W)ABI OR CRY(W)14ABI OR CRY14ABI

L89 0 SEA CRY14AB-1.B OR CRY14AB(W)1(W)B OR CRY14AB(W)1B OR CRY(W)14AB(W)1(W)B OR CRY(W)14AB(W)1(W)B OR CRY(W)14(W)AB(W)1(W)B OR CRY(W)14AB(W)1B OR CRY(W)14AB1(W)B OR CRY14AB1B

L90 0 SEA CRY14AB-L.B OR CRY14AB(W)L(W)B OR CRYL4AB(W)1B OR CRY(W)L4A  
B(W)1(W)B OR CRY(W)L4AB(W)1(W)B OR CRY(W)14(W)AB(W)L(W)B OR  
CRY(W)14AB(W)LB OR CRY(W)14ABL(W)B OR CRY14ABLB  
L91 0 SEA CRY14AB-I.B OR CRY14AB(W)I(W)B OR CRY14AB(W)IB OR CRY(W)14A  
B(W)I(W)B OR CRY(W)14AB(W)I(W)B OR CRY(W)14(W)AB(W)I(W)B OR  
CRY(W)14AB(W)IB OR CRY(W)14ABI(W)B OR CRY14ABIB  
L92 246 SEA (L84 OR L85 OR L86 OR L87 OR L88 OR L89 OR L90 OR L91)  
L93 30571 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR DIKETONITRILE# OR  
PYRAZOLONE# OR TRIKETONE# OR ISOXAFLUTOL## OR IFT) (5A) (RESIST?  
OR TOLERAN? OR PROTECT?)  
L94 10644 SEA (NEMATODE# OR SOYBEAN(W)CYST(W)NEMATODE# OR SCN OR  
HETERODERA(W)GLYCINES OR H(W)GLYCINES) (5A) (RESIST? OR TOLERAN?  
OR PROTECT? OR CONTROL)  
L95 40822 SEA (L93 OR L94)  
L96 446753 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX  
L97 671956 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?))  
L98 7014 SEA L95 AND L96 AND L97  
L99 7170 SEA L83 OR L92 OR L98  
L100 616 SEA L99 NOT P/DT  
L101 0 SEA L99 AND (P/DT AND J/DT)  
L102 616 SEA L100 OR L101  
L103 53 SEA L102 AND PY>=2022  
L104 43 SEA L103 AND UP>=20220701 AND UP<=20230630

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 11:33:56 ON 10  
JUL 2023

L105 146 DUP REM L19 L41 L60 L82 L104 (46 DUPLICATES REMOVED)  
ANSWERS '1-41' FROM FILE MEDLINE  
ANSWERS '42-70' FROM FILE BIOSIS  
ANSWERS '71-87' FROM FILE AGRICOLA  
ANSWERS '88-125' FROM FILE CABA  
ANSWERS '126-146' FROM FILE HCAPLUS