

Title

**Summary of the Literature Review for GHB614 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.
EFSA supporting publications 2019:EN-1614

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SUMMARY

The GHB614 cotton event was developed through *Agrobacterium*-mediated transformation using the vector pTEM2 containing the *2mepsps* gene. GHB614 produces the *Zea mays* L. 5-enolpyruvylshikimate 3-phosphate synthase (2mEPSPS) protein which confers tolerance to glyphosate herbicides. The OECD identifier is BCS-GHØØ2-5.

A scoping review was performed for the GHB614 cotton and its newly expressed protein, 2mEPSPS. The objective of this scoping review was to determine if there were studies about the molecular characterization of GHB614 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 57 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. Four publications were progressed for detailed assessment, and 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 GHB614 cotton or the 2mEPSPS protein, 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.

In summary, these literature searches and review of the retrieved articles identified one relevant publication that supports the existing safety assessment of GHB614 cotton.

1. INTRODUCTION

The GHB614 cotton event was developed through *Agrobacterium*-mediated transformation using the vector pTEM2 containing the *2mepsps* gene. GHB614 produces the *Zea mays* L. 5-enolpyruvylshikimate 3-phosphate synthase (2mEPSPS) protein which confers tolerance to glyphosate herbicides. The OECD identifier is BCS-GHØØ2-5.

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 cotton, and/or any adverse effect of GHB614 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 cotton and its newly expressed protein, 2mEPSPS. 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 cotton and its newly expressed proteins, 2mEPSPS, 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 cotton and its newly expressed protein 2mEPSPS?

Key elements:

Population: Human health; animal health; environmental safety

Exposure: GHB614 cotton, derived food/feed products, newly expressed protein in GHB

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 cotton and its newly expressed protein 2mEPSPS in cotton?

Key elements:

Population: GHB614 cotton and newly expressed protein in GHB614 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 |

| 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 |

| | | |
|---|--|--|
| <p>Stacked events obtained by conventional crosses/ subcombinations</p> | <p>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</p> | <p>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</p> |
| <p>Molecular stacks</p> | <p>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</p> | <p>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</p> |
| <p>Previously risk assessed publications</p> | <p>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</p> | <p>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</p> |
| <p>Access</p> | <p>Full-text document is accessible</p> | <p>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</p> |

| | | |
|------------------|--|--|
| 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

Two previously identified publications related to GHB614 cotton were used to test and validate the search strategy:

- Wu A-J; Chapman K; Sathischandra S; Massengill J; Araujo R; Soria M; Bugas M; Bishop Z; Haas C; Holliday B; Cisneros K; Lor J; Canez C; New S; Mackie S; Ghoshal D; Privalle L; Hunst P; Pallett K (2019). GHB614 x T304-40 x GHB119 x COT102 Cotton: Protein Expression Analyses of Field-Grown Samples. *Journal of Agricultural and Food Chemistry* 67:275-281
- Naegeli H; Birch AN; Casacuberta J; De Schrijver A; Gralak MA; Guerche P; Jones H; Manachini B; Messean A; Nielsen EE; Nogue F; Robaglia C; Rostoks N; Sweet J; Tebbe C; Visioli F; Wal J-M; Broll H; Gennaro A; Neri Franco M; Paraskevopoulos K (2018). Assessment of genetically modified cotton GHB614 x LLCotton25 x MON 15985 for food and feed uses, under Regulation (EC) No 1829/2003 (application EFSA-GMO-NL-2011-94). *EFSA Journal* 16(4):e05213

These two publications are not directly relevant to the GHB614 event. Nevertheless they were selected as reference publications because they include in the searchable fields the event name (GHB614), newly expressed protein (2mEPSPS), intended trait (herbicide tolerance) and/or target crop (cotton). Since this reference was 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 (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 4th, 2023. Only documents updated between July 1, 2022 - June 30, 2023 and 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 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 | Search string | Concepts |
|-----|---|-------------------------|
| 1 | s 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 | Event name |
| 2 | GLYTOL OR GLYTOLTM OR GLYTOLRTM OR GLY(w)TOL OR GLY(w)TOLTM OR GLY(w)TOLRTM | Trade name |
| 3 | 2MEPSPS or 2(w)MEPSPS or 2M(w)EPSPS or 2(w)M(w)EPSPS or (EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKAMATE or ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE) or (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC or ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (SYNTHASE OR SYNTHETASE) or (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE) (3W) PHOSPHATE (W) (SYNTHASE OR | Newly expressed protein |

| | | |
|---|---|---|
| | 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)) | |
| 4 | (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 |
| 5 | cotton# or gossypium or G(w)hirsutum or g(w)barbadense | Plant species |
| 6 | GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3a) (modif? OR transform? OR manipulat? OR improv? OR engineer?)) | GMO general |
| 7 | 4 or 5 or 6 | Intended trait AND Plant species AND GMO general |
| 8 | 1 or 2 or 3 or 7 | Event name OR Trade name OR Newly expressed protein 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 | New proteins | Intended traits | Plant species | GM plants |
|-----------------|-------|--------------|-----------------------------------|--|--------------------------------|
| Agricola | None | None | "HERBICIDE RESISTANCE" | "GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM" | "TRANSGENIC PLANTS" |
| Biosis | None | None | No terms for herbicide resistance | "GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM" | None |
| CABA | None | None | "HERBICIDE RESISTANCE" | "GOSSYPIUM BARBADENSE"/CT "GOSSYPIUM HIRSUTUM"/CT | "TRANSGENIC PLANTS" |
| CAS | None | None | "HERBICIDE RESISTANCE" | GOSSYPIUM/CT | "GENETICALLY MODIFIED PLANTS" |
| Medline | None | None | "HERBICIDE 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 | 4 Jul 2023 |
| Datespan of the search | 1 Jul 2022 – 30 Jun 2023 |

| Database | AGRICOLA | BIOSIS | CABA | CA-Plus | Medline |
|---|------------|-------------|-------------|------------|------------|
| Latest database update | 7 Jun 2023 | 28 Jun 2023 | 27 Jul 2023 | 3 Jul 2023 | 3 Jul 2023 |
| Number of records retrieved | 5 | 18 | 26 | 14 | 6 |
| Number of records after duplicate removal | 5 | 16 | 21 | 9 | 6 |
| Number of relevant records after rapid assessment | 0 | 1 | 3 | 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 - 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 US-EPA website was excluded, since GHB614 cotton does not contain an insect-resistant trait. Therefore, the internet search was limited to 10 key organisations relevant for GHB614 cotton. Search terms consisted of GHB614 or GlyTol or BCS-GHØØ2-5, and 2mEPSPS or Double mutant 5-enolpyruvyl shikimate-3-phosphate synthase enzyme (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 |
|---------------------------------------|---|--|-----------------------------|-------------------------|
| US Department of Agriculture (USDA) | https://www.usda.gov/ | 25.07.2023 | 25.07.2023 | 0 |
| US Food and Drug Administration (FDA) | https://www.fda.gov/ | 25.07.2023 | 28.07.2023 | 0 |

| Source Site Name | Website URL | Date of Most Recent Site Update (dd.mm.yyyy) | Date of Search (dd.mm.yyyy) | No. of Relevant Records |
|--|---|--|-----------------------------|-------------------------|
| Health Canada | https://www.canada.ca/en/health-canada.html | 26.06.2023 | 10.07.2023 | 0 |
| Canadian Food Inspection Agency (CFIA) | https://www.canada.ca/en/food-inspection-agency.html | 26.06.2023 | 20.07.2023 | 0 |
| Food Standards Australia New Zealand (FSANZ) | http://www.foodstandards.gov.au/Pages/default.aspx | 30.06.2023 | 10.07.2023 | 0 |
| Office of the Gene Technology Regulator (OGTR) Australia | http://www.ogtr.gov.au/ | 06.04.2023 | 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/biotechnologia | 17.07.2023 | 17.07.2023 | 0 |
| Genetic Engineering Approval Committee (GEAC) India | http://moef.gov.in/ | 19.07.2023 | 19.07.2023 | 0 |
| Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan | http://www.maff.go.jp/ | 27.07.2023 | 27.07.2023 | 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 |
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| No | Author(s) and Year | Title | Source | Number of relevant bibliographic references retrieved |
|----|--|--|--|---|
| 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, Kossler 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 |
| 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 |

| No | Author(s) and Year | Title | Source | Number of relevant bibliographic references retrieved |
|----|--|---|--|---|
| 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 69 references, which were reduced to 57 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 0](#)).

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 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) | 57 |
| Number of publications excluded from the search results after rapid assessment for relevance (Stage 1) | 53 |
| 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 |
|---|---|---|---|
| Food and Feed Safety | 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.efsa.2021.6671 Published by: Wiley, Oxford |

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 |
|---|---|---|---|
| Sharkey, S. M. Williams, B. J. Parker, K. M. 2021 | Herbicide drift from genetically engineered herbicide-tolerant crops. | Environmental Science + Technology (2021), Volume 55, Number 23, pp. 15559-15568, 107 refs. ISSN: 0013-936X; 1520-5851 DOI: https://doi.org/10.1021/acs.est.1c01906 Published by: American Chemical Society, Washington | The authors present concepts surrounding the physiochemical phenomena of herbicide drift from GM HT crops to support the development of effective approaches to reduce it. The publication does not contain original data. The environmental safety assessment is not related to GHB614 cotton. |

| 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. The environmental safety assessment is not related to GHB614 cotton. |
| Rodrigues, N. R. Ferreira Souza, A. P. de Morais, P. P. P. Braga, D. P. V. Crivellari, A. C. Favoretto, L. R. G. Berger, G. U. de Ferreira Souza, A. P. 2021 | Residues of glyphosate and aminomethylphosphonic acid (AMPA) in genetically modified glyphosate tolerant soybean, corn and cotton crops. | Ciencia Rural (2021), Volume 51, Number 1, 23 refs. ISSN: 0103-8478; 1678-4596 DOI: https://doi.org/10.1590/0103-8478cr20190244 . Published by: Centro de Ciencias Rurais, Universidade Federal de Santa Maria, Santa Maria | The authors monitor glyphosate residues levels and its metabolite AMPA. Soybean and corn grains and cotton seeds were within the Maximum Residue Limits (MRLs) established by ANVISA and Codex Alimentarius. The environmental safety assessment is not related to GHB614 cotton. |

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 four 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 one publication was relevant for the safety assessment of the GHB614 cotton and its newly expressed protein, 2mEPSPS.

The publication identified as relevant, Naegeli *et al.* 2021, provides a scientific risk assessment performed by the EFSA GMO Panel on data submitted in the context of the renewal application for the GHB614 cotton. The GMO Panel concluded that there is no evidence in the renewal application for new hazards, modified exposure, or scientific uncertainties that would change the conclusions of the original risk assessment on GHB614 cotton.

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

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 |
|---|---|-----------------------------------|--------------------------|-------------------------------|--|
| Food and Feed Safety | 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 | GHB614 | None | Not applicable | None, because no new hazards, modified exposure, or scientific uncertainties are reported. |

7. CONCLUSION

The literature searches performed for GHB614 cotton and its newly expressed protein, 2mEPSPS, for the period from July 1, 2022 to June 30, 2023 identified a total of 57 unique publications (after duplicate removal). A total of four publications were progressed for detailed assessment after excluding 53 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 relevant reference with bearing on food and feed safety was identified. The data and knowledge generated from this study does not impact the safety assessment of GHB614 cotton. No issues or topics were identified that would trigger or warrant more specific question formulation.

8. REFERENCES

| No. | Author(s), title, source, edition, year, pages |
|-----|--|
|-----|--|

- | | |
|----|---|
| 1. | Devos Y, Guajardo IM, Alvarez F and Glanville J. Explanatory note on literature searching conducted in the context of GMO applications for (renewed) market authorisation and annual post-market environmental monitoring reports on GMOs authorised in the EU market. EFSA supporting publications 2019:EN-1614. 62 pages. doi:10.2903/sp.efsa.2019.EN-1614. |
|----|---|

9. APPENDICES

Appendix 1: Database descriptions

| Host | File | Description |
|------|------------|--|
| STN | AGRICOLA | <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 09:29:06 ON 04 JUL 2023

L1 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

L2 0 SEA GLYTOL OR GLYTOLTM OR GLYTOLRTM OR GLY(W)TOL OR GLY(W)TOLTM OR GLY(W)TOLRTM

L3 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L4 4348 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKAMATE OR ENOYLPYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L5 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUV OYL) (W) (PHOSPHOSHIKI MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S YNTHASE OR SYNTHETASE)

L6 420 SEA (ENOL(W)PYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUV OYL) (W)SHIKIMATE) (3W)PHOSPHATE(W) (SYNTHASE OR SYNTHETASE)

L7 514 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUV OYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L8 25869 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L9 21 SEA L3 OR ((L4 OR L5 OR L6 OR L7)) (S)L8)

L10 4022 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?)

L11 30428 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L12 4174968 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?))

L13 134 SEA L10 AND L11 AND L12

L14 154 SEA L1 OR L2 OR L9 OR L13

L15 16 SEA L14 AND PY>=2021

L16 6 SEA L15 AND UP>=20220701 AND UP<=20230630

FILE 'BIOSIS' ENTERED AT 09:29:12 ON 04 JUL 2023

L17 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

L18 2 SEA GLYTOL OR GLYTOLTM OR GLYTOLRTM OR GLY(W)TOL OR GLY(W)TOLTM OR GLY(W)TOLRTM

L19 12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L20 5175 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKAMATE OR ENOYLPYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L21 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUV OYL) (W) (PHOSPHOSHIKI MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S YNTHASE OR SYNTHETASE)

L22 761 SEA (ENOL(W)PYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUV OYL) (W)SHIKIMATE) (3W)PHOSPHATE(W) (SYNTHASE OR SYNTHETASE)

L23 29 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUV OYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L24 28087 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L25 21 SEA L19 OR ((L20 OR L21 OR L22 OR L23)) (S)L24)

L26 11838 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?)

L27 79313 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM

L28 494793 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?))
L29 307 SEA L26 AND L27 AND L28
L30 332 SEA L17 OR L18 OR L25 OR L29
L31 29 SEA L30 AND PY>=2021
L32 18 SEA L31 AND UP>=20220701 AND UP<=20230630

FILE 'AGRICOLA' ENTERED AT 09:29:17 ON 04 JUL 2023

L33 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
L34 2 SEA GLYTOL OR GLYTOLTM OR GLYTOLRTM OR GLY(W)TOL OR GLY(W)TOLTM OR GLY(W)TOLRTM
L35 4 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L36 738 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKAMATE OR ENOYLPYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)
L37 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUV OYL) (W) (PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (SYNTHASE OR SYNTHETASE)
L38 336 SEA (ENOL(W)PYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUV OYL) (W) SHIKIMATE) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)
L39 270 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUV OYL (W) SHIKIMIC (3W) PHOSPHOSYNTHASE)
L40 7037 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)
L41 10 SEA L35 OR ((L36 OR L37 OR L38 OR L39)) (S)L40
L42 9392 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?)
L43 67931 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM
L44 113118 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?))
L45 250 SEA L42 AND L43 AND L44
L46 261 SEA L33 OR L34 OR L41 OR L45
L47 12 SEA L46 AND PY>=2021
L48 5 SEA L47 AND UP>=20220701 AND UP<=20230630

FILE 'CABA' ENTERED AT 09:29:22 ON 04 JUL 2023

L49 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
L50 4 SEA GLYTOL OR GLYTOLTM OR GLYTOLRTM OR GLY(W)TOL OR GLY(W)TOLTM OR GLY(W)TOLRTM
L51 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L52 1268 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKAMATE OR ENOYLPYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)
L53 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUV OYL) (W) (PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (SYNTHASE OR SYNTHETASE)
L54 477 SEA (ENOL(W)PYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUV OYL) (W) SHIKIMATE) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)
L55 202 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUV OYL (W) SHIKIMIC (3W) PHOSPHOSYNTHASE)
L56 7766 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)
L57 24 SEA L51 OR ((L52 OR L53 OR L54 OR L55)) (S)L56

L58 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?)
L59 112536 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM
L60 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?))
L61 561 SEA L58 AND L59 AND L60
L62 585 SEA L49 OR L50 OR L57 OR L61
L63 38 SEA L62 AND PY>=2021
L64 26 SEA L63 AND UP>=20220701 AND UP<=20230630
L65 26 SEA L64 NOT P/DT
L66 0 SEA L64 AND (P/DT AND J/DT)
L67 26 SEA L65 OR L66

FILE 'HCAPLUS' ENTERED AT 09:29:30 ON 04 JUL 2023

L68 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
L69 5 SEA GLYTOL OR GLYTOLTM OR GLYTOLRTM OR GLY(W)TOL OR GLY(W)TOLTM OR GLY(W)TOLRTM
L70 31 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L71 4624 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC) (4W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)
L72 9 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (SYNTHASE OR SYNTHETASE)
L73 1130 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W)SHIKIMATE) (3W)PHOSPHATE(W) (SYNTHASE OR SYNTHETASE)
L74 90 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)
L75 77189 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)
L76 46 SEA L70 OR ((L71 OR L72 OR L73 OR L74)) (S) L75)
L77 32108 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?)
L78 293158 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM
L79 746613 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?))
L80 1478 SEA L77 AND L78 AND L79
L81 1524 SEA L68 OR L69 OR L76 OR L80
L82 356 SEA L81 AND PY>=2021
L83 72 SEA L82 AND UP>=20220701 AND UP<=20230630
L84 14 SEA L83 NOT P/DT
L85 0 SEA L83 AND (P/DT AND J/DT)
L86 14 SEA L84 OR L85

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 03:29:37 ON 04 JUL 2023

L87 57 DUP REM L16 L32 L48 L67 L86 (12 DUPLICATES REMOVED)
ANSWERS '1-6' FROM FILE MEDLINE
ANSWERS '7-22' FROM FILE BIOSIS
ANSWERS '23-27' FROM FILE AGRICOLA
ANSWERS '28-48' FROM FILE CABA
ANSWERS '49-57' FROM FILE HCAPLUS