

Title

**Summary of the Literature Review for GHB614 x LLCotton25 cotton
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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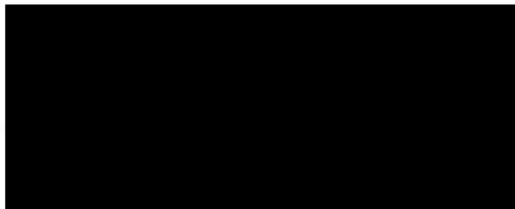
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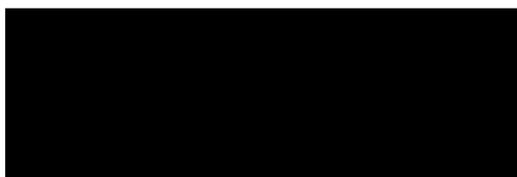
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SUMMARY

BASF has used conventional breeding techniques to develop the stacked trait cotton product GHB614 x LLCotton25 (GlyTol x LL25 cotton; GTxLL cotton) which confers tolerance to glyphosate and glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ2-5 x ACS-GHØØ1-3.

A scoping review was performed for the GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*. The objective of this scoping review was to determine if there were studies about the molecular characterization of GHB614 x LLCotton25 cotton, 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 49 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. Two publications were progressed for detailed assessment and determined to be not relevant after detailed review.

No new publications were found that contained new data on the molecular characterization of the GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of GHB614 x LLCotton25 cotton on human health, animal health, or the environment. No issues or topics were identified that would trigger or warrant more specific question formulation or indicate that a systematic review would be of value.

1. INTRODUCTION

BASF has used conventional breeding techniques to develop the stacked trait cotton product GHB614 x LLCotton25 (GlyTol x LL25 cotton; GTxLL cotton) which confers tolerance to glyphosate and glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ2-5 x ACS-GHØØ1-3.

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 GHB614 x LLCotton25 cotton, and/or any adverse effect of GHB614 x LLCotton25 cotton 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 GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*. 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 GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*, 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 (1).

Question 1: Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the GHB614 x LLCotton25 cotton and its newly expressed proteins 2mEPSPS and PAT/*bar*?

Key elements:

Population: Human health; animal health; environmental safety

Exposure: GHB614 x LLCotton25 cotton, derived food/feed products, newly expressed proteins in GHB614 x LLCotton25 cotton

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 GHB614 x LLCotton25 cotton and its newly expressed proteins 2mEPSPS and PAT/*bar* in cotton?

Key elements:

Population: GHB614 x LLCotton25 cotton and newly expressed proteins in GHB614 x LLCotton25 cotton

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

2.3. Criteria for relevance

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

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

Concepts	Criteria	Comment
Key elements of review questions with PECO structure		
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>i.e.</i> , 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>i.e.</i> , 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 (1).

2.4. Reference publication

One publication related to GHB614 x LLCotton25 cotton was previously identified and was used to test and validate the search strategy:

- Naegeli, H.; Birch, A. N.; Casacuberta, J.; Schrijver, A. de; Gralak, M. A.; Guerche, P.; Jones, H.; Manachini, B.; Messean, A.; Nielsen, E. E.; Nogue, F.; Robaglia, C.; Rostoks, N.; Sweet, J.; Tebbe, C.; Visioli, F.; Wal, J. M.; Broll, H.; Gennaro, A.; Neri, F. M.; Paraskevopoulos, K.; de Schrijver, A. (2018). Assessment of genetically modified cotton GHB614 .times. LLCotton25 .times. MON 15985 for food and feed uses, under Regulation (EC) No 1829/2003 (application EFSA-GMO-NL-2011-94). EFSA Journal 16(4): e05213 p.

This article was selected as reference publications because even though it is not directly relevant to GHB614 x LLCotton25 cotton, it mentions the event names (LLCotton25 and GHB614), the newly expressed proteins (2mEPSPS and PAT/*bar*), and the crop (cotton). Since this article was published outside the search period of this report, the search profile was tested without applying the time filters used in the final 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 (1). The search strategies were designed to be broad and sensitive enough to capture any relevant publications, if available.

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

3.1. Time window and date of the literature search

The database searches were performed on July 13, 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 4](#).

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, stack 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	Search string	Concepts
1	LLcotton25 or LLcotton(w)25 or LL(w)cotton25 or LL(w)cotton(w)25 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3	Event name 1
2	GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)5 OR BCSGH002(W)5 or BCS-GH002-5 or BCS(w)GH002(w)5 or BCSGH002-5	Event name 2
3	GHB614xLLcotton25 or GHB614(w)time#(w)LLcotton25 or LLcotton25xGHB614 or LLcotton25(w)time#(w)GHB614	Event name stack
4	(1 and 2) or 3	Event name all
5	GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(w)TOL? OR GLY(w)TOLTM? OR GLY(w)TOLRTM?	Trade name 1
6	libertylink or libertylinktm or libertylinkrtm or liberty(w)link or liberty(w)linktm or liberty(w)linkrtm or LL or LLTM or LLRTM	Trade name 2

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 ENOLPYRUVOYLSHIKIMATE or ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE) or (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC or ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (SYNTHASE OR SYNTHETASE) or (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE) or (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (3W) PHOSPHOSYNTHASE)) (s) ((DOUBL# or DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M))	Newly expressed protein 1
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 phosphinothricin acetyl (w) transferase	Newly expressed protein 2
10	8 and 9	Newly expressed protein all
11	s (herbicid? or GL!PHOSATE# or GL!FOSATE# OR G360 or g(w)360 or roundup? or round(w)up?) (5a) (resist? or toleran? or protect?)	Intended trait 1
12	s (herbicid? or bialaphos or basta or glufosinate or glufosinate or phosphinothricin or liberty?) (5a) (resist? OR protect? OR toleran?)	Intended trait 2
13	11 and 12	Intended trait all
14	cotton# or gossypium or G(w)hirsutum or g(w)barbadense	Plant species
15	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3a) (modif? OR transform? OR manipulat? OR improv? OR engineer?))	GMO general
16	13 and 14 and 15	Intended trait all AND Plant species AND GMO general
17	4 or 7 or 10 or 16	Event name all OR Trade name all OR Newly expressed protein all or (Intended trait 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" No terms for insect resistance	"GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM"	"TRANSGENIC PLANTS"
Biosis	None	None	No terms for herbicide or insect resistance	"GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM"	None
CABA	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIUM BARBADENSE"/CT "GOSSYPIUM HIRSUTUM"/CT	"TRANSGENIC PLANTS"
CAS	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	GOSSYPIUM/CT	"GENETICALLY MODIFIED PLANTS"
Medline	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM"	"PLANTS, GENETICALLY MODIFIED"

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
Database Provider	STN International				
Coverage	1970-present	1926-present	1973-present	1907-present	1946-present
Date of search	13 Jul 2023				
Datespan of the search	1 Jul 2022 – 30 Jun 2023				
Latest database update	10 Jul 2023	12 Jul 2023	27 Jun 2023	12 Jul 2023	12 Jul 2023
Number of records retrieved	4	14	23	12	5
Number of records after duplicate removal	4	13	19	8	5
Number of relevant records after rapid assessment	0	1	1	0	0

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 (1). Of the 13 key organisations cited in the EFSA 2019 explanatory note (1), 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 USDA, EPA, FDA, CFIA, Health Canada, FSANZ and MAFF websites were excluded, since these agencies do not regulate GM stacked products obtained by conventional breeding techniques. Therefore, the internet search was limited to four key organisations relevant for GHB614 x LLCotton25 cotton. Search terms consisted of GlyTol x LL25 or GHB614 x LL25 or Glytol x LLCOTTON25 or GHB614 x LLCOTTON25 or BCS-GHØØ2-5 x ACS-GHØØ1-3, 2mEPSPS or double mutant 5-enolpyruvyl shikimate-3-phosphate synthase enzyme, and PAT/*bar* or phosphinothricin (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 (dd.mm.yyyy)	Date of Search (dd.mm.yyyy)	No. of Relevant Records
Office of the Gene Technology Regulator (OGTR) Australia	http://www.ogtr.gov.au/	30.06.2023	10.07.2023	0
National Technical Commission on Biosafety (CTNBio) Brazil	http://ctnbio.mcti.gov.br/en	24.07.2023	17-24.07.2023	0
National Advisory Commission on Agricultural Biotechnology (CONABIA) Argentina	https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia	17.07.2023	17.07.2023	0
Genetic Engineering Approval Committee (GEAC) India	http://moef.gov.in/	19.07.2023	19.07.2023	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 W, Simon S, Staiano G, Wüst Saucy AG, Zünd J, Lüthi C. 2023	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
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

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
7	Křížkovská 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	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.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
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 58 references, which were reduced to 49 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 GHB614 x LLCotton25 cotton, 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)	49
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	47
Total number of full-text documents assessed in detail	2
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	2
Total number of unobtainable/unclear publications	0
Total number of relevant publications	0

[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
No publications in any 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
Naegeli, H.; Bresson, J. L.; Dalmay, T.; Dewhurst, I. C.; Epstein, M. 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.; Ardizzone, M.; Raffaello, T. 2021	Assessment of genetically modified cotton GHB614 for renewal authorisation under regulation (EC) No 1829/2003 (application EFSA-GMO -RX-018).	EFSA Journal (2021), Volume 19, Number 7, 10 refs. ISSN: 1831-4732 DOI: https://doi.org/10.2903/j.efs.a.2021.6671 Published by: Wiley, Oxford	This is a publication of the EFSA evaluation of GHB614 cotton. Publications on single events are not considered relevant for stacked events.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Li Dongyang; Zhu Xiangzhen; Zhang Kaixin; Wang Li; Zhang Rui; Liang Chengzhen; Luo Junyu; Cui Jinjie. 2022	Impact assessment of genetically modified herbicide -tolerant cotton on arthropod communities.	Journal of Cotton Research, (MAY 1 2022) Vol. 5, No. 1, pp. Article No.: 14. https://jcottonres.biomedcentral.com/ . ISSN: 2096-5044. E-ISSN: 2523-3254.	Arthropod communities were evaluated on the GM HT cotton variety GGK2 and its near-isogenic non-GM HT variety K312 in China. Arthropod composition was identical between GGK2 and K312. This environmental safety assessment is not related to GHG614 x LLCotton25.

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

Two 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 none of the publications were relevant for the safety assessment of the GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*.

7. CONCLUSION

The literature searches performed for the GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*, for the period from July 1, 2022 to June 30, 2023, identified a total of 49 unique publications (after duplicate removal). Two publication(s) were progressed for detailed assessment after excluding 47 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract). The two 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 new publications were found that contained new data on the molecular characterization of the GHB614 x LLCotton25 cotton and its newly expressed proteins, 2mEPSPS and PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of GHB614 x LLCotton25 cotton on human and animal health or the environment. No issues or topics were identified that would trigger or warrant more specific question formulation or indicate that a systematic review would be of value.

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 11:39:18 ON 13 JUL 2023
L1      3 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON
        (W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR
        ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3
L2      4 SEA GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR
        BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)
        )5 OR BCSGH002(W)5
L3      1 SEA GHB614XLLCOTTON25 OR GHB614(W)TIME#(W)LLCOTTON25 OR
        LLCOTTON25XGHB614 OR LLCOTTON25(W)TIME#(W)GHB614
L4      1 SEA (L1 AND L2) OR L3
L5      2 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR
        GLY(W)TOLTM? OR GLY(W)TOLRTM?
L6      15608 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
        )LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
        OR LLRTM
L7      0 SEA L5 AND L6
L8      14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L9      4349 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
        ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
        OYLSHIKAMATE OR ENOYLPYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (
        4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)
L10     0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
        MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
        YNTHASE OR SYNTHETASE)
L11     421 SEA (ENOL(W)PYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
        ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
        ) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)
L12     514 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
        IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (
        3W) PHOSPHOSYNTHASE)
L13     25882 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)
L14     21 SEA L8 OR (((L9 OR L10 OR L11 OR L12)) (S) L13)
L15     1590 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
L16     208 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
        N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
        ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE
L17     1665 SEA L15 OR L16
L18     8 SEA L14 AND L17
L19     4025 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360
        OR ROUNDUP? OR ROUND(W)UP?) (5A) (RESIST? OR TOLERAN? OR
        PROTECT?)
L20     3818 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
        GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
        PROTECT? OR TOLERAN?)
L21     3528 SEA L19 AND L20
L22     30476 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L23     4178353 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
        (GENETIC?(3A) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
        ENGINEER?))
L24     118 SEA L21 AND L22 AND L23
L25     127 SEA L4 OR L7 OR L18 OR L24
L26     14 SEA L25 AND PY>=2021
L27     5 SEA L26 AND UP>=20220701 AND UP<=20230630

FILE 'BIOSIS' ENTERED AT 11:39:28 ON 13 JUL 2023
L28     5 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON
        (W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR
        ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3
```

L29 5 SEA GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR
BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)
)5 OR BCSGH002(W)5

L30 0 SEA GHB614XLLCOTTON25 OR GHB614(W)TIME#(W)LLCOTTON25 OR
LLCOTTON25XGHB614 OR LLCOTTON25(W)TIME#(W)GHB614

L31 2 SEA (L28 AND L29) OR L30

L32 6 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR
GLY(W)TOLTM? OR GLY(W)TOLRTM?

L33 15869 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM

L34 2 SEA L32 AND L33

L35 12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L36 5178 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
OYLSHIKAMATE OR ENOYLPYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4
W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L37 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L38 761 SEA (ENOL(W)PYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)

L39 29 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (3
W) PHOSPHOSYNTHASE)

L40 28113 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L41 21 SEA L35 OR ((L36 OR L37 OR L38 OR L39)) (S) L40)

L42 2987 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

L43 337 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE

L44 3094 SEA L42 OR L43

L45 8 SEA L41 AND L44

L46 11863 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360
OR ROUNDUP? OR ROUND(W)UP?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L47 10592 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)

L48 10162 SEA L46 AND L47

L49 79416 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L50 495499 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC?(3A) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?))

L51 267 SEA L48 AND L49 AND L50

L52 279 SEA L31 OR L34 OR L45 OR L51

L53 25 SEA L52 AND PY>=2021

L54 14 SEA L53 AND UP>=20220701 AND UP<=20230630

FILE 'AGRICOLA' ENTERED AT 11:39:38 ON 13 JUL 2023

L55 2 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON
(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR
ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3

L56 2 SEA GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR
BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)
)5 OR BCSGH002(W)5

L57 0 SEA GHB614XLLCOTTON25 OR GHB614(W)TIME#(W)LLCOTTON25 OR
LLCOTTON25XGHB614 OR LLCOTTON25(W)TIME#(W)GHB614

L58 0 SEA (L55 AND L56) OR L57

L59 3 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR
GLY(W)TOLTM? OR GLY(W)TOLRTM?

L60 3716 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM

L61 2 SEA L59 AND L60

L62 4 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L63 741 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)

L64 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L65 337 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)

L66 271 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (3
W) PHOSPHOSYNTHASE)

L67 7060 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L68 10 SEA L62 OR (((L63 OR L64 OR L65 OR L66)) (S) L67)

L69 829 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

L70 258 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE

L71 911 SEA L69 OR L70

L72 4 SEA L68 AND L71

L73 9417 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360
OR ROUNDUP? OR ROUND(W)UP?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L74 8885 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)

L75 8691 SEA L73 AND L74

L76 68097 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L77 113690 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC? (3A) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?))

L78 234 SEA L75 AND L76 AND L77

L79 239 SEA L58 OR L61 OR L72 OR L78

L80 9 SEA L79 AND PY>=2021

L81 4 SEA L80 AND UP>=20220701 AND UP<=20230630

FILE 'CABA' ENTERED AT 11:39:48 ON 13 JUL 2023

L82 5 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON
(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR
ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3

L83 7 SEA GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR
BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)
)5 OR BCSGH002(W)5

L84 2 SEA GHB614XLLCOTTON25 OR GHB614(W)TIME#(W)LLCOTTON25 OR
LLCOTTON25XGHB614 OR LLCOTTON25(W)TIME#(W)GHB614

L85 2 SEA (L82 AND L83) OR L84

L86 5 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR
GLY(W)TOLTM? OR GLY(W)TOLRTM?

L87 6044 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM

L88 4 SEA L86 AND L87

L89 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L90 1268 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
OYLSHIKAMATE OR ENOYLPYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4
W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)
L91 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVYOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)
L92 477 SEA (ENOL(W)PYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVYOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)
L93 202 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVYOYL (W) SHIKIMIC (3
W) PHOSPHOSYNTHASE)
L94 7766 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)
L95 24 SEA L89 OR ((L90 OR L91 OR L92 OR L93)) (S) L94)
L96 1630 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
L97 387 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE
L98 1736 SEA L96 OR L97
L99 8 SEA L95 AND L98
L100 20559 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W) 360
OR ROUNDUP? OR ROUND(W)UP?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)
L101 19754 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)
L102 19339 SEA L100 AND L101
L103 112536 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L104 204631 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC? (3A) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?))
L105 521 SEA L102 AND L103 AND L104
L106 531 SEA L85 OR L88 OR L99 OR L105
L107 34 SEA L106 AND PY>=2021
L108 23 SEA L107 AND UP>=20220701 AND UP<=20230630
L109 23 SEA L108 NOT P/DT
L110 0 SEA L108 AND (P/DT AND J/DT)
L111 23 SEA L109 OR L110

FILE 'HCAPLUS' ENTERED AT 05:40:02 ON 13 JUL 2023
L112 11 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON
(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR
ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3
L113 7 SEA GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR
BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)
)5 OR BCSGH002(W)5
L114 1 SEA GHB614XLLCOTTON25 OR GHB614(W)TIME#(W)LLCOTTON25 OR
LLCOTTON25XGHB614 OR LLCOTTON25(W)TIME#(W)GHB614
L115 4 SEA (L112 AND L113) OR L114
L116 8 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR
GLY(W)TOLTM? OR GLY(W)TOLRTM?
L117 22222 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM
L118 3 SEA L116 AND L117
L119 31 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L120 4631 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV

OYLSHIKAMATE OR ENOYLPYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L121 9 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (SYNTHASE OR SYNTHETASE)

L122 1133 SEA (ENOL(W) PYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE) (3W) PHOSPHATE(W) (SYNTHASE OR SYNTHETASE)

L123 90 SEA (PHOSPHOSHIKIMATE(2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W) CARBOXYVINYL(W) TRANSFERASE OR ENOLPYRUVOYL(W) SHIKIMIC(3W) PHOSPHOSYNTHASE)

L124 77228 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L125 46 SEA L119 OR ((L120 OR L121 OR L122 OR L123)) (S)L124)

L126 5704 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

L127 809 SEA PHOSPHINOTHRICIN(W)N(W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W) ACETYL(W) TRANSFERASE OR PHOSPHINOTHRICINACETYL(W) TRANSFERASE

L128 6021 SEA L126 OR L127

L129 21 SEA L125 AND L128

L130 32158 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?) (5A) (RESIST? OR TOLERAN? OR PROTECT?)

L131 30983 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR PROTECT? OR TOLERAN?)

L132 30364 SEA L130 AND L131

L133 293538 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L134 747559 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR (GENETIC?(3A) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR ENGINEER?))

L135 1389 SEA L132 AND L133 AND L134

L136 1411 SEA L115 OR L118 OR L129 OR L135

L137 340 SEA L136 AND PY>=2021

L138 65 SEA L137 AND UP>=20220701 AND UP<=20230630

L139 12 SEA L138 NOT P/DT

L140 0 SEA L138 AND (P/DT AND J/DT)

L141 12 SEA L139 OR L140

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 05:40:12 ON 13 JUL 2023

L142 49 DUP REM L27 L54 L81 L111 L141 (9 DUPLICATES REMOVED)
ANSWERS '1-5' FROM FILE MEDLINE
ANSWERS '6-18' FROM FILE BIOSIS
ANSWERS '19-22' FROM FILE AGRICOLA
ANSWERS '23-41' FROM FILE CABA
ANSWERS '42-49' FROM FILE HCAPLUS