Title

Summary of the Literature Review for T304-40 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.
EFSA supporting publications 2019:EN-1614

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Agency website search	[redacted] Global Regulatory Affairs Manager – Cotton, Ph.D. in Plant Pathology, 24 years experience in Regulatory Affairs Plant Biotechnology.
Manual search **(reference list from review articles)**	[redacted] PhD in Food Science and Technology. Twenty years of expertise in food chemistry, food allergy and safety assessment of GMOs.
Stage 1 assessment	[redacted]
Stage 2 assessment	<u>Food and Feed safety</u> [redacted] PhD in Toxicology. Regulatory Toxicologist for plant biotechnology since 2013. [redacted] 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. <u>Molecular characterization</u> [redacted] Bachelor Pharmaceutical and Biological Techniques. Expert in molecular characterization and plant biotechnology since 1999 and protein characterization since 2010. [redacted] PhD in Plant Molecular Genetics.Ten years of expertise in molecular characterization and detection methods of GMOs. <u>Environmental safety</u> [redacted] [redacted] Agronomist Engineer, PhD in Agronomy (Vegetable Production/Integrated Pest Management). Ten years of expertise in field entomology and environmental safety assessment of GM crops.
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SUMMARY

The T304-40 cotton event produces the *Bacillus thuringiensis* subsp. *berliner* Cry1Ab protein that is effective in controlling lepidopteran larvae such as cotton bollworm and tobacco budworm. T304-40 cotton also expresses the herbicide tolerant inert ingredient phosphinothricin acetyl transferase (PAT/*bar*) as a selectable marker which confers tolerance to glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ4-7.

A scoping review was performed for the T304-40 cotton and its newly expressed proteins, Cry1Ab and PAT/*bar*. The objective of this scoping review was to determine if there were studies about the molecular characterization of T304-40 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 202 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of eight publications were progressed for detailed assessment.

No new publications were found that contained new data on the molecular characterization of the T304-40 cotton and its newly expressed proteins, Cry1Ab and PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of T304-40 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 T304-40 cotton event produces the *Bacillus thuringiensis* subsp. *berliner* Cry1Ab protein that is effective in controlling lepidopteran larvae such as cotton bollworm and tobacco budworm. T304-40 cotton also expresses the herbicide tolerant inert ingredient phosphinothricin acetyl transferase (PAT/*bar*) as a selectable marker which confers tolerance to glufosinate-ammonium herbicides. The OECD identifier is BCS-GHØØ4-7.

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 T304-40 cotton, and/or any adverse effect of T304-40 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)[1] applications and post-market environmental monitoring activities (2019).

The literature searches were performed for the T304-40 cotton and its newly expressed proteins, Cry1Ab 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 T304-40 cotton and its newly expressed proteins, Cry1Ab and PAT/*bar*, in order to identify any specific issues related to food or feed safety, molecular characterization or environmental safety that might require in-depth examination.

2.2. Review questions

Review questions were formulated to conform to PE(I)CO structure (Population, Exposure (Intervention), Comparators, Outcome) if possible, and to address data requirements. They were modeled after the review question examples provided in the EFSA 2019 explanatory note[1].

Question 1: Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the T304-40 cotton and its newly expressed proteins Cry1Ab and PAT/*bar*?

Key elements:

Population: Human health; animal health; environmental safety
Exposure: T304-40 cotton, derived food/feed products, newly expressed proteins in T304-40 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 T304-40 cotton and its newly expressed proteins Cry1Ab and PAT/*bar* in cotton?

Key elements:

Population: T304-40 cotton and newly expressed proteins in T304-40 cotton
Outcome: Molecular characterization (which would indicate the information/data requirement for molecular characteristics)

2.3. Criteria for relevance

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

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

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

Concepts	Criteria	Comment
Additional concepts		
Information/data requirements	The publication reports information pertaining to one or more information/data requirement(s) outlined in Appendix A for the GMO and derived food/feed products under consideration, including the intended trait(s)	Publications that potentially contribute to the knowledge informing the risk assessment of the GMO under consideration, and thus the risk hypotheses addressed, taking account of both hazard and exposure, can be considered relevant according to this eligibility/inclusion criterion. Publications addressing other issues such as benefits, socio-economics, ethics, crop protection, detection methods, efficacy, public perception and risk communication can be excluded, as they are not necessarily relevant to the risk assessment of GMOs
Plant species	The publication addresses the same plant species as the GMO under consideration	This eligibility/inclusion criterion permits the exclusion of publications on GMOs that contain the same intended trait(s) as the GMO under consideration, but which are introduced in another plant species
Scope of GMO application	The publication addresses pathways and levels of exposure to the GMO, derived food/feed products, and the intended trait(s) that are relevant for the intended uses of the GMO and derived food/feed products under regulatory review	From the publications that address the GMO under consideration, those that consider pathways and levels of exposure relevant to the scope of the GMO application (i.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 related to T304-40 cotton was previously identified and 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

Although this article is not directly relevant for the T304-40 cotton event, it was selected as reference publication because it mentions the event (T304-40 cotton), one of the newly expressed proteins (PAT/*bar*, phosphinothricin acetyl transferase) and the intended traits (herbicide tolerance, insect control). Since this reference was published before the current search period, the search profile was tested without applying the time limit used in the final search profile (UP>=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[1]. The search strategies were designed to be broad and sensitive enough to capture any relevant publications, if available.

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

3.1. Time window and date of the literature search

The database searches were performed on July 13, 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. Since the 'newly expressed proteins' profiles and the 'intended trait' profiles produced too many results when used on their own, they were combined with additonal 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	T304-40 or T304(w)40 or T(w)304(w)40 or BCS-GH004-7 or BCS-GHOO4-7 or BCS(w)GH004(w)7 or BCS(w)GHOO4(w)7 or BCSGH004(w)7 or BCSGHOO4(w)7	Event name
	none	Trade name
2	(((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) or (cry1ab# or cry(w)1(w)ab# or cry(w)1ab# or cry1(w)ab# or cry1(w)a(w)b# or cry(w)1(w)a(w)b# or cry1a(w)b# or cryIab# or cry(w)I(w)ab# or cry(w)Iab# or cryI(w)ab# or cryI(w)a(w)b# or cry(w)I(w)a(w)b# or cryIa(w)b# or crylab# or cry(w)l(w)ab# or cry(w)lab# or cryl(w)ab# or cryl(w)a(w)b# or cry(w)l(w)a(w)b# or cryla(w)b#)	Newly expressed proteins
3	(herbicid? or bialaphos or basta or glufosinate or gluphosinate 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

4	cotton# or gossypium or G(w)hirsutum or g(w)barbadense	Plant species
5	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
6	2 and 4	Newly expressed proteins AND Plant species
7	3 and 4 and 5	Intended traits AND Plant species AND GMO general
8	1 or 6 or 7	Event name OR (Newly expressed proteins AND Plant species) 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
Agricola	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM"	"TRANSGENIC PLANTS"
Biosis	None	None	No terms for herbicide or insect resistance	"GOSSYPIUM BARBADENSE"	None

Database	Event	New proteins	Intended traits	Plant species	GM plants
				"GOSSYPIUM HIRSUTUM"	
CABA	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIUM BARBADENSE"/CT "GOSSYPIUM HIRSUTUM"/CT	"TRANSGENIC PLANTS"
CAS	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	GOSSYPIUM/CT	"GENETICALLY MODIFIED PLANTS"
Medline	None	None	"HERBICIDE RESISTANCE" No terms for insect resistance	"GOSSYPIUM BARBADENSE" "GOSSYPIUM HIRSUTUM"	"PLANTS, GENETICALLY MODIFIED"

The search results were limited to documents updated between 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
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	13 July 2022	13 July 2022	13 July 2022	13 July 2022	13 July 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 July 2022	6 July 2022	5 July 2022	12 July 2022	12 July 2022

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Number of records retrieved	24	53	80	55	52
Number of records after duplicate removal	17	43	55	35	52
Number of *relevant* records after rapid assessment	0	5	0	1	2

4. INTERNET and MANUAL SEARCHES

4.1. Internet Searches of food safety, agriculture, and biotechnology-related authority webpages

A search of the web pages of food safety, agriculture, and biotechnology-related authorities was conducted. Search results were manually examined for relevant records that were either published during the time period under consideration (date span of search: 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[1]. Of the 13 key organisations cited in the EFSA 2019 explanatory note[1], Environment and Climate Change Canada and Intersecretarial Commission on Biosafety of GMOs (CIBIOGEM) were excluded, since they are not involved in the risk assessment of GM plants. Therefore, the internet search was limited to 11 key organisations relevant for T304-40 cotton. Search terms consisted of T304-40 cotton or OECD Identifier or trait-specific protein(s) in T304-40 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)	https://www.epa.gov/	Sep 16 2022	Sep 16 2022	0
US Department of Agriculture (USDA)	https://www.usda.gov/	Sep 5 2022	Sep 5 2022	0
US Food and Drug Administration (FDA)	https://www.fda.gov/	Sep 7 2022	Sep 7 2022	0
Health Canada	https://www.canada.ca/en/health-canada.html	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)	https://www.canada.ca/en/food-inspection-agency.html	Aug 1 2022	Sep 2 - 7 2022	0
Food Standards Australia New Zealand (FSANZ)	http://www.foodstandards.gov.au/Pages/default.aspx	Aug 12 2022	Aug 24 2022	0
Office of the Gene Technology Regulator (OGTR) Australia	http://www.ogtr.gov.au/	Aug 1 2022	Aug 29 2022	0
National Technical Commission on Biosafety (CTNBio) Brazil	http://ctnbio.mcti.gov.br/en	Aug 1 2022	Aug 29 2022	0
National Advisory Commission on Agricultural Biotechnology (CONABIA) Argentina	https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia	Sep 8 2022	Sep 8 2022	0
Genetic Engineering Approval Committee (GEAC) India	http://moef.gov.in/	Aug 12 2022	Aug 24 2022	0
Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan	http://www.maff.go.jp/	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 264 references, which were reduced to 202 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 T304-40 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)	202
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	194
Total number of full-text documents assessed in detail	8
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	8
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 Table 1
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 T304-40 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 Table 1
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 mediates community stress?	Journal of Applied Entomology, (FEB 2022) Vol. 146, No. 1-2. http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1439-0418. ISSN: 0931-2048. E-ISSN: 1439-0418.	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. T304-40 was not included in this study.
Lv, Bo; Zhou, Ying; Peng, Yuan-de; Wang, Zhi; Song, Qi-sheng. 2022	Integrative analysis identifies the safety of transgenic Cry1Ab rice to non-target spider *Pardosa pseudoannulata*.	Biological Control, (MAY 2022) Vol. 168, pp. Article No.: 104873. http://www.journals.elsevier.com/biological-control/#description. ISSN: 1049-9644. E-ISSN: 1090-2112.	The authors aimed to evaluate the effects of Cry1Ab on both adults and spiderlings of the wolf spider *Pardosa pseudoannulata* in terms of detoxifying enzyme activity, gene expression, protein level, and foraging response by using *Nilaparvata lugens* (brown planthopper) fed on Bt rice expressing Cry1Ab as food source for the spider. They identified that the accumulation of Cry1Ab protein expressed in GM rice via the food chain did not harbor an adverse impact on the wolf spider *P. pseudoannulata*. T304-40 is not considered.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Peng Yong, Lv Bo, Lei Zi-Yan, Peng Yuan-de, Chen Li-Jun, Wang Zhi. 2022	Toxic effects of the combined cadmium and Cry1Ab protein exposure on the protective and transcriptomic responses of *Pirata subpiraticus*.	Ecotoxicology and environmental safety, (2022 May 19) Vol. 239, pp. 113631. Electronic Publication Date: 19 May 2022 Journal code: 7805381. E-ISSN: 1090-2414. L-ISSN: 0147-6513.	The authors assessed the effects of combined Cry1Ab+Cd (Cadmium) exposure on the wolf spider *Pardosa pseudoannulata*, and found that spiders treated with the combined exposure accumulated more Cd than those treated with Cd alone. A mass of cuticle encoding genes, whose protein products are required for insect growth and development, were down-regulated under the combined exposure, thus prolonging developmental duration in P. subpiraticus. Besides, this work also identified a large number of transcriptional factors (TFs) and putative protein interaction networks that may play indispensable roles in the adverse responsiveness under the combined exposure vs Cd or Cry1Ab exposure alone. This ERA study is not related to T304-40 cotton, and the Cry1Ab protein was not tested on its own.
Raeman, Reben; Hua, Gang Zhang, Qi; Adang, Michael J. 2020	Fluorescent analyses of *Bacillus thuringiensis* Cry1Fa and Cry1Ab toxin binding sites on brush border membrane vesicles of *Ostrinia nubilalis* (Hubner), *Diatraea grandiosella* (Dyar), *and Helicoverpa zea* (Boddie) larvae.	Pesticide Biochemistry and Physiology, (JUL 2020) Vol. 167, pp. Article No.: 104592. http://www.journals.elsevier.com/pesticide-biochemistry-and-physiology/#description. CODEN: PCBPBS. ISSN: 0048-3575. E-ISSN: 1095-9939.	The paper is related to the development of a quantitative fluorescence-based binding assay for analyses of Cry1 toxin (Cry1F and Cry1Ab) interactions with BBMV (brush border membrane vesicle) preparations from *Ostrinia nubilalis*, *Diatraea grandiosella*, and *Helicoverpa zea*. T304-40 cotton is not considered in the publication. The publication is about a method development and does not included T304-40 cotton.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
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. https://pubs.acs.org/loi/esthag. CODEN: ESTHAG. ISSN: 0013-936X. E-ISSN: 1520-5851.	The authors presented concepts surrounding the physiochemical phenomena of herbicide drift from GM HT crops to support the development of effective approaches to reduce it. The publication doesnot contain original data, and the ERA is not related to T340-40 cotton.
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 techonology 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 grownth 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 publication is not related to T304-40 cotton

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Zhang Meng, Ma Yamin, Luo Junyu, Ji Jichao, Gao Xueke, Wu Changcai, Zhu Xiangzhen, Wang Li, Zhang Kaixin, Li Dongyang, Wang Lisha, Niu Lin, Cui Jinjie. 2021	Transgenic insect - resistant Bt cotton expressing Cry1Ac/1Ab does not harm the insect predator Geocoris pallidipennis.	Ecotoxicology and environmental safety, (2021 Dec 31) Vol. 230, pp. 113129. Electronic Publication Date: 31 Dec 2021 Journal code: 7805381. E-ISSN: 1090-2414. L-ISSN: 0147-6513.	The authors tested the effect of the GM cotton variety A26-5 (which produces Cry1Ac) on the predatory insect *G. pallidipennis*. The variety J14 (conventional parental of A26-5) was used as control. The ERA is not related to T340-40 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 eight 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 T304-40 cotton and its newly expressed proteins, Cry1Ab and PAT/*bar*.

7. CONCLUSION

The literature searches performed for the T304-40 cotton and its newly expressed proteins, Cry1Ab and PAT/*bar*, for the period from October 1, 2021 to June 30, 2022, identified a total of 202 unique publications (after duplicate removal). A total of eight publications were progressed for detailed assessment after excluding 194 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract). The eight 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 T304-40 cotton and its newly expressed proteins, Cry1Ab and PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of T304-40 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	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. 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.
STN	BIOSIS	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. 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. Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are all searchable.
STN	CABA/CAB	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. Sources for CABA include journals, books, reports, published theses, conference proceedings, and patents. Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are searchable.
STN	CAS-CA/CAPLUS	The Chemical Abstracts (CA) database covers all areas of Biochemistry, Chemistry and Chemical engineering, and related sciences. 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. Bibliographic terms, indexing terms, roles, CAS Registry Numbers, International Patent Classification, and abstracts are searchable.

Host	File	Description
STN	MEDLINE	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. Sources include journals and chapters in books or symposia. Bibliographic information, indexing terms, abstracts, chemical names, and CAS Registry Numbers are all searchable. Online thesauri are available for the Medical Subject Headings (/MN), Controlled Terms (/CT) and Chemical Name (/CN) fields.

Appendix 2 Search history

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     FILE 'MEDLINE' ENTERED AT 14:49:01 ON 13 JUL 2022
L1             4 SEA T304-40 OR T304(W)40 OR T(W)304(W)40 OR BCS-GH004-7 OR
                  BCS-GHOO4-7 OR BCS(W)GH004(W)7 OR BCS(W)GHOO4(W)7 OR BCSGH004(W
                  )7 OR BCSGHOO4(W)7
L2          1511 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           943 SEA CRY1AB# OR CRY(W)1(W)AB# OR CRY(W)1AB# OR CRY1(W)AB# OR
                  CRY1(W)A(W)B# OR CRY(W)1(W)A(W)B# OR CRY1A(W)B#
L5           115 SEA CRYIAB# OR CRY(W)I(W)AB# OR CRY(W)IAB# OR CRYI(W)AB# OR
                  CRYI(W)A(W)B# OR CRY(W)I(W)A(W)B# OR CRYIA(W)B#
L6            36 SEA CRYLAB# OR CRY(W)L(W)AB# OR CRY(W)LAB# OR CRYL(W)AB# OR
                  CRYL(W)A(W)B# OR CRY(W)L(W)A(W)B# OR CRYLA(W)B#
L7          2649 SEA (L2 OR L3 OR L4 OR L5 OR L6)
L8         31635 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSIN
                  ATE OR PHOSPHINOTHRICIN OR LIBERTY?
L9        216277 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
L10        14523 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
L11        24313 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
L12      2531871 SEA (RESIST? OR PROTECT? OR TOLERAN?)
L13        12344 SEA ((L8 OR L9 OR L10 OR L11))(5A)L12
L14        28459 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L15      4012071 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?))
L16           76 SEA L7 AND L14
L17          692 SEA L13 AND L14 AND L15
L18          731 SEA L1 OR L16 OR L17
L19          123 SEA L18 AND PY>=2020
L20           52 SEA L19 AND UP>=20211001 AND UP<=20220630

     FILE 'BIOSIS' ENTERED AT 14:49:11 ON 13 JUL 2022
L21            2 SEA T304-40 OR T304(W)40 OR T(W)304(W)40 OR BCS-GH004-7 OR
                  BCS-GHOO4-7 OR BCS(W)GH004(W)7 OR BCS(W)GHOO4(W)7 OR BCSGH004(W
                  )7 OR BCSGHOO4(W)7
L22         2899 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
L23          334 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                  N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                  ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L24         1580 SEA CRY1AB# OR CRY(W)1(W)AB# OR CRY(W)1AB# OR CRY1(W)AB# OR
                  CRY1(W)A(W)B# OR CRY(W)1(W)A(W)B# OR CRY1A(W)B#
L25          229 SEA CRYIAB# OR CRY(W)I(W)AB# OR CRY(W)IAB# OR CRYI(W)AB# OR
                  CRYI(W)A(W)B# OR CRY(W)I(W)A(W)B# OR CRYIA(W)B#
L26          265 SEA CRYLAB# OR CRY(W)L(W)AB# OR CRY(W)LAB# OR CRYL(W)AB# OR
                  CRYL(W)A(W)B# OR CRY(W)L(W)A(W)B# OR CRYLA(W)B#
L27         4796 SEA (L22 OR L23 OR L24 OR L25 OR L26)
L28        90391 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSIN
                  ATE OR PHOSPHINOTHRICIN OR LIBERTY?
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L29     1450990 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
L30       28194 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
L31       34630 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
L32     2500668 SEA (RESIST? OR PROTECT? OR TOLERAN?)
L33       35260 SEA ((L28 OR L29 OR L30 OR L31))(5A)L32
L34       77103 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L35      478392 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?))
L36         198 SEA L27 AND L34
L37         994 SEA L33 AND L34 AND L35
L38        1113 SEA L21 OR L36 OR L37
L39         113 SEA L38 AND PY>=2020
L40          53 SEA L39 AND UP>=20211001 AND UP<=20220630

     FILE 'AGRICOLA' ENTERED AT 14:49:19 ON 13 JUL 2022
L41           3 SEA T304-40 OR T304(W)40 OR T(W)304(W)40 OR BCS-GH004-7 OR
                BCS-GHOO4-7 OR BCS(W)GH004(W)7 OR BCS(W)GHOO4(W)7 OR BCSGH004(W
                )7 OR BCSGHOO4(W)7
L42         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
L43         255 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L44         929 SEA CRY1AB# OR CRY(W)1(W)AB# OR CRY(W)1AB# OR CRY1(W)AB# OR
                CRY1(W)A(W)B# OR CRY(W)1(W)A(W)B# OR CRY1A(W)B#
L45         158 SEA CRYIAB# OR CRY(W)I(W)AB# OR CRY(W)IAB# OR CRYI(W)AB# OR
                CRYI(W)A(W)B# OR CRY(W)I(W)A(W)B# OR CRYIA(W)B#
L46          11 SEA CRYLAB# OR CRY(W)L(W)AB# OR CRY(W)LAB# OR CRYL(W)AB# OR
                CRYL(W)A(W)B# OR CRY(W)L(W)A(W)B# OR CRYLA(W)B#
L47        1965 SEA (L42 OR L43 OR L44 OR L45 OR L46)
L48       59573 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSIN
                ATE OR PHOSPHINOTHRICIN OR LIBERTY?
L49      350161 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
L50       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
L51        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
L52      683691 SEA (RESIST? OR PROTECT? OR TOLERAN?)
L53       31197 SEA ((L48 OR L49 OR L50 OR L51))(5A)L52
L54       66661 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L55      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?))
L56         102 SEA L47 AND L54
L57         779 SEA L53 AND L54 AND L55
L58         840 SEA L41 OR L56 OR L57
L59          65 SEA L58 AND PY>=2020
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L60          24 SEA L59 AND UP>=20211001 AND UP<=20220630

     FILE 'CABA' ENTERED AT 14:49:43 ON 13 JUL 2022
L61           6 SEA T304-40 OR T304(W)40 OR T(W)304(W)40 OR BCS-GH004-7 OR
                BCS-GHOO4-7 OR BCS(W)GH004(W)7 OR BCS(W)GHOO4(W)7 OR BCSGH004(W
                )7 OR BCSGHOO4(W)7
L62        1579 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
L63         380 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L64        1710 SEA CRY1AB# OR CRY(W)1(W)AB# OR CRY(W)1AB# OR CRY1(W)AB# OR
                CRY1(W)A(W)B# OR CRY(W)1(W)A(W)B# OR CRY1A(W)B#
L65         221 SEA CRYIAB# OR CRY(W)I(W)AB# OR CRY(W)IAB# OR CRYI(W)AB# OR
                CRYI(W)A(W)B# OR CRY(W)I(W)A(W)B# OR CRYIA(W)B#
L66          27 SEA CRYLAB# OR CRY(W)L(W)AB# OR CRY(W)LAB# OR CRYL(W)AB# OR
                CRYL(W)A(W)B# OR CRY(W)L(W)A(W)B# OR CRYLA(W)B#
L67        3593 SEA (L62 OR L63 OR L64 OR L65 OR L66)
L68      156076 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSIN
                ATE OR PHOSPHINOTHRICIN OR LIBERTY?
L69      950747 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
L70        33728 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
L71        14052 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
L72      1376774 SEA (RESIST? OR PROTECT? OR TOLERAN?)
L73        89243 SEA ((L68 OR L69 OR L70 OR L71))(5A)L72
L74        99203 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L75       193299 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?))
L76          231 SEA L67 AND L74
L77         2311 SEA L73 AND L74 AND L75
L78         2434 SEA L61 OR L76 OR L77
L79          210 SEA L78 AND PY>=2020
L80           80 SEA L79 AND UP>=20211001 AND UP<=20220630
L81           80 SEA L80 NOT P/DT
L82            0 SEA L80 AND (P/DT AND J/DT)
L83           80 SEA L81 OR L82

     FILE 'HCAPLUS' ENTERED AT 14:50:03 ON 13 JUL 2022
L84           4 SEA T304-40 OR T304(W)40 OR T(W)304(W)40 OR BCS-GH004-7 OR
                BCS-GHOO4-7 OR BCS(W)GH004(W)7 OR BCS(W)GHOO4(W)7 OR BCSGH004(W
                )7 OR BCSGHOO4(W)7
L85        5395 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
L86         793 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L87        1837 SEA CRY1AB# OR CRY(W)1(W)AB# OR CRY(W)1AB# OR CRY1(W)AB# OR
                CRY1(W)A(W)B# OR CRY(W)1(W)A(W)B# OR CRY1A(W)B#
L88        1446 SEA CRYIAB# OR CRY(W)I(W)AB# OR CRY(W)IAB# OR CRYI(W)AB# OR
                CRYI(W)A(W)B# OR CRY(W)I(W)A(W)B# OR CRYIA(W)B#
L89          57 SEA CRYLAB# OR CRY(W)L(W)AB# OR CRY(W)LAB# OR CRYL(W)AB# OR
                CRYL(W)A(W)B# OR CRY(W)L(W)A(W)B# OR CRYLA(W)B#
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L90         8011 SEA (L85 OR L86 OR L87 OR L88 OR L89)
L91       159750 SEA HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR GLUPHOSIN
                 ATE OR PHOSPHINOTHRICIN OR LIBERTY?
L92       324420 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
L93        24143 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
L94        26932 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
L95      6178598 SEA (RESIST? OR PROTECT? OR TOLERAN?)
L96        58302 SEA ((L91 OR L92 OR L93 OR L94))(5A)L95
L97       278996 SEA COTTON# OR GOSSYPIUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L98       716765 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?))
L99          508 SEA L90 AND L97
L100        2491 SEA L96 AND L97 AND L98
L101        2742 SEA L84 OR L99 OR L100
L102         590 SEA L101 AND PY>=2020
L103          90 SEA L102 AND UP>=20211001 AND UP<=20220630
L104          55 SEA L103 NOT P/DT
L105           0 SEA L103 AND (P/DT AND J/DT)
L106          55 SEA L104 OR L105

     FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 08:50:12 ON 13
     JUL 2022
L107         202 DUP REM L20 L40 L60 L83 L106 (62 DUPLICATES REMOVED)
                   ANSWERS '1-52' FROM FILE MEDLINE
                   ANSWERS '53-95' FROM FILE BIOSIS
                   ANSWERS '96-112' FROM FILE AGRICOLA
                   ANSWERS '113-167' FROM FILE CABA
                   ANSWERS '168-202' FROM FILE HCAPLUS
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