

Title

**Summary of the Literature Review for LLCotton25 Cotton
October 1, 2018 – September 30, 2019**

Final Report

Data or Guideline Requirement

Explanatory note on literature searching
conducted in the context of GMO applications for (renewed) market authorization
and annual post-market environmental monitoring reports on GMOs authorised in the EU market.
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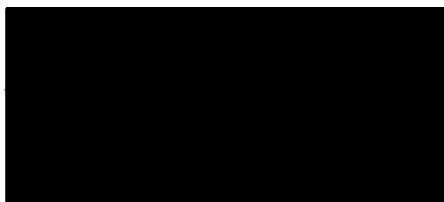


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SIGNATURE PAGE

Principal author:



Date

2018-11-25
(YYYY-MM-DD)

BASF Agricultural Solutions GmbH

STUDY PERSONNEL

Electronic database search	[REDACTED]
Manual search	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
Stage 1 assessment	[REDACTED] [REDACTED]
Stage 2 assessment	<u>Food and Feed safety</u> [REDACTED] [REDACTED] <u>Molecular characterization</u> [REDACTED] [REDACTED] <u>Environmental safety</u> [REDACTED] [REDACTED]
Report	[REDACTED] [REDACTED] [REDACTED]

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SUMMARY

The LLCotton25 cotton event was developed through *Agrobacterium*-mediated transformation using the vector pGSV71 containing the bar expression cassette. LLCotton25 cotton produces phosphinothricin acetyl transferase (PAT/*bar*) protein, which confers tolerance to glufosinate-ammonium herbicides. The OECD identifier is ACS-GH001-3.

A scoping review was performed for the LLCotton25 cotton and its newly expressed protein, PAT/*bar*. The objective of this scoping review was to determine if there were studies about the molecular characterization of LLCotton25 cotton, its effects on food and feed safety, or on 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, 2018 to September 30, 2019. 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.

This literature search identified a total of 49 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of 8 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 LLCotton25 cotton and its newly expressed protein, PAT/*bar*. Similarly, no new publications were found that suggested any potential adverse effects of LLCotton25 cotton on human health, animal health, or the environment. No issues or topics were identified that would trigger or warrant more specific question formulation or indicate that a systematic review would be of value.

1. INTRODUCTION

The LLCotton25 cotton event was developed through Agrobacterium-mediated transformation using the vector pGSV71 containing the bar expression cassette. LLCotton25 cotton produces phosphinothricin acetyl transferase (PAT/*bar*) protein, which confers tolerance to glufosinate-ammonium herbicides. The OECD identifier is ACS-GH001-3.

The objective of the literature searches described here was to determine if there were publications published between October 1, 2018 and September 30, 2019 that mention the molecular characterization of the LLCotton25 cotton, and/or any adverse effect of LLCotton25 cotton in food, feed or the environment. In that context, a broad and inclusive literature search was performed and the articles retrieved were reviewed in a comprehensive and transparent manner. This was intended as a scoping review. The literature review was performed as recommended in the European Food Safety Authority (EFSA) explanatory note on literature searching conducted in the context of Genetically Modified Organisms (GMO)¹ applications and post-market environmental monitoring activities (2019).

The literature searches were performed for the LLCotton25 cotton and its newly expressed protein PAT/*bar*. The search terms also included relevant synonyms, trade name, intended trait, plant species and general GMO terms.

2. OVERALL METHODS

2.1. Objective of the scoping review

The objective of the scoping review was to survey the evidence base for the LLCotton25 cotton and its newly expressed protein phosphinothricin acetyltransferase, 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 PECO structure (Population, Exposure, Comparators, Outcome) if possible, and to address data requirements. They were modeled after the review question examples provided in the EFSA 2019 explanatory note¹.

Question 1: Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the LLCotton25 cotton and its newly expressed protein phosphinothricin acetyltransferase?

Key elements:

Population: Human health; animal health; environmental safety

Exposure: LLCotton25 cotton, derived food/feed products, newly expressed protein in LLCotton25 cotton

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

Outcome: Adverse effects

Question 2: Were any studies published during the reporting period that focus on molecular characterization of the LLCotton25 cotton and its newly expressed protein phosphinothricin acetyltransferase?

Key elements:

Population: LLCotton25 cotton and newly expressed protein in LLCotton25 cotton
Outcome: Molecular characterization (which would indicate the information/data requirement for molecular characteristics)

2.3. Criteria for relevance

Criteria for establishing the relevance of retrieved publications were defined prior to conduct of the search. These criteria were modeled after those given in the EFSA 2019 explanatory note¹ 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		
Intervention/exposure	The publication addresses the GMO, derived food/feed products, and/or the intended trait(s) (e.g., newly expressed protein(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
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
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
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

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

Stacked events obtained by conventional crosses/subcombinations	The publication addresses the higher stacked event and/or a subcombination or subcombinations of the single events of the higher stacked event, independently of its/their origin	This permits the selection of publications on the higher stacked event and/or subcombinations of the single events of the higher stacked event that are in the scope of the GMO application(e), independently of their origin. This permits the exclusion of publications on the single events of the higher stacked event, because the risk assessment of GMO applications for stacked events covers only the products in the scope of the GMO application – i.e., the higher stacked event and subcombinations of the singles involved, independently of their origin
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.	This permits the exclusion of publications that do not present original/primary data (e.g., editorials, position papers). Reviews should only be included if they present data that are not available from a primary research study
Reporting format	A study in a publication should only be presented once, but if it is presented in more than one publication, all publications should be listed and grouped	Duplicate publications should be excluded at the screening stage. Only one copy of a study is required even if it is reported in different publications, and identified in more than one database

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

2.4. Reference publication

No relevant publications for LLCotton25 cotton were known before starting the search, therefore, a related publication referring to the same trait (glufosinate resistance) and the same crop (cotton) was used as reference:

- Wu, A-J; B Holliday; C Canez; C Haas; D Ghoshal; J Lor; J Massengill; K Chapman; K Cisneros; K Pallett; L Privalle; M Bugas; M Soria; P Hunst; R Araujo; S Mackie; S New; S Sathischandra; Z Bish (2018). GHB614 x T304-40 x GHB119 x COT102 Cotton: Protein Expression Analyses of Field-Grown Samples. Journal of Agricultural and Food Chemistry 67(1):275-281

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 activities¹. 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 November 20, 2019. Only documents updated between October 1, 2018 and September 30, 2019, 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, trade name, newly expressed proteins and intended traits. Since the 'Trade name' profile, the 'Newly expressed protein' profile and the 'Intended trait' profile retrieved a very large number of publications when used on their own, they were combined with additional profiles: the 'Trade name' profile and 'Newly expressed protein' profile were combined with a 'Plant species' profile, while the 'Intended trait' profile was combined with a 'General GMO' profile as well as with the 'Plant species' profile. See [Table 2](#) for a detailed search profile.

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

The search results were limited to documents updated between October 1, 2018 and September 30, 2019 (UP>=20181001 and UP<=20190930), and to non-patent documents (not P/DT). To ensure that documents with indexing errors where two 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 3](#) summarizes the number of results obtained from each of the databases searched.

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

Table 2: Search profile for database search

Set	Search string	Concepts
1	LLCotton25 or LLcotton(w)25 or LL(w)cotton25 or LL(w)cotton(w)25 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3 or ACS-GH001-3 or ACS(w)GH001(w)3 or ACSGH001(w)3	Event name
2	libertylink or libertylinktm or libertylinkrtm or liberty(w)link or liberty(w)linktm or liberty(w)linkrtm or LL or LLTM or LLRTM	Trade name
3	((bar or pat) (2a) (gene# or protein# or enzyme#)) or ppt(2w)acetyltransferase or ppt(2w)acetyl(w)transferase or pt(w)n(2w)acetyltransferase or pt(w)n(2w)acetyl(w)transferase or phosphinothricin(w)n(w)acetyltransferase or phosphinothricin(2w)acetyltransferase or phosphinothricin(2w)acetyl(w)transferase or phosphinothricinacetyl(w)transferase	Newly expressed protein
4	(herbicid? or bialaphos or basta or glufosinate or gluphosinate or phosphinothricin or liberty?) (5a) (resist? OR protect? OR toleran?)	Intended trait
5	cotton# or gossypium or G(w)hirsutum or g(w)barbadense	Plant species
6	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3a) (modif? OR transform? OR manipul? OR improv? OR engineer?))	GMO general
7	(2 or 3) and 5	(Trade name or Newly expressed protein) AND Plant species
8	4 and 5 and 6	Intended trait AND Plant species AND GMO general
9	1 or 7 or 8	Event name OR ((Trade name OR Newly expressed protein) AND Plant species) OR (Intended trait AND Plant species AND GMO general)

Table 3: 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	20 Nov 2019	20 Nov 2019	20 Nov 2019	20 Nov 2019	20 Nov 2019
Datespan of the search	1 Oct 2018 – 30 Sept 2019	1 Oct 2018 – 30 Sept 2019	1 Oct 2018 – 30 Sept 2019	1 Oct 2018 – 30 Sept 2019	1 Oct 2018 – 30 Sept 2019
Latest database update	5 Nov 2019	13 Nov 2019	13 Nov 2019	19 Nov 2019	19 Nov 2019
Number of records retrieved	7	18	16	17	8
Number of records after duplicate removal	4	16	11	10	8
Number of relevant records after rapid assessment	1	3	2	1	1

4. MANUAL SEARCHES

4.1. Manual searches of web pages 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, 2018 to September 30, 2019) 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 4](#). All web pages searched were justified by their recommendation in the EFSA 2019 explanatory note¹. Search terms consisted of LLCotton25 or LL25 or ACS-GH001-3; or PAT/*bar* or Phosphinothricin in LLCotton25 (all searched singly, with no search limits applied).

Table 4: 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/	Oct 4 2019	Oct 8 2019	0
US Department of Agriculture (USDA)	https://www.usda.gov/	Oct 8 2019	Oct 9 2019	0
US Food and Drug Administration (FDA)	https://www.fda.gov/	Oct 9 2019	Oct 9 2019	0
Health Canada	https://www.canada.ca/en/health-canada.html	Oct 7 2019	Oct 9 2019	0
Food Inspection Agency Canada	https://www.canada.ca/en/food-inspection-agency.html	Aug 23 2019	Oct 9 2019	0
Environment and Climate Change Canada	https://www.canada.ca/en/services/environment/weather/climate-change.html	Jul 26 2019	Oct 9 2019	0
Food Standards Australia New Zealand (FSANZ)	http://www.foodstandards.gov.au/Pages/default.aspx	Oct 9 2019	Oct 9 2019	0
Office of the Gene Technology Regulator (OGTR) Australia	http://www.ogtr.gov.au/	Oct 8 2019	Oct 9 2019	0
National Technical Commission on Biosafety (CTNBio) Brazil	http://ctnbio.mcti.gov.br/en	Sep 19	Oct 7-21 2019	0
National Advisory Commission on Agricultural Biotechnology (CONABIA) Argentina	https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia	Oct 1 2019	Oct 2 2019	0
National Food Safety and Quality Service (SENASA) Argentina	https://www.argentina.gob.ar/senasa	Oct 2 2019	Oct 2 2019	0
Genetic Engineering Approval Committee (GEAC) India	http://moef.gov.in/	Sep 30 2019	Oct 9 2019	0
Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan	http://www.maff.go.jp/	Oct 30 2019	Oct 30 2019	0

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
Ministry of Health, Labour and Welfare (MHLW) Japan	http://www.mhlw.go.jp/	Oct 30 2019	Oct 30 2019	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, 2018 to September 30, 2019 bibliographies of these review articles is given in the table below.

Table 5: Documents for which reference lists were scanned for relevant studies

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
1	Agapito-Tenfen SZ, Okoli AS, Bernstein MJ, Wikmark OG, Myhr AI. 2018	Revisiting Risk Governance of GM Plants: The Need to Consider New and Emerging Gene-Editing Techniques.	Front Plant Sci. 2018 Dec 21;9:1874. doi: 10.3389/fpls.2018.01874.	0
2	Alarcon CM, Shan G, Layton DT, Bell TA, Whipkey S, Shillito RD. 2019	Application of DNA- and Protein-Based Detection Methods in Agricultural Biotechnology.	J Agric Food Chem. 2019 Jan 30;67(4):1019-1028. doi: 10.1021/acs.jafc.8b05157.	0
3	Bogner A, Torgersen H. 2018	Precaution, Responsible Innovation and Beyond - In Search of a Sustainable Agricultural Biotechnology Policy.	Front Plant Sci. 2018 Dec 18;9:1884. doi: 10.3389/fpls.2018.01884.	0
4	Boonchaisri S, Rochfort S, Stevenson T, Dias DA. 2019	Recent developments in metabolomics-based research in understanding transgenic grass metabolism.	Metabolomics. 2019 Mar 15;15(4):47. doi: 10.1007/s11306-019-1507-4.	0
5	Collins C, Lorenzen N, Collet B. 2019	DNA vaccination for finfish aquaculture.	Fish Shellfish Immunol. 2019 Feb;85:106-125. doi: 10.1016/j.fsi.2018.07.012.	0

6	Gaffar FY, Koch A. 2019	Catch Me If You Can! RNA Silencing-Based Improvement of Antiviral Plant Immunity.	Viruses. 2019 Jul 23;11(7). pii: E673. doi: 10.3390/v11070673.	0
7	Ghosh S, Ghosh S, Sil PC. 2019	Role of nanostructures in improvising oral medicine.	Toxicol Rep. 2019 Apr 15;6:358-368. doi: 10.1016/j.toxrep.2019.04.004.	0
8	Halford NG. 2019	Legislation governing genetically modified and genome-edited crops in Europe: the need for change.	J Sci Food Agric. 2019 Jan 15;99(1):8-12. doi: 10.1002/jsfa.9227.	0
9	Hamburger DJS. 2018	Normative Criteria and Their Inclusion in a Regulatory Framework for New Plant Varieties Derived From Genome Editing.	Front Bioeng Biotechnol. 2018 Dec 19;6:176. doi: 10.3389/fbioe.2018.00176.	0
10	Hundleby PAC, Harwood WA. 2019	Impacts of the EU GMO regulatory framework for plant genome editing.	Food Energy Secur. 2019 May;8(2):e00161. doi: 10.1002/fes3.161.	0
11	Ichim MC. 2019	The Romanian experience and perspective on the commercial cultivation of genetically modified crops in Europe.	Transgenic Res. 2019 Feb;28(1):1-7. doi: 10.1007/s11248-018-0095-9.	0
12	Ishaq N, Bilal M, Iqbal HMN. 2019	Medicinal Potentialities of Plant Defensins: A Review with Applied Perspectives.	Medicines (Basel). 2019 Feb 19;6(1). pii: E29. doi: 10.3390/medicines6010029.	0
13	Jyoti A, Kaushik S, Srivastava VK, Datta M, Kumar S, Yugandhar P, Kothari SL, Rai V, Jain A. 2019	The potential application of genome editing by using CRISPR/Cas9, and its engineered and ortholog variants for studying the transcription factors involved in the maintenance of phosphate homeostasis in model plants.	Semin Cell Dev Biol. 2019 Apr 6. pii: S1084-9521(18)30112-5. doi: 10.1016/j.semcdb.2019.03.010.	0
14	Kauffmann F, Van Damme P, Leroux-Roels G, Vandermeulen C, Berthels N, Beuneu C, Mali S. 2019	Clinical trials with GMO-containing vaccines in Europe: Status and regulatory framework.	Vaccine. 2019 Sep 30;37(42):6144-6153. doi: 10.1016/j.vaccine.2019.08.018.	0

15	Looi FY, Baker ML, Townson T, Richard M, Novak B, Doran TJ, Short KR. 2018	Creating Disease Resistant Chickens: A Viable Solution to Avian Influenza?	Viruses. 2018 Oct 15;10(10). pii: E561. doi: 10.3390/v10100561.	0
16	Mat Jalaluddin NS, Othman RY, Harikrishna JA. 2019	Global trends in research and commercialization of exogenous and endogenous RNAi technologies for crops.	Crit Rev Biotechnol. 2019 Feb;39(1):67-78. doi: 10.1080/07388551.2018.1496064.	0
17	Napier JA, Haslam RP, Tsalavouta M, Sayanova O. 2019	The challenges of delivering genetically modified crops with nutritional enhancement traits.	Nat Plants. 2019 Jun;5(6):563-567. doi: 10.1038/s41477-019-0430-z.	0
18	Rostoks N, Grantina-Ievina L, Ievina B, Evelone V, Valcina O, Aleksejeva I. 2019	Genetically modified seeds and plant propagating material in Europe: potential routes of entrance and current status.	Heliyon. 2019 Feb 15;5(2):e01242. doi: 10.1016/j.heliyon.2019.e01242.	0
19	Tyczewska A, Wozniak E, Gracz J, Kuczyński J, Twardowski T. 2018	Towards Food Security: Current State and Future Prospects of Agrobiotechnology.	Trends Biotechnol. 2018 Dec;36(12):1219-1229. doi: 10.1016/j.tibtech.2018.07.008.	0
20	Wolt JD, Wolf C. 2018	Policy and Governance Perspectives for Regulation of Genome Edited Crops in the United States.	Front Plant Sci. 2018 Nov 8;9:1606. doi: 10.3389/fpls.2018.01606.	0
21	Wu Y, Li J, Li X, Zhai S, Gao H, Li Y, Zhang X, Wu G. 2019	Development and strategy of reference materials for the DNA-based detection of genetically modified organisms.	Anal Bioanal Chem. 2019 Mar;411(9):1729-1744. doi: 10.1007/s00216-019-01576-w.	0
22	Zimny T, Sowa S, Tyczewska A, Twardowski T. 2019	Certain new plant breeding techniques and their marketability in the context of EU GMO legislation - recent developments.	N Biotechnol. 2019 Jul 25;51:49-56. doi: 10.1016/j.nbt.2019.02.003.	0

5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS

The database searches (Section 3) identified a total of 66 references, which were reduced to 49 after removal of duplicates ([Table 3](#)). 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.

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, unrelated topics, etc.

Publications which appear 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 6](#) 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. All eligible references were assessed in detail. This detailed assessment included evaluation of the scope of the article and the study quality and reliability. Categorization of reliability (as described in the EFSA 2019 explanatory note¹ was dependent upon the following:

- appropriateness of methodology
- whether the description of methodology would allow independent repetition of the study
- extent of characterization of test materials
- reporting of evidence of reproducibility

[Table 6](#) gives an overview of the reference selection process and results of the detailed assessment.

Table 6: Results of the publication selection process

Total number of publications retrieved after all searches of the scientific literature (excluding duplicates)	49
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	41
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 7](#) 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 8](#). [Table 9](#) lists the publications for which full-text documents were unobtainable for detailed assessment or for which relevance was unclear after detailed assessment.

Table 7: 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). Year	Title	Source
Molecular Characterization	No studies in this category		
Food & Feed Safety	No studies in this category		
Environmental Safety	No studies in this category		

Table 8: 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
Hernandez-Teran, Alejandra Wegier, Ana Benitez, Mariana Lira, Rafael Sosa Fuentes, Tania Gabriela Escalante, Ana E. [Reprint Author]. 2019	In vitro performance in cotton plants with different genetic backgrounds: the case of <i>Gossypium hirsutum</i> in Mexico, and its implications for germplasm conservation.	PeerJ, (JUN 10 2019) Vol. 7, pp. Article No.: e7017. https://peerj.com/ . ISSN: 2167-8359. E-ISSN: 2167-8359.	Evaluated and compared in vitro performance of wild and domesticated cotton populations in Mexico. No ERA related to LLCotton25 cotton.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Naegeli H, Birch AN, Casacuberta J, De Schrijver A, Gralak MA, Jones H, Manachini B, Messean A, Nielsen EE, Nogue F, Robaglia C, Rostoks N, Sweet J, Tebbe C, Visioli F, Wal JM, Poeting A, Alvarez F, Broll H, Ramon M. 2017	Scientific opinion on an application by Monsanto (EFSA-GMO -NL-2013-114) for the placing on the market of a herbicide -tolerant genetically modified cotton MON 88701 for food and feed uses, import and processing under Regulation (EC) No 1829/2003	EFSA Journal (2017), 15(3), n/a CODEN: EJFOA6; ISSN: 1831-4732	This publication was excluded because it does not contain original/primary data. In addition, it is related to MON88701 cotton and not to LLCotton25 cotton.
Naegeli H, Bresson J L, Dalmay T, Dewhurst I C, Epstein M M, Firbank L G, Guerche P, Hejatko J, Moreno F J, Mullins E, Nogue F, Rostoks N, Serrano J J S, Savoini G, Veromann E, Veronesi F, Alvarez F, Ardizzone M, Paraskevopoulos K. 2018	Assessment of genetically modified LLCotton25 for renewal of authorisation under Regulation (EC) No 1829/2003 (application EFSA-GMO -RX-010).	EFSA Journal (2018), Volume 16, Number 11, e05473 p., 7 refs. ISSN: 1831-4732 DOI: 10.2903/j.efsa.2018.5473 Published by: Wiley, Oxford	This publication was excluded because it does not contain original/primary data.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Naegeli H, Birch A N, Casacuberta J, de Schrijver A, 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 (2018), Volume 16, Number 4, e05213 p., many ref. ISSN: 1831-4732 DOI: 10.2903/j.efsa.2018.5213 Published by: Wiley, Oxford	This publication was excluded because it does not contain original/primary data. In addition, report is on stacked product involving LLCotton25 cotton and not on LLCotton25 cotton itself.
Ricroch, Agnes [Reprint Author] Akkoyunlu, Serife Martin-Laffon, Jacqueline Kuntz, Marcel 2018	Assessing the Environmental Safety of Transgenic Plants: Honey Bees as a Case Study.	Kuntz, M [Editor]. Adv. Bot. Res., (2018) pp. 111-167. Transgenic Plants and Beyond. Publisher: ACADEMIC PRESS LTD-ELSEVIER SCIENCE LTD, 24-28 OVAL ROAD, LONDON NW1 7DX, UK. Series: Advances in Botanical Research. CODEN: ABTRAJ. ISSN: 0065-2296. ISBN: 978-0-12-809447-1(P).	Review on the impact of insecticidal and herbicidal trait on the health of honey bees. It does not contain original/primary data. No ERA related to LLCotton25 cotton.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Rocha-Munive, Martha G. [Reprint Author] Soberon, Mario Castaneda, Saul Niaves, Esteban Scheinvar, Enrique Eguiarte, Luis E. Mota-Sanchez, David Rosales-Robles, Enrique Nava-Camberos, Urbano Martinez-Carrillo, Jose L. Blanco, Carlos A. Bravo, Alejandra [Reprint Author], Souza, Valeria [Reprint Author] 2018	Evaluation of the Impact of Genetically Modified Cotton After 20 Years of Cultivation in Mexico.	Frontiers in Bioengineering and Biotechnology, (JUN 22 2018) Vol. 6, pp. Article No.: 82. http://journal.frontiersin.org/journal/bioengineering-and-biotechnology# . ISSN: 2296-4185. E-ISSN: 2296-4185.	Environmental and agronomic effects of the use of GM cotton in the past 20 years in Mexico were evaluated. No ERA related to LLCotton25 cotton. Data from previous publications were analyzed.
Wu A-J, Holliday B, Canez C, Haas C, Ghoshal D, Lor J, Massengill J, Chapman K, Cisneros K, Pallett K, Privalle L, Bugas M, Soria M, Hunst P, Araujo R, Mackie S, New S, Sathischandra S, Bishop Z. 2018	GHB614 x T304-40 x GHB119 x COT102 Cotton : Protein Expression Analyses of Field-Grown Samples	Journal of agricultural and food chemistry (2018), Volume 67, Number 1, pp. 275-281 ISSN: 1520-5118 Published by: American Chemical Society Source Note: 2018 Dec. 06, v. 67, no. 1	Publication is not about the LLCotton25 cotton.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Xiaoping P. 2019	Determining Pollen-Mediated Gene Flow in Transgenic Cotton	Methods in molecular biology (Clifton, N.J.), (2019) Vol. 1902, pp. 309-321. Journal code: 9214969. E-ISSN: 1940-6029. L-ISSN: 1064-3745.	Evaluated the extent of gene flow for GM cotton (NewCott 33B and TFD) in field. No ERA related to LLCotton25 cotton.

Table 9: 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 8 publications were selected during Stage 1 evaluation (rapid assessment based on title and abstract). After Stage 2 evaluation (detailed review based on full text), no relevant references were found in the searches on LLCotton25 and its newly expressed protein, phosphinothricin acetyltransferase, covering October 1, 2018 to September 30, 2019 to provide additional information.

7. CONCLUSION

The literature searches performed for the LLCotton25 cotton and its newly expressed protein phosphinothricin acetyltransferase for the period from October 1, 2018 to September 30, 2019, identified a total of 49 unique publications (after duplicate removal). A total of 8 publications were progressed for detailed assessment after excluding 41 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract).

The 8 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 relevant publications with bearing on molecular characterization, human or animal safety assessment, or environmental safety assessment were identified. No issues or topics were identified that would trigger or warrant more specific question formulation.

8. REFERENCES

No.	Author(s), title, source, edition, year, pages
1.	Devos Y, Guajardo IM, Alvarez F and Glanville J. Explanatory note on literature searching conducted in the context of GMO applications for (renewed) market authorisation and annual post-market environmental monitoring reports on GMOs authorised in the EU market. EFSA supporting publications 2019:EN-1614. 62 pages. doi:10.2903/sp.efsa.2019.EN-1614.

9. APPENDICES

Appendix 1 Database descriptions

Host	File	Description
STN	AGRICOLA	<p>Agriculture Online Access is a bibliographic database containing selected worldwide literature of agriculture and related fields. AGRICOLA is the locator and bibliographic access and control system of the National Agricultural Library (NAL) collections and also includes records from other cooperating institutions. Coverage of the database includes agricultural economics and rural sociology, agricultural production, animal sciences, chemistry, entomology, food and human nutrition, forestry, natural resources, pesticides, plant science, soils and fertilizers, and water resources. Also covered are related areas such as biology and biotechnology, botany, ecology, and natural history.</p> <p>The database draws on bibliographies, serial articles, book chapters, monographs, computer files, serials, maps, audiovisuals, and reports. Bibliographic information, abstracts, geographic terms, controlled terms, and supplementary terms are searchable.</p>
STN	BIOSIS	<p>BIOSIS Previews® is the largest and most comprehensive life science database in the world. Amongst others subject coverage includes Agriculture, Biochemistry, Biophysics, Botany, Environmental Biology, Physiology, Toxicology.</p> <p>Sources include periodicals, journals, conference proceedings, reviews, reports, patents, and short communications. Nearly 6,000 life source journals, 1,500 international meetings as well as review articles, books, and monographs are reviewed for inclusion.</p> <p>Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are all searchable.</p>
STN	CABA/CAB	<p>The CAB Abstracts database covers worldwide literature from all areas of agriculture and related sciences including Agriculture, Agricultural chemicals, Animal sciences and production, Crop protection, Crop sciences and production, Environment, Soils and fertilizers.</p> <p>Sources for CABA include journals, books, reports, published theses, conference proceedings, and patents.</p> <p>Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are searchable.</p>
STN	CAS-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 11:18:47 ON 20 NOV 2019

L1 1 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 OR ACS-GH001-3
OR ACS(W)GH001(W)3 OR ACSGH001(W)3

L2 12136 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM

L3 1325 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

L4 194 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L5 1396 SEA (L3 OR L4)

L6 2837 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)

L7 23674 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L8 3454655 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?))

L9 18 SEA (L2 OR L5) AND L7

L10 98 SEA L6 AND L7 AND L8

L11 109 SEA L1 OR L9 OR L10

L12 21 SEA L11 AND PY>=2017

L13 8 SEA L12 AND UP>=20181001 AND UP<=20190930

FILE 'BIOSIS' ENTERED AT 11:19:18 ON 20 NOV 2019

L14 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 OR ACS-GH001-3
OR ACS(W)GH001(W)3 OR ACSGH001(W)3

L15 13422 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM

L16 2654 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

L17 321 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L18 2752 SEA (L16 OR L17)

L19 9071 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)

L20 70403 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE

L21 430194 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?))

L22 79 SEA (L15 OR L18) AND L20

L23 232 SEA L19 AND L20 AND L21

L24 298 SEA L14 OR L22 OR L23

L25 28 SEA L24 AND PY>=2017

L26 18 SEA L25 AND UP>=20181001 AND UP<=20190930

FILE 'AGRICOLA' ENTERED AT 11:19:42 ON 20 NOV 2019
CHARGED TO COST=87799041

L27 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 OR ACS-GH001-3

OR ACS(W)GH001(W)3 OR ACSGH001(W)3
L28 2672 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM
L29 711 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
L30 238 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L31 785 SEA (L29 OR L30)
L32 7419 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)
L33 59520 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L34 90652 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?))
L35 44 SEA (L28 OR L31) AND L33
L36 207 SEA L32 AND L33 AND L34
L37 242 SEA L27 OR L35 OR L36
L38 15 SEA L37 AND PY>=2017
L39 7 SEA L38 AND UP>=20181001 AND UP<=20190930

FILE 'CABA' ENTERED AT 11:20:36 ON 20 NOV 2019

L40 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 OR ACS-GH001-3
OR ACS(W)GH001(W)3 OR ACSGH001(W)3
L41 4577 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM
L42 1441 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 364 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L44 1539 SEA (L42 OR L43)
L45 16690 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)
L46 89355 SEA COTTON# OR GOSSYPIMUM OR G(W)HIRSUTUM OR G(W)BARBADENSE
L47 166680 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?))
L48 85 SEA (L41 OR L44) AND L46
L49 462 SEA L45 AND L46 AND L47
L50 522 SEA L40 OR L48 OR L49
L51 46 SEA L50 AND PY>=2017
L52 16 SEA L51 AND UP>=20181001 AND UP<=20190930
L53 16 SEA L52 NOT P/DT
L54 0 SEA L52 AND (P/DT AND J/DT)
L55 16 SEA L53 OR L54

FILE 'HCAPLUS' ENTERED AT 11:21:06 ON 20 NOV 2019

L56 9 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 OR ACS-GH001-3
OR ACS(W)GH001(W)3 OR ACSGH001(W)3
L57 17880 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM
OR LLRTM

L58 6313 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
L59 744 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE
L60 6593 SEA (L58 OR L59)
L61 25012 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
GLUPHOSINATE OR PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR
PROTECT? OR TOLERAN?)
L62 237581 SEA COTTON# OR GOSSYPIUM OR G (W) HIRSUTUM OR G (W) BARBADENSE
L63 638304 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?))
L64 255 SEA (L57 OR L60) AND L62
L65 1210 SEA L61 AND L62 AND L63
L66 1362 SEA L56 OR L64 OR L65
L67 509 SEA L66 AND PY>=2017
L68 82 SEA L67 AND UP>=20181001 AND UP<=20190930
L69 17 SEA L68 NOT P/DT
L70 0 SEA L68 AND (P/DT OAND J/DT)
L71 17 SEA L69 OR L70

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 11:21:37 ON 20
NOV 2019

L72 49 DUP REM L13 L26 L39 L55 L71 (17 DUPLICATES REMOVED)
ANSWERS '1-8' FROM FILE MEDLINE
ANSWERS '9-24' FROM FILE BIOSIS
ANSWERS '25-28' FROM FILE AGRICOLA
ANSWERS '29-39' FROM FILE CABA
ANSWERS '40-49' FROM FILE HCAPLUS