

Title

**Summary of the Literature Review for GHB614 x LLCotton25 x MON 15985 cotton stack  
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.  
EFSA supporting publications 2019:EN-1614

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Principal author

  
BASF Agricultural Solutions GmbH  
67063 Ludwigshafen  
Germany

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Summary of the Literature Review for GHB614 x LLcotton25 x MON 15985  
October 1, 2021 – June 30, 2022

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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)

## STUDY PERSONNEL

Electronic database search	<p>██████████ PhD. More than 20 years of expertise in plant molecular biology and plant biotechnology. Has performed professional-level database searches since 2013.</p>
Agency website search	<p>██████████ Global Regulatory Affairs Manager, PhD in Crop Protection, 8 years of experience in R&amp;D Seeds&amp;Traits.</p>
Manual search (reference list from review articles)	<p>██████████ PhD in Food Science and Technology. Twenty years of expertise in food chemistry, food allergy and safety assessment of GMOs.</p>
Stage 1 assessment	<p>██████████</p>
Stage 2 assessment	<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>
Report	<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

BASF has used conventional breeding techniques to develop the stacked trait cotton product GHB614 x LLCotton25 x MON 15985 (GLB2 cotton) which confers resistance to lepidopteran insects and tolerance to glyphosate and glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ2-5 x ACS-GHØØ1-3 x MON-15985-7.

A scoping review was performed for the GHB614 x LLCotton25 x MON 15985 cotton stack and its newly expressed proteins, 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2. The objective of this scoping review was to determine if there were studies about the molecular characterization of GHB614 x LLCotton25 x MON 15985 cotton stack, 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 45 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of three 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 GHB614 x LLCotton25 x MON 15985 cotton and its newly expressed proteins, 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2. Similarly, no new publications were found that suggested any potential adverse effects of GHB614 x LLCotton25 x MON 15985 cotton on human health, animal health, or the environment. No issues or topics were identified that would trigger or warrant more specific question formulation or indicate that a systematic review would be of value.

## 1. INTRODUCTION

BASF has used conventional breeding techniques to develop the stacked trait cotton product GHB614 x LLCotton25 x MON 15985 (GLB2 cotton) which confers resistance to lepidopteran insects and tolerance to glyphosate and glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ2-5 x ACS-GHØØ1-3 x MON-15985-7.

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 GHB614 x LLCotton25 x MON 15985 cotton stack, and/or any adverse effect of GHB614 x LLCotton25 x MON 15985 cotton stack 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 GHB614 x LLCotton25 x MON 15985 cotton stack and its newly expressed proteins, 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2. The search terms also included relevant synonyms, trade name and intended trait, 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 GHB614 x LLCotton25 x MON 15985 cotton stack and its newly expressed proteins, 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2, 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 GHB614 x LLCotton25 x MON 15985 cotton stack and its newly expressed proteins 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2?

**Key elements:**

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

**Exposure:** GHB614 x LLCotton25 x MON 15985 cotton stack, derived food/feed products, newly expressed proteins in GHB614 x LLCotton25 x MON 15985 cotton stack

**Comparators:** When applicable, comparable populations or subjects exposed to appropriate controls (e.g., vehicle only, innocuous control protein, non-GM comparator) or conventional counterpart used for comparative analysis of plant material

**Outcome:** Adverse effects

**Question 2:** Were any studies published during the reporting period that focus on molecular characterization of the GHB614 x LLCotton25 x MON 15985 cotton stack and its newly expressed proteins 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2 in cotton?



#### Key elements:

**Population:** GHB614 x LLCotton25 x MON 15985 cotton stack and newly expressed proteins in GHB614 x LLCotton25 x MON 15985 cotton stack

**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
Additional concepts		

Concepts	Criteria	Comment
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

Two publications related to GHB614 x LLCotton25 x MON 15985 cotton stack were previously identified and used to test and validate the search strategy:

- Naegeli, H.; Birch, A. N.; Casacuberta, J.; Schrijver, A. de; Gralak, M. A.; Guerche, P.; Jones, H.; Manachini, B.; Messean, A.; Nielsen, E. E.; Nogue, F.; Robaglia, C.; Rostoks, N.; Sweet, J.; Tebbe, C.; Visioli, F.; Wal, J. M.; Broll, H.; Gennaro, A.; Neri, F. M.; Paraskevopoulos, K.; de Schrijver, A. (2018). Assessment of genetically modified cotton GHB614 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 p.
- Assif, M.; Siddiqui, H.A.; Naqvi, R. Z.; Amin, I.; Asad, S.; Mukhtar, Z.; Bashir, A.; Mansoor. S. (2021). Development of event-specific detection method for identification of insect resistant NIBGE-1601 cotton harboring double gene Cry1Ac-Cry2Ab construct. Scientific Reports 11, article 3479.

The first article is directly relevant for the GHB614 x LLCotton25 x MON 15985 cotton stack, while the second article mentions event MON 15985, its newly expressed proteins Cry1Ac and Cry2Ab, the crop (cotton) and one of the intended traits (insect resistance)

Since one of these references was published before the current search period, the search profile was tested without applying the time limit used in the final search profile (UP>=20211001 and UP<=20220630).

## 3. SEARCH METHODS AND OUTCOMES

The search strategies used here followed the 2019 EFSA explanatory note on literature searching conducted in the context of GMO applications and post-market environmental monitoring 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 August 16, 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 event name, newly expressed proteins and intended traits of the stack. Since the 'intended traits' profile identified too many references when used alone, it was combined with a 'general GMO' profile and a 'plant species' profile. The reference publication ([Section 2.4](#)) was identified by the search profiles confirming the validity of the applied search strategy. See Table 2 for a detailed search profile.

**Table 2: Search profile for database search**

Set	Search string	Concepts
1	GHB614 OR GHB(W)614 OR BCS-GH002-5 OR BCSGH002-5 OR BCS(W)GH002(W)5 OR BCSGH002(W)5 OR BCS-GH002-5 OR BCS(W)GH002(W)5 OR BCSGH002(W)5 or GHB614x OR GHB(W)614x OR BCS-GH002-5x OR BCSGH002-5x OR BCS(W)GH002(W)5x OR BCSGH002(W)5x OR BCS-GH002-5x OR BCS(W)GH002(W)5x OR BCSGH002(W)5x	Event name GHB614
2	LLcotton25 or LLcotton(w)25 or LL(w)cotton25 or LL(w)cotton(w)25 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3 or LLcotton25x or LLcotton(w)25x or LL(w)cotton25x or LL(w)cotton(w)25x or ACS-GH001-3x or ACS(w)GH001(w)3x or ACSGH001(w)3x or ACS-GH001-3x or ACS(w)GH001(w)3x or ACSGH001(w)3x or xLLcotton25 or xLLcotton(w)25 or xLL(w)cotton25 or xLL(w)cotton(w)25 or xACS-GH001-3 or xACS(w)GH001(w)3 or xACSGH001(w)3 or xACS-GH001-3 or xACS(w)GH001(w)3 or xACSGH001(w)3 or xLLcotton25x or xLLcotton(w)25x or xLL(w)cotton25x or xLL(w)cotton(w)25x or xACS-GH001-3x or xACS(w)GH001(w)3x or xACSGH001(w)3x or xACS-GH001-3x or xACS(w)GH001(w)3x or xACSGH001(w)3x	Event name LLCotton25
3	MON(w)15985 or MON15985 or MON-15985-7 or MON(w)15985(w)7 or MON15985(w)7 or xMON(w)15985 or xMON15985 or xMON-15985-7 or xMON(w)15985(w)7 or xMON15985(w)7	Event name MON 15985
4	GHB614XLLcotton25xMON15985 or GHB(w)614XLLcotton25xMON15985 or GHB614XLL(w)cotton25xMON15985 or GHB614XLLcotton(w)25xMON15985 or GHB614XLLcotton25xMON(w)15985 or GHB(w)614XLL(w)cotton25xMON15985 or	Event name stack

Set	Search string	Concepts
	GHB(w)614XLlcotton(w)25xMON15985 or GHB(w)614XLlcotton25xMON(w)15985 or GHB(w)614XLL(w)cotton(w)25xMON15985 or GHB(w)614XLL(w)cotton25xMON(w)15986 or GHB(w)614XLL(w)cotton(w)25xMON(w)15985 or GHB614(w)time#(w)LLcotton25(w)time#(w)MON15985 or GHB614(w)time#(w)LLcotton25(w)time#(w)MON(w)15985	
5	(1 and 2) or (1 and 3) or (2 and 3) or 4	Event name all
6	GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(w)TOL? OR GLY(w)TOLTM? OR GLY(w)TOLRTM?	Trade name GHB614
7	libertylink or liberty(w)link or libertylinktm or liberty(w)linktm or libertylinkrtm or liberty(w)linkrtm	Trade name LLCotton25
8	bollgard? or bolgard?	Trade name MON 15985
9	(6 and 7) or (6 and 8) or (7 and 8)	Trade name all
10	(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 ENOLPYRUVVOYLSHIKIMATE OR ENOYL PYRUVVOYL SHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE) or (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC or ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE) or (ENOL(W)PYRUVVOYL SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE) or (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)(s) ((DOUBL# or DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M))	Newly expressed proteins GHB614
11	((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 proteins LLCotton25
12	crylaC# or cry(w)l(w)aC# or cry(w)laC# or cryl(w)aC# or cryl(w)a(w)c# or cry(w)l(w)a(w)c# or cryla(w)c# or cryIaC# or cry(w)I(w)aC# or cry(w)IaC# or cryI(w)aC# or cryI(w)a(w)c# or cry(w)I(w)a(w)c# or cryIa(w)c# or crylaC# or cry(w)l(w)aC# or cry(w)laC# or cryl(w)aC# or cryl(w)a(w)c# or cry(w)l(w)a(w)c# or cryla(w)c# or Cry2Ab2 or Cry(w)2Ab2 Cry2(w)Ab2 or Cry2A(w)b2 or Cry2Ab(w)2 or Cry2(w)Ab(w)2 or Cry(w)2(w)Ab2 or Cry(w)2(w)A(w)b2 or CryiiAb2 or Cry(w)iiAb2 Cryii(w)Ab2 or CryiiA(w)b2 or CryiiAb(w)2 or Cryii(w)Ab(w)2 or Cry(w)ii(w)Ab2 or Cry(w)ii(w)A(w)b2	Newly expressed proteins MON 15985

Set	Search string	Concepts
13	(10 and 11) or (10 and 12) or (11 and 12)	Newly expressed proteins all
14	(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 traits GHB614
15	(herbicid? or bialaphos or basta or glufosinate or gluphosinate or phosphinothricin or liberty?)(5a)(resist? OR protect? OR toleran?)	Intended traits LLCotton25
16	(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 MON 15985
17	(14 and 15) or (14 and 16) or (15 and 16)	Intended traits all
18	cotton# or gossypium or G(w)hirsutum or g(w)barbadense	Plant species
19	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3a)(modif? OR transform? OR manipulatio? OR improv? OR engineer?))	GMO general
20	17 and 18 and 19	Intended traits all AND Plant species AND GMO general
21	5 or 9 or 13 or 20	Event name all OR Trade name all OR Newly expressed proteins all species) OR (Intended traits all AND Plant species AND GMO general)

All searches were performed in the Basic Index (BI) field, which includes the following subject headings/field names:

- **Agricola:** title (TI), controlled term (CT), supplementary term (ST), abstract (AB), named person (NA), corporate name (CO), note (NTE), geographic term, CABA and other fields (GT)
- **Biosis:** title (TI), abstract (AB), biosystematic codes (BC), chemical name (CN), controlled term (CT), gene name (GEN), geographic term (GT), organism (ORGN) and supplementary term (ST); as well as CAS Registry Numbers (RN)
- **CA-Plus:** title (TI), supplementary term (ST), index term (IT) and abstract (AB); as well as CAS Registry Numbers
- **CABA:** title (TI), controlled term (CT), supplementary term (ST), broader term (BT), abstract (AB), organism name (ORGN) and geographic term (GT); as well as CAS Registry Numbers

- **Medline:** title (TI), chemical name (CN), gene name (GEN), controlled term (excluding MeSH numbers) (CT), supplementary term (ST), named person (NA), other source (OS), and abstract (AB), as well as CAS Registry Numbers and GenBank Numbers

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

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

Database	Event	New proteins	Intended traits	Plant species	GM plants
<b>Agricola</b>	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIMUM BARBADENSE" "GOSSYPIMUM HIRSUTUM"	"TRANSGENIC 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 CAPIus.

[Table 4](#) summarizes the number of results obtained from each of the databases searched.

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



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

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Database Provider	STN International	STN International	STN International	STN International	STN International
Coverage	1970-present	1926-present	1973-present	1907-present	1946-present
Date of search	16 Aug 2022	16 Aug 2022	16 Aug 2022	16 Aug 2022	16 Aug 2022
Datespan of the search	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
Latest database update	8 Aug 2022	10 Aug 2022	10 Aug 2022	15 Aug 2022	15 Aug 2022
Number of records retrieved	6	17	19	11	8
Number of records after duplicate removal	4	15	12	6	8
Number of relevant records after rapid assessment	0	3	0	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: 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. The USDA, EPA, FDA, CFIA, Health Canada, FSANZ and MAFF websites were excluded, since these agencies do not regulate GM stacked products obtained by conventional breeding techniques. Therefore, the internet search was limited to four key organisations relevant for GHB614 x LLCotton25 x MON 15985 cotton stack. Search terms consisted of GHB614 x LLCotton25 x MON 15985 cotton stack or OECD Identifier or trait-specific protein(s) in GHB614 x LLCotton25 x MON 15985 cotton stack (all searched singly, with no search limits applied).

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

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
Office of the Gene Technology Regulator (OGTR) Australia	<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/biotechnology">https://www.argentina.gob.ar/agroindustria/bioeconomia/biotechnology</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

#### 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 MS, Munir A, Sultan Q, Abd-Elsalam KA, Qari SH. 2021	An Outlook on Global Regulatory Landscape for Genome-Edited Crops	Int J Mol Sci. 2021 Oct 29;22(21):11753.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
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 61 references, which were reduced to 45 after removal of duplicates ([Table 4](#)). No additional studies were identified in the manual searches ([Section 4](#)).

### 5.1. Screening of titles and abstracts to exclude obviously irrelevant references (Stage 1)

All references identified in the database searches described in [Section 3](#) were assessed for relevance based on information in their title and abstract by two reviewers independently. If opinions of relevance differed, the discrepancies were discussed between the reviewers and if a disagreement persisted, the publication under the discussion was transferred to Stage 2 for detailed evaluation by the experts. In this search, both evaluator were in 100 % agreement.

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

- Duplicated entries
- Secondary literature (reviews), other than assessments from regulatory agencies
- Articles on non-relevant topics like detection methods, socio-economic implications of GM crops, GM policy, agronomical performance, other herbicide resistant GM crops, other insect resistant GM crops, unrelated topics, etc.

Publications which appeared to be relevant and those of unclear relevance were tagged as “Relevant” and progressed to Stage 2 (detailed assessment; see [Section 5.2](#)).

The number of publications excluded after rapid assessment for relevance is presented in [Table 7](#) documenting the selection process.

### 5.2. Detailed assessment of eligible references (Stage 2)

Publications tagged as “Relevant” in Stage 1 were assessed in detail independently by two scientific experts in each of three corresponding areas (i.e., Molecular Biology, Food and Feed Safety, Environmental Safety), based on the full text of the publications. If opinions of relevance differed between reviewers within each area, the initial reviewers discussed the discrepancy as necessary and consulted additional reviewers to resolve the discrepancy if needed.

In the relevance assessment of the literature review for the GHB614 x LLCotton25 x MON 15985 cotton stack, 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)	45
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	42
Total number of full-text documents assessed in detail	3
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	0

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

**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>
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 GLB2 cotton event was not included in this study.

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	A 90-day subchronic toxicity study of transgenic cotton expressing Cry1Ac, Cry2A and CP4-EPSPS proteins in Sprague-Dawley rats.	Food and Chemical Toxicology, (DEC 2020 ) Vol. 146, pp. Article No.: 111783. <a href="https://www.journals.elsevier.com/food-and-chemical-toxicology">https://www.journals.elsevier.com/food-and-chemical-toxicology</a> . CODEN: FCTOD7. ISSN: 0278-6915. E-ISSN: 1873-6351.	The GLB2 cotton event was not included in this study.
Sharkey, Stephen M. Williams, Brent J. Parker, Kimberly M. 2021	Herbicide Drift from Genetically Engineered Herbicide -Tolerant Crops.	Environmental Science + Technology, (DEC 7 2021 ) Vol. 55, No. 23, pp. 15559-15568. <a href="https://pubs.acs.org/loi/esthag">https://pubs.acs.org/loi/esthag</a> . CODEN: ESTHAG. ISSN: 0013-936X. E-ISSN: 1520-5851.	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 present original data. The ERA is not related to GLB2 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 3 publications were selected during Stage 1 evaluation (rapid assessment based on title and abstract). After Stage 2 evaluation (detailed review based on full text), it was determined that the publications were not relevant for the safety assessment of GHB614 x LLCotton25 x MON 15985 cotton and its newly expressed proteins 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2.

## 7. CONCLUSION

The literature searches performed for the GHB614 x LLCotton25 x MON 15985 cotton and its newly expressed proteins, 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2, for the period from October 1, 2021 to June 30, 2022, identified a total of 45 unique publications (after duplicate removal). A total of 3 publications were progressed for detailed assessment after excluding 42 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract). The 3 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](#).

None of the publications was found to contain any new data on the molecular characterization of the GHB614 x LLCotton25 x MON 15985 cotton and its newly expressed proteins, 2mEPSPS, PAT/*bar*, Cry1Ac and Cry2Ab2. Similarly, no new publications were found that suggested any potential adverse effects of GHB614 x LLCotton25 x MON 15985 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 11:49:44 ON 16 AUG 2022

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 GHB614X OR GHB(W)614X OR BCS-GH002-5X OR BCSGH002-5X OR BCS(W)GH002(W)5X OR BCSGH002(W)5X OR BCS-GH002-5X OR BCS(W)GH002(W)5X OR BCSGH002(W)5X

L3 4 SEA (L1 OR L2)

L4 3 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3

L5 0 SEA LLCOTTON25X OR LLCOTTON(W)25X OR LL(W)COTTON25X OR LL(W)COTTON(W)25X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)3X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)3X

L6 0 SEA XLLCOTTON25 OR XLLCOTTON(W)25 OR XLL(W)COTTON25 OR XLL(W)COTTON(W)25 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3

L7 0 SEA XLLCOTTON25X OR XLLCOTTON(W)25X OR XLL(W)COTTON25X OR XLL(W)COTTON(W)25X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X

L8 3 SEA (L4 OR L5 OR L6 OR L7)

L9 12 SEA MON(W)15985 OR MON15985 OR MON-15985-7 OR MON(W)15985(W)7 OR MON15985(W)7 OR XMON(W)15985 OR XMON15985 OR XMON-15985-7 OR XMON(W)15985(W)7 OR XMON15985(W)7

L10 0 SEA GHB614XLLCOTTON25XMON15985 OR GHB(W)614XLLCOTTON25XMON15985 OR GHB614XLL(W)COTTON25XMON15985 OR GHB614XLLCOTTON(W)25XMON15985 OR GHB614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON25XMON15985 OR GHB(W)614XLLCOTTON(W)25XMON15985

L11 1 SEA GHB(W)614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON(W)25XMON15985 OR GHB(W)614XLL(W)COTTON25XMON(W)15986 OR GHB(W)614XLL(W)COTTON(W)25XMON(W)15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME#(W)MON15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME#(W)MON(W)15985

L12 1 SEA (L10 OR L11)

L13 1 SEA (L3 AND L8) OR (L3 AND L9) OR (L8 AND L9) OR L12

L14 2 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR GLY(W)TOLTM? OR GLY(W)TOLRTM?

L15 71 SEA BOLLGARD? OR BOLGARD?

L16 18 SEA LIBERTYLINK OR LIBERTY(W)LINK OR LIBERTYLINKTM OR LIBERTY(W)LINKTM OR LIBERTYLINKRTM OR LIBERTY(W)LINKRTM

L17 0 SEA (L14 AND L15) OR (L14 AND L16) OR (L15 AND L16)

L18 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L19 4281 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKIMATE OR ENOYLPRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L20 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L21 402 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L22 504 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L23 25131 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)

L24 20 SEA L18 OR ((L19 OR L20 OR L21 OR L22))(S)L23)

L25 1521 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  
L26 204 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE  
L27 1595 SEA (L25 OR L26)  
L28 1236 SEA CRY1AC# OR CRY(W)1(W)AC# OR CRY(W)1AC# OR CRY1(W)AC# OR  
CRY1(W)A(W)C# OR CRY(W)1(W)A(W)C# OR CRY1A(W)C#  
L29 127 SEA CRYIAC# OR CRY(W)I(W)AC# OR CRY(W)IAC# OR CRYI(W)AC# OR  
CRYI(W)A(W)C# OR CRY(W)I(W)A(W)C# OR CRYIA(W)C#  
L30 59 SEA CRYLAC# OR CRY(W)L(W)AC# OR CRY(W)LAC# OR CRYL(W)AC# OR  
CRYL(W)A(W)C# OR CRY(W)L(W)A(W)C# OR CRYLA(W)C#  
L31 91 SEA CRY2AB2 OR CRY(W)2AB2 CRY2(W)AB2 OR CRY2A(W)B2 OR CRY2AB(W)  
2 OR CRY2(W)AB(W)2 OR CRY(W)2(W)AB2 OR CRY(W)2(W)A(W)B2 OR  
CRYIIAB2 OR CRY(W)IIAB2 CRYII(W)AB2 OR CRYIIA(W)B2 OR CRYIIAB(W)  
)2 OR CRYII(W)AB(W)2 OR CRY(W)II(W)AB2 OR CRY(W)II(W)A(W)B2  
L32 1450 SEA (L28 OR L29 OR L30 OR L31)  
L33 25 SEA (L24 AND L27) OR (L24 AND L32) OR (L27 AND L32)  
L34 3764 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?)  
L35 3582 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?)(5A)(RESIST? OR  
PROTECT? OR TOLERAN?)  
L36 217099 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)NONAGRIOIDES  
L37 14581 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  
L38 24480 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  
L39 2545395 SEA (RESIST? OR PROTECT? OR TOLERAN?)  
L40 9123 SEA ((L36 OR L37 OR L38))(5A)L39  
L41 3329 SEA (L34 AND L35) OR (L34 AND L40) OR (L35 AND L40)  
L42 28636 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE  
L43 4027140 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?))  
L44 116 SEA L41 AND L42 AND L43  
L45 141 SEA L13 OR L17 OR L33 OR L44  
L46 17 SEA L45 AND PY>=2020  
L47 8 SEA L46 AND UP>=20211001 AND UP<=20220630

FILE 'BIOSIS' ENTERED AT 11:50:03 ON 16 AUG 2022  
L48 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  
L49 0 SEA GHB614X OR GHB(W)614X OR BCS-GH002-5X OR BCSGH002-5X OR  
BCS(W)GH002(W)5X OR BCSGH002(W)5X OR BCS-GH002-5X OR BCS(W)GH00  
2(W)5X OR BCSGH002(W)5X  
L50 4 SEA (L48 OR L49)  
L51 4 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON  
(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR  
ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3  
L52 0 SEA LLCOTTON25X OR LLCOTTON(W)25X OR LL(W)COTTON25X OR  
LL(W)COTTON(W)25X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR  
ACSGH001(W)3X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)  
)3X  
L53 0 SEA XLLCOTTON25 OR XLLCOTTON(W)25 OR XLL(W)COTTON25 OR

XLL(W)COTTON(W)25 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3

L54 0 SEA XLLCOTTON25X OR XLLCOTTON(W)25X OR XLL(W)COTTON25X OR XLL(W)COTTON(W)25X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X

L55 4 SEA (L51 OR L52 OR L53 OR L54)

L56 15 SEA MON(W)15985 OR MON15985 OR MON-15985-7 OR MON(W)15985(W)7 OR MON15985(W)7 OR XMON(W)15985 OR XMON15985 OR XMON-15985-7 OR XMON(W)15985(W)7 OR XMON15985(W)7

L57 0 SEA GHB614XLLCOTTON25XMON15985 OR GHB(W)614XLLCOTTON25XMON15985 OR GHB614XLL(W)COTTON25XMON15985 OR GHB614XLLCOTTON(W)25XMON15985 OR GHB614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON25XMON15985 OR GHB(W)614XLLCOTTON(W)25XMON15985

L58 0 SEA GHB(W)614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON(W)25XMON15985 OR GHB(W)614XLL(W)COTTON25XMON(W)15986 OR GHB(W)614XLL(W)COTTON(W)25XMON(W)15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME#(W)MON15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME#(W)MON(W)15985

L59 0 SEA (L57 OR L58)

L60 1 SEA (L50 AND L55) OR (L50 AND L56) OR (L55 AND L56) OR L59

L61 6 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR GLY(W)TOLTM? OR GLY(W)TOLRTM?

L62 212 SEA BOLLGARD? OR BOLGARD?

L63 47 SEA LIBERTYLINK OR LIBERTY(W)LINK OR LIBERTYLINKTM OR LIBERTY(W)LINKTM OR LIBERTYLINKRTM OR LIBERTY(W)LINKRTM

L64 3 SEA (L61 AND L62) OR (L61 AND L63) OR (L62 AND L63)

L65 12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L66 5113 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKIMATE OR ENOYLPYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L67 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUV OYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L68 746 SEA (ENOL(W)PYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUV OYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L69 28 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUV OYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L70 27464 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)

L71 19 SEA L65 OR (((L66 OR L67 OR L68 OR L69))(S)L70)

L72 2904 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

L73 334 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L74 3008 SEA (L72 OR L73)

L75 1999 SEA CRY1AC# OR CRY(W)1(W)AC# OR CRY(W)1AC# OR CRY1(W)AC# OR CRY1(W)A(W)C# OR CRY(W)1(W)A(W)C# OR CRY1A(W)C#

L76 231 SEA CRYIAC# OR CRY(W)I(W)AC# OR CRY(W)IAC# OR CRYI(W)AC# OR CRYI(W)A(W)C# OR CRY(W)I(W)A(W)C# OR CRYIA(W)C#

L77 367 SEA CRYLAC# OR CRY(W)L(W)AC# OR CRY(W)LAC# OR CRYL(W)AC# OR CRYL(W)A(W)C# OR CRY(W)L(W)A(W)C# OR CRYLA(W)C#

L78 123 SEA CRY2AB2 OR CRY(W)2AB2 CRY2(W)AB2 OR CRY2A(W)B2 OR CRY2AB(W)2 OR CRY2(W)AB(W)2 OR CRY(W)2(W)AB2 OR CRY(W)2(W)A(W)B2 OR CRYIIAB2 OR CRY(W)IIAB2 CRYII(W)AB2 OR CRYIIA(W)B2 OR CRYIIAB(W)2 OR CRYII(W)AB(W)2 OR CRY(W)II(W)AB2 OR CRY(W)II(W)A(W)B2

L79 2356 SEA (L75 OR L76 OR L77 OR L78)

L80 46 SEA (L71 AND L74) OR (L71 AND L79) OR (L74 AND L79)

L81 11498 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?)

L82 10282 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?)(5A)(RESIST? OR PROTECT? OR TOLERAN?)

L83 1454234 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

L84 28312 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

L85 34795 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

L86 2512286 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L87 25757 SEA ((L83 OR L84 OR L85))(5A)L86

L88 9921 SEA (L81 AND L82) OR (L81 AND L87) OR (L82 AND L87)

L89 77327 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L90 480076 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?))

L91 266 SEA L88 AND L89 AND L90

L92 316 SEA L60 OR L64 OR L80 OR L91

L93 30 SEA L92 AND PY>=2020

L94 17 SEA L93 AND UP>=20211001 AND UP<=20220630

FILE 'AGRICOLA' ENTERED AT 05:50:20 ON 16 AUG 2022

L95 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

L96 0 SEA GHB614X OR GHB(W)614X OR BCS-GH002-5X OR BCSGH002-5X OR BCS(W)GH002(W)5X OR BCSGH002(W)5X OR BCS-GH002-5X OR BCS(W)GH002(W)5X OR BCSGH002(W)5X

L97 2 SEA (L95 OR L96)

L98 2 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3

L99 0 SEA LLCOTTON25X OR LLCOTTON(W)25X OR LL(W)COTTON25X OR LL(W)COTTON(W)25X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)3X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)3X

L100 0 SEA XLLCOTTON25 OR XLLCOTTON(W)25 OR XLL(W)COTTON25 OR XLL(W)COTTON(W)25 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3

L101 0 SEA XLLCOTTON25X OR XLLCOTTON(W)25X OR XLL(W)COTTON25X OR XLL(W)COTTON(W)25X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X

L102 2 SEA (L98 OR L99 OR L100 OR L101)

L103 9 SEA MON(W)15985 OR MON15985 OR MON-15985-7 OR MON(W)15985(W)7 OR MON15985(W)7 OR XMON(W)15985 OR XMON15985 OR XMON-15985-7 OR XMON(W)15985(W)7 OR XMON15985(W)7

L104 0 SEA GHB614XLLCOTTON25XMON15985 OR GHB(W)614XLLCOTTON25XMON15985 OR GHB614XLL(W)COTTON25XMON15985 OR GHB614XLLCOTTON(W)25XMON15985 OR GHB614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON25XMON15985

L105 0 SEA GHB(W)614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON(W)25XMON15985 OR GHB(W)614XLL(W)COTTON25XMON(W)15986 OR GHB(W)614XLL(W)COTTON(W)25XMON(W)15985 OR GHB614(W)TIME#(W)LLCO

TTON25(W)TIME#(W)MON15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME  
#(W)MON(W)15985  
L106 0 SEA (L104 OR L105)  
L107 0 SEA (L97 AND L102) OR (L97 AND L103) OR (L102 AND L103) OR  
L106  
L108 3 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR  
GLY(W)TOLTM? OR GLY(W)TOLRTM?  
L109 203 SEA BOLLGARD? OR BOLGARD?  
L110 42 SEA LIBERTYLINK OR LIBERTY(W)LINK OR LIBERTYLINKTM OR LIBERTY(W)  
)LINKTM OR LIBERTYLINKRTM OR LIBERTY(W)LINKRTM  
L111 3 SEA (L108 AND L109) OR (L108 AND L110) OR (L109 AND L110)  
L112 4 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS  
L113 727 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR  
ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV  
OYLSHIKIMATE OR ENOYLPYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(  
4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)  
L114 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVYOYL)(W)(PHOSPHOSHIKI  
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(S  
YNTHASE OR SYNTHETASE)  
L115 333 SEA (ENOL(W)PYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR  
ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVYOYL)(W)SHIKIMATE  
)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)  
L116 265 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK  
IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVYOYL(W)SHIKIMIC(  
3W)PHOSPHOSYNTHASE)  
L117 6893 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)  
L118 9 SEA L112 OR (((L113 OR L114 OR L115 OR L116))(S)L117)  
L119 815 SEA ((BAR OR PAT)(2A)(GENE# OR PROTEIN# OR ENZYME#)) OR  
PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR  
PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE  
L120 255 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE  
L121 896 SEA (L119 OR L120)  
L122 1210 SEA CRY1AC# OR CRY(W)1(W)AC# OR CRY(W)1AC# OR CRY1(W)AC# OR  
CRY1(W)A(W)C# OR CRY(W)1(W)A(W)C# OR CRY1A(W)C#  
L123 151 SEA CRYIAC# OR CRY(W)I(W)AC# OR CRY(W)IAC# OR CRYI(W)AC# OR  
CRYI(W)A(W)C# OR CRY(W)I(W)A(W)C# OR CRYIA(W)C#  
L124 24 SEA CRYLAC# OR CRY(W)L(W)AC# OR CRY(W)LAC# OR CRYL(W)AC# OR  
CRYL(W)A(W)C# OR CRY(W)L(W)A(W)C# OR CRYLA(W)C#  
L125 91 SEA CRY2AB2 OR CRY(W)2AB2 CRY2(W)AB2 OR CRY2A(W)B2 OR CRY2AB(W)  
2 OR CRY2(W)AB(W)2 OR CRY(W)2(W)AB2 OR CRY(W)2(W)A(W)B2 OR  
CRYIIAB2 OR CRY(W)IIAB2 CRYII(W)AB2 OR CRYIIA(W)B2 OR CRYIIAB(W)  
)2 OR CRYII(W)AB(W)2 OR CRY(W)II(W)AB2 OR CRY(W)II(W)A(W)B2  
L126 1427 SEA (L122 OR L123 OR L124 OR L125)  
L127 21 SEA (L118 AND L121) OR (L118 AND L126) OR (L121 AND L126)  
L128 9209 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?)  
L129 8711 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?)(5A)(RESIST? OR  
PROTECT? OR TOLERAN?)  
L130 351392 SEA INSECT# OR PEST# OR LEPIDOPTERA# OR NOCTUIDAE OR CRAMBIDAE  
OR BORER# OR CORNBORER# OR STALKBORER# OR EARWORM# OR EAR(W)WORM  
M# OR ARMYWORM# OR ARMY(W)WORM# OR CUTWORM# OR CUT(W)WORM# OR  
OSTRINIA OR O(W)NUBILALIS OR SESAMIA OR S(W)NONAGRIOIDES  
L131 15086 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  
L132 5590 SEA AGROTIS OR A(W)IPSILOIN 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

L133 689311 SEA (RESIST? OR PROTECT? OR TOLERAN?)  
L134 22984 SEA ((L130 OR L131 OR L132))(5A)L133  
L135 8548 SEA (L128 AND L129) OR (L128 AND L134) OR (L129 AND L134)  
L136 66887 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE  
L137 110799 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?))  
L138 235 SEA L135 AND L136 AND L137  
L139 257 SEA L107 OR L111 OR L127 OR L138  
L140 13 SEA L139 AND PY>=2020  
L141 6 SEA L140 AND UP>=20211001 AND UP<=20220630

FILE 'CABA' ENTERED AT 05:51:44 ON 16 AUG 2022

L142 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  
L143 0 SEA GHB614X OR GHB(W)614X OR BCS-GH002-5X OR BCSGH002-5X OR  
BCS(W)GH002(W)5X OR BCSGH002(W)5X OR BCS-GH002-5X OR BCS(W)GH00  
2(W)5X OR BCSGH002(W)5X  
L144 7 SEA (L142 OR L143)  
L145 5 SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON  
(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR  
ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3  
L146 0 SEA LLCOTTON25X OR LLCOTTON(W)25X OR LL(W)COTTON25X OR  
LL(W)COTTON(W)25X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR  
ACSGH001(W)3X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)  
)3X  
L147 0 SEA XLLCOTTON25 OR XLLCOTTON(W)25 OR XLL(W)COTTON25 OR  
XLL(W)COTTON(W)25 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR  
XACSGH001(W)3 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)  
3  
L148 0 SEA XLLCOTTON25X OR XLLCOTTON(W)25X OR XLL(W)COTTON25X OR  
XLL(W)COTTON(W)25X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR  
XACSGH001(W)3X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR  
XACSGH001(W)3X  
L149 5 SEA (L145 OR L146 OR L147 OR L148)  
L150 19 SEA MON(W)15985 OR MON15985 OR MON-15985-7 OR MON(W)15985(W)7  
OR MON15985(W)7 OR XMON(W)15985 OR XMON15985 OR XMON-15985-7  
OR XMON(W)15985(W)7 OR XMON15985(W)7  
L151 0 SEA GHB614XLLCOTTON25XMON15985 OR GHB(W)614XLLCOTTON25XMON15985  
OR GHB614XLL(W)COTTON25XMON15985 OR GHB614XLLCOTTON(W)25XMON15  
985 OR GHB614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON25  
XMON15985 OR GHB(W)614XLLCOTTON(W)25XMON15985  
L152 1 SEA GHB(W)614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON(W)  
)25XMON15985 OR GHB(W)614XLL(W)COTTON25XMON(W)15986 OR  
GHB(W)614XLL(W)COTTON(W)25XMON(W)15985 OR GHB614(W)TIME#(W)LLCO  
TTON25(W)TIME#(W)MON15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME  
#(W)MON(W)15985  
L153 1 SEA (L151 OR L152)  
L154 2 SEA (L144 AND L149) OR (L144 AND L150) OR (L149 AND L150) OR  
L153  
L155 5 SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR  
GLY(W)TOLTM? OR GLY(W)TOLRTM?  
L156 392 SEA BOLLGARD? OR BOLGARD?  
L157 106 SEA LIBERTYLINK OR LIBERTY(W)LINK OR LIBERTYLINKTM OR LIBERTY(W)  
)LINKTM OR LIBERTYLINKRTM OR LIBERTY(W)LINKRTM  
L158 6 SEA (L155 AND L156) OR (L155 AND L157) OR (L156 AND L157)  
L159 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS  
L160 1202 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR  
ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV  
OYLSHIKAMATE OR ENOYLPYRUVYOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(  
4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)  
L161 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKI



MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L162 462 SEA (ENOL(W)PYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L163 192 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L164 7683 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)

L165 21 SEA L159 OR ((L160 OR L161 OR L162 OR L163))(S)L164)

L166 1585 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

L167 380 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L168 1687 SEA (L166 OR L167)

L169 2200 SEA CRY1AC# OR CRY(W)1(W)AC# OR CRY(W)1AC# OR CRY1(W)AC# OR CRY1(W)A(W)C# OR CRY(W)1(W)A(W)C# OR CRY1A(W)C#

L170 235 SEA CRYIAC# OR CRY(W)I(W)AC# OR CRY(W)IAC# OR CRYI(W)AC# OR CRYI(W)A(W)C# OR CRY(W)I(W)A(W)C# OR CRYIA(W)C#

L171 42 SEA CRYLAC# OR CRY(W)L(W)AC# OR CRY(W)LAC# OR CRYL(W)AC# OR CRYL(W)A(W)C# OR CRY(W)L(W)A(W)C# OR CRYLA(W)C#

L172 147 SEA CRY2AB2 OR CRY(W)2AB2 CRY2(W)AB2 OR CRY2A(W)B2 OR CRY2AB(W)2 OR CRY2(W)AB(W)2 OR CRY(W)2(W)AB2 OR CRY(W)2(W)A(W)B2 OR CRYIIAB2 OR CRY(W)IIAB2 CRYII(W)AB2 OR CRYIIA(W)B2 OR CRYIIAB(W)2 OR CRYII(W)AB(W)2 OR CRY(W)II(W)AB2 OR CRY(W)II(W)A(W)B2

L173 2546 SEA (L169 OR L170 OR L171 OR L172)

L174 38 SEA (L165 AND L168) OR (L165 AND L173) OR (L168 AND L173)

L175 19848 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?)

L176 19067 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?)(5A)(RESIST? OR PROTECT? OR TOLERAN?)

L177 953875 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

L178 33894 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

L179 14161 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

L180 1384888 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L181 71838 SEA ((L177 OR L178 OR L179))(5A)L180

L182 18738 SEA (L175 AND L176) OR (L175 AND L181) OR (L176 AND L181)

L183 99555 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L184 194286 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?))

L185 517 SEA L182 AND L183 AND L184

L186 555 SEA L154 OR L158 OR L174 OR L185

L187 47 SEA L186 AND PY>=2020

L188 19 SEA L187 AND UP>=20211001 AND UP<=20220630

L189 19 SEA L188 NOT P/DT

L190 0 SEA L188 AND (P/DT AND J/DT)

L191 19 SEA L189 OR L190

FILE 'HCAPLUS' ENTERED AT 05:52:15 ON 16 AUG 2022

L192 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
L193	0	SEA GHB614X OR GHB(W)614X OR BCS-GH002-5X OR BCSGH002-5X OR BCS(W)GH002(W)5X OR BCSGH002(W)5X OR BCS-GH002-5X OR BCS(W)GH002(W)5X OR BCSGH002(W)5X
L194	7	SEA (L192 OR L193)
L195	11	SEA LLCOTTON25 OR LLCOTTON(W)25 OR LL(W)COTTON25 OR LL(W)COTTON(W)25 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3 OR ACS-GH001-3 OR ACS(W)GH001(W)3 OR ACSGH001(W)3
L196	0	SEA LLCOTTON25X OR LLCOTTON(W)25X OR LL(W)COTTON25X OR LL(W)COTTON(W)25X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)3X OR ACS-GH001-3X OR ACS(W)GH001(W)3X OR ACSGH001(W)3X
L197	0	SEA XLLCOTTON25 OR XLLCOTTON(W)25 OR XLL(W)COTTON25 OR XLL(W)COTTON(W)25 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3 OR XACS-GH001-3 OR XACS(W)GH001(W)3 OR XACSGH001(W)3
L198	0	SEA XLLCOTTON25X OR XLLCOTTON(W)25X OR XLL(W)COTTON25X OR XLL(W)COTTON(W)25X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X OR XACS-GH001-3X OR XACS(W)GH001(W)3X OR XACSGH001(W)3X
L199	11	SEA (L195 OR L196 OR L197 OR L198)
L200	33	SEA MON(W)15985 OR MON15985 OR MON-15985-7 OR MON(W)15985(W)7 OR MON15985(W)7 OR XMON(W)15985 OR XMON-15985-7 OR XMON(W)15985(W)7 OR XMON15985(W)7
L201	0	SEA GHB614XLLCOTTON25XMON15985 OR GHB(W)614XLLCOTTON25XMON15985 OR GHB614XLL(W)COTTON25XMON15985 OR GHB614XLLCOTTON(W)25XMON15985 OR GHB614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON25XMON15985 OR GHB(W)614XLLCOTTON(W)25XMON15985
L202	1	SEA GHB(W)614XLLCOTTON25XMON(W)15985 OR GHB(W)614XLL(W)COTTON25XMON(W)15986 OR GHB(W)614XLL(W)COTTON(W)25XMON(W)15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME#(W)MON15985 OR GHB614(W)TIME#(W)LLCOTTON25(W)TIME#(W)MON(W)15985
L203	1	SEA (L201 OR L202)
L204	9	SEA (L194 AND L199) OR (L194 AND L200) OR (L199 AND L200) OR L203
L205	8	SEA GLYTOL? OR GLYTOLTM? OR GLYTOLRTM? OR GLY(W)TOL? OR GLY(W)TOLTM? OR GLY(W)TOLRTM?
L206	185	SEA BOLLGARD? OR BOLGARD?
L207	52	SEA LIBERTYLINK OR LIBERTY(W)LINK OR LIBERTYLINKTM OR LIBERTY(W)LINKTM OR LIBERTYLINKRTM OR LIBERTY(W)LINKRTM
L208	4	SEA (L205 AND L206) OR (L205 AND L207) OR (L206 AND L207)
L209	29	SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L210	4514	SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKIMATE OR ENOYLPRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)
L211	9	SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)
L212	1111	SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)
L213	84	SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)
L214	76000	SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)
L215	42	SEA L209 OR ((L210 OR L211 OR L212 OR L213))(S)L214)
L216	5431	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
L217	794	SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN

N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L218 5738 SEA (L216 OR L217)

L219 2381 SEA CRY1AC# OR CRY(W)1(W)AC# OR CRY(W)1AC# OR CRY1(W)AC# OR CRY1(W)A(W)C# OR CRY(W)1(W)A(W)C# OR CRY1A(W)C#

L220 1932 SEA CRYIAC# OR CRY(W)I(W)AC# OR CRY(W)IAC# OR CRYI(W)AC# OR CRYI(W)A(W)C# OR CRY(W)I(W)A(W)C# OR CRYIA(W)C#

L221 74 SEA CRYLAC# OR CRY(W)L(W)AC# OR CRY(W)LAC# OR CRYL(W)AC# OR CRYL(W)A(W)C# OR CRY(W)L(W)A(W)C# OR CRYLA(W)C#

L222 153 SEA CRY2AB2 OR CRY(W)2AB2 CRY2(W)AB2 OR CRY2A(W)B2 OR CRY2AB(W)2 OR CRY2(W)AB(W)2 OR CRY(W)2(W)AB2 OR CRY(W)2(W)A(W)B2 OR CRYIIAB2 OR CRY(W)IIAB2 CRYII(W)AB2 OR CRYIIA(W)B2 OR CRYIIAB(W)2 OR CRYII(W)AB(W)2 OR CRY(W)II(W)AB2 OR CRY(W)II(W)A(W)B2

L223 3174 SEA (L219 OR L220 OR L221 OR L222)

L224 3 SEA (L205 AND L208) OR (L205 AND L213) OR (L208 AND L213)

L225 30360 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?)

L226 29242 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?)(5A)(RESIST? OR PROTECT? OR TOLERAN?)

L227 326701 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

L228 24329 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

L229 27446 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

L230 6223577 SEA (RESIST? OR PROTECT? OR TOLERAN?)

L231 42201 SEA ((L227 OR L228 OR L229))(5A)L230

L232 28788 SEA (L225 AND L226) OR (L225 AND L231) OR (L226 AND L231)

L233 280595 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L234 720020 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?))

L235 1340 SEA L232 AND L233 AND L234

L236 1348 SEA L204 OR L208 OR L224 OR L235

L237 359 SEA L236 AND PY>=2020

L238 34 SEA L237 AND UP>=20211001 AND UP<=20220630

L239 11 SEA L238 NOT P/DT

L240 0 SEA L238 AND (P/DT AND J/DT)

L241 11 SEA L239 OR L240

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 05:52:34 ON 16 AUG 2022

L242 45 DUP REM L47 L94 L141 L191 L241 (16 DUPLICATES REMOVED)  
ANSWERS '1-8' FROM FILE MEDLINE  
ANSWERS '9-23' FROM FILE BIOSIS  
ANSWERS '24-27' FROM FILE AGRICOLA  
ANSWERS '28-39' FROM FILE CABA  
ANSWERS '40-45' FROM FILE HCAPLUS