

Title

**Summary of the Literature Review for GHB119 cotton  
October 1, 2021 – June 30, 2022**

**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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Principal author

  
BASF Agricultural Solutions GmbH  
67063 Ludwigshafen  
Germany

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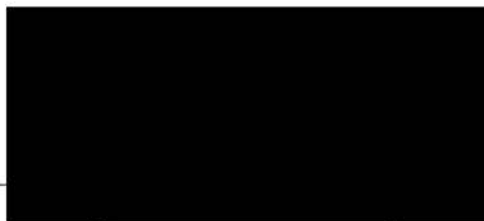
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**SIGNATURE PAGE**

Principal author:



Dr. [Redacted]  
Dietary Exposure Safety Manager  
Regulatory Science Seeds & Traits  
BASF Agricultural Solutions GmbH

Date

2022-08-29  
(YYYY-MM-DD)

## PERSONNEL

<b>Electronic database search</b>	<p>██████████ PhD. More than 20 years of expertise in plant molecular biology and plant biotechnology. Has performed professional-level database searches since 2013.</p>
<b>Agency website search</b>	<p>██████████ Global Regulatory Affairs Manager – Cotton, Ph.D. in Plant Pathology, 24 years experience in Regulatory Affairs Plant Biotechnology.</p>
<b>Manual search (reference list from review articles)</b>	<p>██████████ PhD in Food Science and Technology. Twenty years of expertise in food chemistry, food allergy and safety assessment of GMOs.</p>
<b>Stage 1 assessment</b>	<p>██████████ ██████████ ██████████</p>
<b>Stage 2 assessment</b>	<p><u>Food and Feed safety</u></p> <p>██████████ PhD in Toxicology. Regulatory Toxicologist for plant biotechnology since 2013.</p> <p>██████████ ██████████ PhD in Pathology with focus in Toxicology. Experience in regulatory toxicology for crop protection products. Regulatory Product Safety Manager for Environmental and Human Health for biotechnology products since 2021.</p> <p><u>Molecular characterization</u></p> <p>██████████ Bachelor Pharmaceutical and Biological Techniques. Expert in molecular characterization and plant biotechnology since 1999 and protein characterization since 2010.</p> <p>██████████ PhD in Plant Molecular Genetics. Ten years of expertise in molecular characterization and detection methods of GMOs.</p> <p><u>Environmental safety</u></p> <p>██████████ ██████████</p> <p>██████████ Agronomist Engineer, PhD in Agronomy (Vegetable Production/Integrated Pest Management). Ten years of expertise in field entomology and environmental safety assessment of GM crops.</p>
<b>Report</b>	<p>██████████ PhD in Food Chemistry. Expert in nutritional and dietary intake assessment of GM products since 1998 and Product Safety Manager for GM products since 2017.</p> <p>██████████</p>

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## SUMMARY

The GHB119 cotton event expresses the *Bacillus thuringiensis* subsp. *dakota* Cry2Ae insecticidal protein that is effective in controlling lepidopteran larvae such as cotton bollworm, tobacco budworm, and fall armyworm. GHB119 cotton also expresses the herbicide tolerant phosphinothricin acetyl transferase (PAT/*bar*) as a selectable marker which confers tolerance to glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ5-8.

A scoping review was performed for the GHB119 cotton and its newly expressed proteins, Cry2Ae and PAT/*bar*. The objective of this scoping review was to determine if there were studies about the molecular characterization of GHB119 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 October 1, 2021 to June 30, 2022. Additional sources of information, such as web pages of food safety, agriculture, and biotechnology-related authorities were searched for the same time window, along with the bibliographies of relevant reviews. The references identified were evaluated for potential relevance to the scoping review questions according to pre-defined criteria.

These literature searches identified a total of 200 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of four publications were progressed for detailed assessment and were determined to be not relevant after detailed review.

No new publications were found that contained new data on the molecular characterization of the GHB119 cotton and its newly expressed protein, Cry2Ae and PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of GHB119 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

The GHB119 cotton event expresses the *Bacillus thuringiensis* subsp. *dakota* Cry2Ae insecticidal protein that is effective in controlling lepidopteran larvae such as cotton bollworm, tobacco budworm, and fall armyworm. GHB119 cotton also expresses the herbicide tolerant phosphinothricin acetyl transferase (PAT/*bar*) as a selectable marker which confers tolerance to glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ5-8.

The objective of the literature searches described here was to determine if there were studies published between October 1, 2021 and June 30, 2022 that mention the molecular characterization of the GHB119, and/or any adverse effect of GHB119 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)<sup>1</sup> applications and post-market environmental monitoring activities (2019).

The literature searches were performed for the GHB119 cotton and its newly expressed proteins, Cry2Ae and PAT/*bar*. The search terms also included relevant synonyms and intended traits, plant species and general GMO terms. When needed, plant species and general GMO terms were used to limit the search results (described in [Section 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 GHB119 cotton and its newly expressed proteins, Cry2Ae 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<sup>1</sup>.

**Question 1:** Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the GHB119 cotton and its newly expressed proteins Cry2Ae and PAT/*bar*?

**Key elements:**

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

**Exposure:** GHB119 cotton, derived food/feed products, newly expressed proteins in GHB119 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 GHB119 cotton and its newly expressed proteins Cry2Ae and PAT/*bar* in cotton?



**Key elements:**

**Population:** GHB119 cotton and newly expressed proteins in GHB119 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<sup>1</sup> and are described in Table 1.

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

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

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

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

Concepts	Criteria	Comment
Reporting format	A study in a publication should only be presented once, but if it is presented in more than one publication, all publications should be listed and grouped	Duplicate publications should be excluded at the screening stage. Only one copy of a study is required even if it is reported in different publications, and identified in more than one database

Table adapted from EFSA, 2019: Explanatory note on literature searching conducted in the context of GMO applications for (renewed) market authorisation and annual post-market environmental monitoring reports on GMOs authorised in the EU market.

## 2.4. Reference publication

One publication that is related to GHB119 cotton was previously identified and was 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 Agriculture and Food Chemistry* 67(1):275-281

This article was selected as reference publication because even though it is not directly relevant for the GHB119 event, it mentions the event (GHB119), one of the newly expressed proteins (phosphinothricin acetyl transferase), the intended traits (insect control; herbicide tolerance) and the crop (cotton). Since this article was published outside of the timeframe of this report, the search profile was tested without applying the time filters used in the final profile (UP>=20211001 and UP<=20220630).

## 3. SEARCH METHODS AND OUTCOMES

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

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

### 3.1. Time window and date of the literature search

The database searches were performed on July 18, 2022. Only documents updated between October 1, 2021 and June 30, 2022, were considered in the search. The dates of most recent database updates are provided in [Table 3](#).

### 3.2. Databases used in the literature search

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

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

See [Appendix 1](#) for detailed database descriptions.

### 3.3. Search strategy

The search profiles were designed to cover the event name, the newly expressed proteins, and the 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	GHB119 or GHB(w)119 or BCS-GH005-8 or BCS(w)GH005(w)8 or BCSGH005(w)8 or BCS-GH005-8 or BCS-(w)GH005(w)8 or BCSGH005(w)8 or BCS-GH005-8 or BCS-(w)GH005(w)8 or BCSGH005(w)8	Event name
2	s ((bar or pat)(2a)(gene# or protein# or enzyme#)) or ppt(2w)acetyltransferase or ppt(2w)acetyl(w)transferase or pt(w)n(2w)acetyltransferase or pt(w)n(2w)acetyl(w)transferase or phosphinothricin(w)n(w)acetyltransferase or phosphinothricin(2w)acetyltransferase or phosphinothricin(2w)acetyl(w)transferase or phosphinothricinacetyl(w)transferase	Newly expressed protein 1
3	cry2ae# or cry(w)2(w)ae# or cry(w)2ae# or cry2(w)ae# or cry2(w)a(w)e# or cry(w)2(w)a(w)e# or cry2a(w)e# or cryIIae# or cry(w)II(w)ae# or cry(w)IIae# or cryII(w)ae# or cryII(w)a(w)e# or cry(w)II(w)a(w)e# or cryIIa(w)e# or cryllae# or cry(w)ll(w)ae# or cry(w)llae# or cryll(w)ae# or cryll(w)a(w)e# or cry(w)ll(w)a(w)e# or crylla(w)e#	Newly expressed protein 2
4	(herbicid? or bialaphos or basta or glufosinate or phosphinothricin or liberty? Or Insect# OR pest# OR Lepidoptera# OR Noctuidae OR Crambidae OR borer# OR cornborer# OR stalkborer# OR earworm# OR ear(w)worm# OR armyworm# OR army(w)worm# OR cutworm# OR cut(w)worm# OR Ostrinia OR O(w)nubilalis OR Sesamia OR S(w)nonagrioides or Diatraea OR D(w)grandiosella OR D(w)crambidoides OR Helicoverpa OR H(w)zea OR Spodoptera OR S(w)frugiperda OR Papaipema OR P(w)nebris OR Elasmopalpus OR E(w)lignosellus OR D(w)saccharalis OR Striacosta OR S(w)albicosta or Agrotis OR A(w)ipsilon OR S(w)cretica OR Mythimna OR M(w)unipuncta OR ECB OR MCB OR SWCB OR SCSB OR CEW OR FAW OR SCB OR WBC) (5a) (resist? OR protect? OR toleran?)	Intended traits

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	2 and 5	Newly expressed protein 1 AND Plant species
8	4 and 5 and 6	Intended trait AND Plant species AND GMO general
9	1 or 3 or 7 or 8	Event name OR (Newly expressed protein 1 AND plant species) OR Newly expressed protein 2 OR (Intended traits 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
<b>Agricola</b>	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIMUM BARBADENSE" "GOSSYPIMUM HIRSUTUM"	"TRANSGENIC PLANTS"

Database	Event	New proteins	Intended traits	Plant species	GM plants
<b>Biosis</b>	None	None	No terms for herbicide or insect resistance	"GOSSYPIMUM BARBADENSE" "GOSSYPIMUM HIRSUTUM"	None
<b>CABA</b>	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIMUM BARBADENSE"/CT "GOSSYPIMUM HIRSUTUM"/CT	"TRANSGENIC PLANTS"
<b>CAS</b>	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	GOSSYPIMUM/CT	"GENETICALLY MODIFIED PLANTS"
<b>Medline</b>	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIMUM BARBADENSE" "GOSSYPIMUM HIRSUTUM"	"PLANTS, GENETICALLY MODIFIED"

The search results were limited to documents updated between October 1, 2021 and June 30, 2022 (UP>=20211001 and UP<=20220630), and to non-patent documents (not P/DT). To ensure that documents with indexing errors where two document types (DTs) (one eligible and one ineligible) were attached to a single record were not missed, documents with both 'journal' and 'patent' as document type were also kept. These putative documents would be identified with (P/DT AND J/DT) in CABA and CAPLus.

Table 4 summarizes the number of results obtained from each of the databases searched.

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

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

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
<b>Database Provider</b>	STN International	STN International	STN International	STN International	STN International
<b>Coverage</b>	1970-present	1926-present	1973-present	1907-present	1946-present
<b>Date of search</b>	18 July 2022	18 July 2022	18 July 2022	18 July 2022	18 July 2022
<b>Datespan of the search</b>	1 Oct 2021 – 30 Jun 2022	1 Oct 2021 – 30 Jun 2022	1 Oct 2021 – 30 Jun 2022	1 Oct 2021 – 30 Jun 2022	1 Oct 2021 – 30 Jun 2022
<b>Latest database update</b>	8 July 2022	13 July 2022	13 July 2022	17 July 2022	17 July 2022

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Number of records retrieved	23	52	78	52	53
Number of records after duplicate removal	17	42	54	34	53
Number of relevant records after rapid assessment	1	2	0	1	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: October 1, 2021 to June 30, 2022) or refer to relevant records published during this time frame. Relevance of results were determined based on the criteria listed in [Table 1](#) and they were summarized in Table 5. All web pages searched were justified by their recommendation in the EFSA 2019 explanatory note<sup>1</sup>. Of the 13 key organisations cited in the EFSA 2019 explanatory note<sup>1</sup>, Environment and Climate Change Canada and Intersecretarial Commission on Biosafety of GMOs (CIBIOGEM) were excluded, since they are not involved in the risk assessment of GM plants. Therefore, the internet search was limited to 11 key organisations relevant for GHB119 cotton. Search terms consisted of GHB119 cotton or OECD Identifier or trait-specific protein(s) in GHB119 cotton (all searched singly, with no search limits applied).

**Table 5: Results of search of food safety, agriculture, and biotechnology-related authority websites**

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
US Environmental Protection Agency (EPA)	<a href="https://www.epa.gov/">https://www.epa.gov/</a>	Sep 16 2022	Sep 16 2022	0
US Department of Agriculture (USDA)	<a href="https://www.usda.gov/">https://www.usda.gov/</a>	Sep 5 2022	Sep 5 2022	0
US Food and Drug Administration (FDA)	<a href="https://www.fda.gov/">https://www.fda.gov/</a>	Sep 7 2022	Sep 7 2022	0
Health Canada	<a href="https://www.canada.ca/en/health-canada.html">https://www.canada.ca/en/health-canada.html</a>	Aug 1 2022	Aug 31 – Sep 1 2022	0



Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
Canadian Food Inspection Agency (CFIA)	<a href="https://www.canada.ca/en/food-inspection-agency.html">https://www.canada.ca/en/food-inspection-agency.html</a>	Aug 1 2022	Sep 2 - 7 2022	0
Food Standards Australia New Zealand (FSANZ)	<a href="http://www.foodstandards.gov.au/Pages/default.aspx">http://www.foodstandards.gov.au/Pages/default.aspx</a>	Aug 12 2022	Aug 24 2022	0
Office of the Gene Technology Regulator (OGTR) Australia	<a href="http://www.ogtr.gov.au/">http://www.ogtr.gov.au/</a>	Aug 1 2022	Aug 29 2022	0
National Technical Commission on Biosafety (CTNBio) Brazil	<a href="http://ctnbio.mcti.gov.br/en">http://ctnbio.mcti.gov.br/en</a>	Aug 1 2022	Aug 29 2022	0
National Advisory Commission on Agricultural Biotechnology (CONABIA) Argentina	<a href="https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia">https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia</a>	Sep 8 2022	Sep 8 2022	0
Genetic Engineering Approval Committee (GEAC) India	<a href="http://moef.gov.in/">http://moef.gov.in/</a>	Aug 12 2022	Aug 24 2022	0
Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan	<a href="http://www.maff.go.jp/">http://www.maff.go.jp/</a>	Sep 6 2022	Sep 6 2022	0

#### 4.2. Manual searches of reference lists of recent review articles

Recent review articles as sources of reference lists to search for potentially relevant studies were identified via searches of PubMed.gov for general terms such as “GMO” or “GM crops” in the titles and abstracts. The search of PubMed.gov was also restricted to recent reviews published between October 1, 2021 and June 30, 2022. The resulting number of relevant studies found within the bibliographies of these review articles is given in Table 6.

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

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
1	Ahmad A, Munawar N, Khan Z, Qusmani AT, Khan SH, Jamil A, Ashraf S, Ghouri MZ, Aslam S, Mubarik	An Outlook on Global Regulatory Landscape for Genome-Edited Crops	Int J Mol Sci. 2021 Oct 29;22(21):11753.	0

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

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

The database searches ([Section 3](#)) identified a total of 258 references, which were reduced to 200 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 evaluator were in 100 % agreement.

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

- Duplicated entries
- Secondary literature (reviews), other than assessments from regulatory agencies
- Articles on non-relevant topics like detection methods, socio-economic implications of GM crops, GM policy, agronomical performance, other herbicide 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 GHB119 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)	200
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	196
Total number of full-text documents assessed in detail	4
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	4
Total number of unobtainable/unclear publications	0
Total number of relevant publications	0

[Table 8](#) lists the publications determined to be relevant based on detailed evaluation. Publications that were clearly not relevant after a detailed assessment are listed in [Table 9](#). [Table 10](#) lists the publications for which full-text documents were unobtainable for detailed assessment or for which relevance was unclear after detailed assessment.

**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 <a href="#">Table 1</a>
Ali, Qasim Salisu, Ibrahim Bala Shahid, Ahmad Ali Liaqat, Ayesha Rao, Abdul Qayyum. 2020	90-day subchronic toxicity study of transgenic cotton expressing Cry1Ac, Cry2A and CP4-EPSPS proteins in Sprague-Dawley rats.	Food and chemical toxicology: an international journal published for the British Industrial Biological Research Association (Dec 2020), Volume 146, pp. 111783 ISSN: 0278-6915 Source Note: December 2020 v. 146	GM cotton variety (VH289) expressing Cry1Ac, Cry2A and CP4-EPSPS proteins was used in a 90-day rat study. No adverse effects were observed.  The study is not relevant for GHB119 (Cry 2Ae, PAT/ <i>bar</i> ) event.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in <a href="#">Table 1</a>
Fast Brandon, J. Shan Guomin, Herman Rod A., Gampala Satyalinga Srinivas. 2019	Transgene expression in sprayed and non- sprayed herbicide - tolerant genetically engineered crops is equivalent.	Regulatory toxicology and pharmacology : RTP, (2020 Mar) Vol. 111, pp. 104572. Electronic Publication Date: 26 Dec 2019 Journal code: 8214983. E-ISSN: 1096- 0295. L-ISSN: 0273-2300.	The GHB119 cotton event was not included in this study.
Luz, Carlos Eduardo Almeida Zuim, Vitor Oliveira, Andrea Aparecida Santos dos Santos, Patricia de Jesus Campos, Karolayne Lopes Haro, Marcelo Mendes Vivan, Lucia Madalena Bastos, Cristina Schetino Guedes, Raul Narciso Carvalho 2022	Arthropod food webs associated with cotton : Does Bt cotton mediate community stress?	Journal of applied entomology (Feb 2022), Volume 146, Number 1-2, pp. 56-66, 11 p. ISSN: 0931-2048	The authors analysed the short-term impact of Bt cotton on the associated arthropod community in Neotropical fields. Bt cotton (MON15985; Bollgard II) and related non-Bt cotton (FMT 709) were cultivated for two years, and the arthropods were sampled. The Bt cotton-associated food webs were similar to those of the non-Bt cotton, indicating no significant impact of the event on arthropod food webs.  The ERA is not related to GHB119 cotton.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in <a href="#">Table 1</a>
Wang, Tiantian Yan, Bing Chen, Yanjun Guan, Xiao Li, Junsheng 2021	Characteristics of bacterial community of rhizosphere soil of transgenic insect - resistant cotton at different growth stages	Huanjing Kexue Yanjiu (2021 ), 34(7), 1728-1736 CODEN: HKYAEZ; ISSN: 1001-6929	The authors conducted a study at Xingtai, Hebei Province in China to assess the effect of Bt cotton on rhizosphere soil bacterial community using high-throughput sequencing technology to study the composition and diversity compared with samples from non-GM cotton at different crop growth stages. According to the paper the Bt protein content in rhizosphere of the GM cotton did not affect the alpha diversity of bacteria besides the effect observed on abundance and community structure at different growth stages. There is no information about the event neither the protein(s) expressed and clarity on the methods (already considering that the paper is in Chinese).  This ERA is not related to GHB119 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 none of the publications were relevant for the safety assessment of the GHB119 cotton and its newly expressed proteins, Cry2Ae and PAT/*bar*.

## 7. CONCLUSION

The literature searches performed for the GHB119 cotton and its newly expressed proteins, Cry2Ae and PAT/*bar*, for the period from October 1, 2021 to June 30, 2022, identified a total of 200 unique publications (after duplicate removal). A total of four publications were progressed for detailed assessment after excluding 196 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](#).

No new publications were found that contained new data on the molecular characterization of the GHB119 cotton and its newly expressed proteins, Cry2Ae and PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of GHB119 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.

## 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-CA/CAPLUS	<p>The Chemical Abstracts (CA) database covers all areas of Biochemistry, Chemistry and Chemical engineering, and related sciences.</p> <p>Sources include over 8,000 journals, patents from 38 national patent offices and two international patent organizations, technical reports, books, conference proceedings, and dissertations. Electronic only journals and Web preprints are also covered.</p> <p>Bibliographic terms, indexing terms, roles, CAS Registry Numbers, International Patent Classification, and abstracts are searchable.</p>

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

## Appendix 2 Search history

FILE 'MEDLINE' ENTERED AT 08:47:09 ON 18 JUL 2022

L1 4 SEA GHB119 OR GHB(W)119 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR  
BCSGH005(W)8 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8

L2 1512 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

L3 204 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L4 1586 SEA (L2 OR L3)

L5 13 SEA CRY2AE# OR CRY(W)2(W)AE# OR CRY(W)2AE# OR CRY2(W)AE# OR  
CRY2(W)A(W)E# OR CRY(W)2(W)A(W)E# OR CRY2A(W)E#

L6 0 SEA CRYIIAE# OR CRY(W)II(W)AE# OR CRY(W)IIAE# OR CRYII(W)AE#  
OR CRYII(W)A(W)E# OR CRY(W)II(W)A(W)E# OR CRYIIA(W)E#

L7 0 SEA CRYLLAE# OR CRY(W)LL(W)AE# OR CRY(W)LLAE# OR CRYLL(W)AE#  
OR CRYLL(W)A(W)E# OR CRY(W)LL(W)A(W)E# OR CRYLLA(W)E#

L8 13 SEA (L5 OR L6 OR L7)

L9 31643 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINO  
THRICIN OR LIBERTY?

L10 216372 SEA INSECT# OR PEST# OR LEPIDOPTERA# OR NOCTUIDAE OR CRAMBIDAE  
OR BORER# OR CORNBORER# OR STALKBORER# OR EARWORM# OR EAR(W)WOR  
M# OR ARMYWORM# OR ARMY(W)WORM# OR CUTWORM# OR CUT(W)WORM# OR  
OSTRINIA OR O(W)NUBILALIS OR SESAMIA OR S(W)NONAGRIODES

L11 14528 SEA DIATRAEA OR D(W)GRANDIOSELLA OR D(W)CRAMBIDOIDES OR  
HELICOVERPA OR H(W)ZEA OR SPODOPTERA OR S(W)FRUGIPERDA OR  
PAPAIPEMA OR P(W)NEBRIS OR ELASMOPALPUS OR E(W)LIGNOSELLUS OR  
D(W)SACCHARALIS OR STRIACOSTA OR S(W)ALBICOSTA

L12 24336 SEA AGROTIS OR A(W)IPSILON OR S(W)CRETICA OR MYTHIMNA OR  
M(W)UNIPUNCTA OR ECB OR MCB OR SWCB OR SCSB OR CEW OR FAW OR  
SCB OR WBC

L13 2533275 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L14 12349 SEA ((L9 OR L10 OR L11 OR L12))(5A)L13

L15 28485 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L16 4013707 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR  
(GENETIC?(3A)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR  
ENGINEER?))

L17 14 SEA L4 AND L15

L18 694 SEA L14 AND L15 AND L16

L19 705 SEA L1 OR L8 OR L17 OR L18

L20 120 SEA L19 AND PY>=2020

L21 53 SEA L20 AND UP>=20211001 AND UP<=20220630

FILE 'BIOSIS' ENTERED AT 08:47:19 ON 18 JUL 2022

L22 2 SEA GHB119 OR GHB(W)119 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR  
BCSGH005(W)8 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8

L23 2901 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

L24 334 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L25 3005 SEA (L23 OR L24)

L26 19 SEA CRY2AE# OR CRY(W)2(W)AE# OR CRY(W)2AE# OR CRY2(W)AE# OR  
CRY2(W)A(W)E# OR CRY(W)2(W)A(W)E# OR CRY2A(W)E#

L27 0 SEA CRYIIAE# OR CRY(W)II(W)AE# OR CRY(W)IIAE# OR CRYII(W)AE#  
OR CRYII(W)A(W)E# OR CRY(W)II(W)A(W)E# OR CRYIIA(W)E#

L28 0 SEA CRYLLAE# OR CRY(W)LL(W)AE# OR CRY(W)LLAE# OR CRYLL(W)AE#  
OR CRYLL(W)A(W)E# OR CRY(W)LL(W)A(W)E# OR CRYLLA(W)E#

L29 19 SEA (L26 OR L27 OR L28)

L30 90426 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINO  
THRICIN OR LIBERTY?

L31 1451475 SEA INSECT# OR PEST# OR LEPIDOPTERA# OR NOCTUIDAE OR CRAMBIDAE  
OR BORER# OR CORNBORER# OR STALKBORER# OR EARWORM# OR EAR(W)WORM#  
OR ARMYWORM# OR ARMY(W)WORM# OR CUTWORM# OR CUT(W)WORM# OR  
OSTRINIA OR O(W)NUBILALIS OR SESAMIA OR S(W)NONAGRIOIDES

L32 28219 SEA DIATRAEA OR D(W)GRANDIOSELLA OR D(W)CRAMBIDOIDES OR  
HELICOVERPA OR H(W)ZEA OR SPODOPTERA OR S(W)FRUGIPERDA OR  
PAPAIPEMA OR P(W)NEBRIS OR ELASMOPALPUS OR E(W)LIGNOSELLUS OR  
D(W)SACCHARALIS OR STRIACOSTA OR S(W)ALBICOSTA

L33 34658 SEA AGROTIS OR A(W)IPSILON OR S(W)CRETICA OR MYTHIMNA OR  
M(W)UNIPUNCTA OR ECB OR MCB OR SWCB OR SCSB OR CEW OR FAW OR  
SCB OR WBC

L34 2502394 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L35 35281 SEA ((L30 OR L31 OR L32 OR L33))(5A)L34

L36 77139 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L37 478634 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?))

L38 44 SEA L25 AND L36

L39 996 SEA L35 AND L36 AND L37

L40 1040 SEA L22 OR L29 OR L38 OR L39

L41 110 SEA L40 AND PY>=2020

L42 52 SEA L41 AND UP>=20211001 AND UP<=20220630

FILE 'AGRICOLA' ENTERED AT 08:47:28 ON 18 JUL 2022

L43 2 SEA GHB119 OR GHB(W)119 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR  
BCSGH005(W)8 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8

L44 813 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

L45 255 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L46 894 SEA (L44 OR L45)

L47 10 SEA CRY2AE# OR CRY(W)2(W)AE# OR CRY(W)2AE# OR CRY2(W)AE# OR  
CRY2(W)A(W)E# OR CRY(W)2(W)A(W)E# OR CRY2A(W)E#

L48 0 SEA CRYIIAE# OR CRY(W)II(W)AE# OR CRY(W)IIAE# OR CRYII(W)AE#  
OR CRYII(W)A(W)E# OR CRY(W)II(W)A(W)E# OR CRYIIA(W)E#

L49 0 SEA CRYLLAE# OR CRY(W)LL(W)AE# OR CRY(W)LLAE# OR CRYLL(W)AE#  
OR CRYLL(W)A(W)E# OR CRY(W)LL(W)A(W)E# OR CRYLLA(W)E#

L50 10 SEA (L47 OR L48 OR L49)

L51 59572 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINO  
THRICIN OR LIBERTY?

L52 350161 SEA INSECT# OR PEST# OR LEPIDOPTERA# OR NOCTUIDAE OR CRAMBIDAE  
OR BORER# OR CORNBORER# OR STALKBORER# OR EARWORM# OR EAR(W)WORM#  
OR ARMYWORM# OR ARMY(W)WORM# OR CUTWORM# OR CUT(W)WORM# OR  
OSTRINIA OR O(W)NUBILALIS OR SESAMIA OR S(W)NONAGRIOIDES

L53 15020 SEA DIATRAEA OR D(W)GRANDIOSELLA OR D(W)CRAMBIDOIDES OR  
HELICOVERPA OR H(W)ZEA OR SPODOPTERA OR S(W)FRUGIPERDA OR  
PAPAIPEMA OR P(W)NEBRIS OR ELASMOPALPUS OR E(W)LIGNOSELLUS OR  
D(W)SACCHARALIS OR STRIACOSTA OR S(W)ALBICOSTA

L54 5545 SEA AGROTIS OR A(W)IPSILON OR S(W)CRETICA OR MYTHIMNA OR  
M(W)UNIPUNCTA OR ECB OR MCB OR SWCB OR SCSB OR CEW OR FAW OR  
SCB OR WBC

L55 683691 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L56 31197 SEA ((L51 OR L52 OR L53 OR L54))(5A)L55

L57 66661 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L58 110181 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?))

L59 21 SEA L46 AND L57

L60 779 SEA L56 AND L57 AND L58

L61 796 SEA L43 OR L50 OR L59 OR L60

L62 62 SEA L61 AND PY>=2020

L63 23 SEA L62 AND UP>=20211001 AND UP<=20220630

FILE 'CABA' ENTERED AT 08:47:49 ON 18 JUL 2022

L64 6 SEA GHB119 OR GHB(W)119 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8

L65 1580 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

L66 380 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L67 1682 SEA (L65 OR L66)

L68 15 SEA CRY2AE# OR CRY(W)2(W)AE# OR CRY(W)2AE# OR CRY2(W)AE# OR CRY2(W)A(W)E# OR CRY(W)2(W)A(W)E# OR CRY2A(W)E#

L69 0 SEA CRYIIAE# OR CRY(W)II(W)AE# OR CRY(W)IIAE# OR CRYII(W)AE# OR CRYII(W)A(W)E# OR CRY(W)II(W)A(W)E# OR CRYIIA(W)E#

L70 0 SEA CRYLLAE# OR CRY(W)LL(W)AE# OR CRY(W)LLAE# OR CRYLL(W)AE# OR CRYLL(W)A(W)E# OR CRY(W)LL(W)A(W)E# OR CRYLLA(W)E#

L71 15 SEA (L68 OR L69 OR L70)

L72 156129 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?

L73 951302 SEA INSECT# OR PEST# OR LEPIDOPTERA# OR NOCTUIDAE OR CRAMBIDAE OR BORER# OR CORNBORER# OR STALKBORER# OR EARWORM# OR EAR(W)WORM# OR ARMYWORM# OR ARMY(W)WORM# OR CUTWORM# OR CUT(W)WORM# OR OSTRINIA OR O(W)NUBILALIS OR SESAMIA OR S(W)NONAGRIOIDES

L74 33763 SEA DIATRAEA OR D(W)GRANDIOSELLA OR D(W)CRAMBIDOIDES OR HELICOVERPA OR H(W)ZEA OR SPODOPTERA OR S(W)FRUGIPERDA OR PAPAIPEMA OR P(W)NEBRIS OR ELASMOPALPUS OR E(W)LIGNOSELLUS OR D(W)SACCHARALIS OR STRIACOSTA OR S(W)ALBICOSTA

L75 14077 SEA AGROTIS OR A(W)IPSILON OR S(W)CRETICA OR MYTHIMNA OR M(W)UNIPUNCTA OR ECB OR MCB OR SWCB OR SCSB OR CEW OR FAW OR SCB OR WBC

L76 1378259 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L77 89303 SEA ((L72 OR L73 OR L74 OR L75))(5A)L76

L78 99263 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L79 193516 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 35 SEA L67 AND L78

L81 2313 SEA L77 AND L78 AND L79

L82 2333 SEA L64 OR L71 OR L80 OR L81

L83 204 SEA L82 AND PY>=2020

L84 78 SEA L83 AND UP>=20211001 AND UP<=20220630

L85 78 SEA L84 NOT P/DT

L86 0 SEA L84 AND (P/DT AND J/DT)

L87 78 SEA L85 OR L86

FILE 'HCAPLUS' ENTERED AT 08:48:05 ON 18 JUL 2022

L88 7 SEA GHB119 OR GHB(W)119 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8 OR BCS-GH005-8 OR BCS-(W)GH005(W)8 OR BCSGH005(W)8

L89 5402 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

L90 793 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L91 5708 SEA (L89 OR L90)

L92 44 SEA CRY2AE# OR CRY(W)2(W)AE# OR CRY(W)2AE# OR CRY2(W)AE# OR CRY2(W)A(W)E# OR CRY(W)2(W)A(W)E# OR CRY2A(W)E#

L93 4 SEA CRYIIAE# OR CRY(W)II(W)AE# OR CRY(W)IIAE# OR CRYII(W)AE# OR CRYII(W)A(W)E# OR CRY(W)II(W)A(W)E# OR CRYIIA(W)E#

L94 0 SEA CRYLLAE# OR CRY(W)LL(W)AE# OR CRY(W)LLAE# OR CRYLL(W)AE# OR CRYLL(W)A(W)E# OR CRY(W)LL(W)A(W)E# OR CRYLLA(W)E#

L95 45 SEA (L92 OR L93 OR L94)  
L96 159807 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINO  
THRIN OR LIBERTY?  
L97 324716 SEA INSECT# OR PEST# OR LEPIDOPTERA# OR NOCTUIDAE OR CRAMBIDAE  
OR BORER# OR CORNBORER# OR STALKBORER# OR EARWORM# OR EAR(W)WORM#  
OR ARMYWORM# OR ARMY(W)WORM# OR CUTWORM# OR CUT(W)WORM# OR  
OSTRINIA OR O(W)NUBILALIS OR SESAMIA OR S(W)NONAGRIOIDES  
L98 24164 SEA DIATRAEA OR D(W)GRANDIOSELLA OR D(W)CRAMBIDOIDES OR  
HELICOVERPA OR H(W)ZEA OR SPODOPTERA OR S(W)FRUGIPERDA OR  
PAPAIPEMA OR P(W)NEBRIS OR ELASMOPALPUS OR E(W)LIGNOSELLUS OR  
D(W)SACCHARALIS OR STRIACOSTA OR S(W)ALBICOSTA  
L99 26989 SEA AGROTIS OR A(W)IPSILON OR S(W)CRETICA OR MYTHIMNA OR  
M(W)UNIPUNCTA OR ECB OR MCB OR SWCB OR SCSB OR CEW OR FAW OR  
SCB OR WBC  
L100 6185138 SEA (RESIST? OR PROTECT? OR TOLERAN?)  
L101 58344 SEA ((L96 OR L97 OR L98 OR L99))(5A)L100  
L102 279226 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE  
L103 717225 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?))  
L104 215 SEA L91 AND L102  
L105 2493 SEA L101 AND L102 AND L103  
L106 2619 SEA L88 OR L95 OR L104 OR L105  
L107 575 SEA L106 AND PY>=2020  
L108 88 SEA L107 AND UP>=20211001 AND UP<=20220630  
L109 52 SEA L108 NOT P/DT  
L110 0 SEA L108 AND (P/DT AND J/DT)  
L111 52 SEA L109 OR L110

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 02:48:15 ON 18  
JUL 2022

L112 200 DUP REM L21 L42 L63 L87 L111 (58 DUPLICATES REMOVED)  
ANSWERS '1-53' FROM FILE MEDLINE  
ANSWERS '54-95' FROM FILE BIOSIS  
ANSWERS '96-112' FROM FILE AGRICOLA  
ANSWERS '113-166' FROM FILE CABA  
ANSWERS '167-200' FROM FILE HCAPLUS