

**Title**

Summary of the Literature Review for A5547-127 soybean  
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.  
EFSA supporting publications 2019:EN-1614

**Completion date**

November 29, 2019

**Principal author**

[REDACTED]

**Report Number**

19-RSSB0018

**Activity ID**

RSSB0018



We create chemistry

Report No: 19-RSSB0018  
Summary of the Literature Review for A5547-127 Soybean  
October 1, 2018 – September 30, 2019  
Page 2 of 31

The following statement is only intended and valid for submissions which are subject to the United States – Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

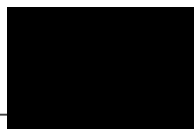
**STATEMENT OF NO DATA CONFIDENTIALITY CLAIMS**

No claim of confidentiality, on any basis whatsoever, is made for any information contained in this document. I acknowledge that the information not designated as within the scope of FIFRA, section 10 (d)(1)(A),(B), or (C) in the USA and which pertains to a registered or previously registered pesticide is not entitled to confidential treatment and may be released to the public, subject to provisions regarding disclosure to multinational entities under FIFRA 10(g) in the USA.

However, these data are the property of BASF Agricultural Solutions Seed GmbH or one of its affiliates and, as such, are considered to be a trade secret and confidential for all purposes other than compliance with FIFRA 10 in USA.

Submission of these data in compliance with FIFRA does not constitute a waiver of any right to confidentiality which may exist under any other statute or in any country other than the USA.

Submitter  
signature:



Date:

2019-11-29  
(YYYY-MM-DD)

Typed name of submitter:



Typed name of company:

BASF Belgium Coordination Center CommV

The above statement supersedes all other statements of confidentiality that may occur elsewhere in this report.



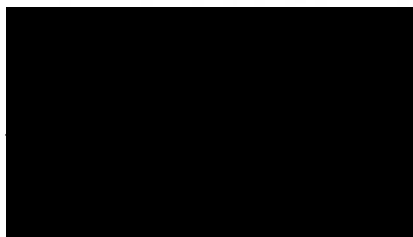
We create chemistry

Report No: 19-RSSB0018  
Summary of the Literature Review for A5547-127 Soybean  
October 1, 2018 – September 30, 2019  
Page 3 of 31

---

**SIGNATURE PAGE**

Principal author:














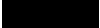

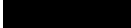


Date

2019-11-29

(YYYY-MM-DD)

BASF Belgium Coordination Center CommV

**STUDY PERSONNEL**

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

---

**TABLE OF CONTENTS**

<b>STATEMENT OF NO DATA CONFIDENTIALITY CLAIMS .....</b>	<b>2</b>
<b>SIGNATURE PAGE .....</b>	<b>3</b>
<b>Study Personnel .....</b>	<b>4</b>
<b>TABLE OF CONTENTS .....</b>	<b>5</b>
<b>TABLES .....</b>	<b>6</b>
<b>Appendices .....</b>	<b>6</b>
<b>SUMMARY .....</b>	<b>7</b>
<b>1. INTRODUCTION .....</b>	<b>8</b>
<b>2. OVERALL METHODS .....</b>	<b>8</b>
2.1. Objective of the scoping review .....	8
2.2. Review questions .....	8
2.3. Criteria for relevance .....	9
2.4. Reference publication .....	12
<b>3. SEARCH METHODS AND OUTCOMES .....</b>	<b>12</b>
3.1. Time window and date of the literature search .....	12
3.2. Search strategy .....	12
3.3. Databases used in the literature search .....	14
<b>4. MANUAL SEARCHES .....</b>	<b>15</b>
4.1. Manual searches of web pages of food safety, agriculture, and biotechnology-related authority webpages .....	15
4.2. Manual searches of reference lists of recent review articles .....	16
<b>5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS .....</b>	<b>19</b>
5.1. Screening of titles and abstracts to exclude obviously irrelevant references (Stage 1) ...	19
5.2. Detailed assessment of eligible references (Stage 2) .....	20
<b>6. NARRATIVE SYNTHESIS AND SUMMARY OF RELEVANT STUDIES .....</b>	<b>26</b>
<b>7. CONCLUSION .....</b>	<b>26</b>
<b>8. REFERENCES .....</b>	<b>26</b>
<b>9. APPENDICES .....</b>	<b>27</b>

---

## TABLES

Table 1:-	Eligibility/inclusion criteria to establish the relevance of retrieved publications.....	9
Table 2:	Search profile for database search.....	13
Table 3:	Overview of the selected databases and summary of search results from each database .....	14
Table 4:	Results of search of food safety, agriculture, and biotechnology-related authority websites .....	15
Table 5:	Documents for which reference lists were scanned for relevant studies.....	17
Table 6:	Results of the publication selection process.....	20
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).....	21
Table 8:	Report of publications excluded from the risk assessment after detailed assessment of full-text documents.....	21
Table 9:	Report of unobtainable/unclear publications.....	25
Table 10:	Report of the summary of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s).....	26
Table 11:	Report of the reliability and implications for the risk assessment of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s).....	26

## APPENDICES

Appendix 1	Search history.....	27
Appendix 2	Database descriptions .....	30

## SUMMARY

Glycine max (soybean) plants were transformed by direct gene transfer using transformation vector pB2/35SAcK. The vector contains a *pat* gene cassette conferring tolerance to the herbicide glufosinate-ammonium and the betalactamase (*bla*) antibiotic resistance gene. Prior to transformation, the vector was digested with the *PvuI* restriction enzyme to disrupt the coding sequence of the *bla* gene and thereby removing any remote possibility of its expression. The OECD identifier is ACS-GMØØ6-4.

A scoping review was performed for A5547-127 soybean and its newly expressed protein, PAT/*pat*. The objective was to determine if there were studies about the molecular characterization of A5547-127 soybean, its effect 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 regulatory authorities for food and feed safety, agriculture, and biotechnology 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.

The literature searches identified a total of 123 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of 10 publications were progressed for further assessment. After a detailed review, all 10 publications were determined to not relevant.

No publications were found that contained new data on the molecular characterization of A5547-127 soybean and its newly expressed protein PAT/*pat*. Similarly, no new publications were found that suggested any potential adverse effects of A5547-127 soybean on human health and animal health, or the environment.

In summary, these literature searches and detailed review of the retrieved publications identified no publications that would change the existing safety assessment of A5547-127 soybean.

## 1. INTRODUCTION

*Glycine max* (soybean) plants were transformed by direct gene transfer using transformation vector pB2/35SAck. The vector contains a *pat* gene cassette conferring tolerance to the herbicide glufosinate-ammonium and the betalactamase (*bla*) antibiotic resistance gene. Prior to transformation, the vector was digested with the *PvuI* restriction enzyme to disrupt the coding sequence of the *bla* gene and thereby removing any remote possibility of its expression. The OECD identifier is ACS-GMØØ6-4.

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 A5547-127 soybean, and/or any adverse effect of A5547-127 soybean in food, feed or the environment. In that context, broad and inclusive literature searches were performed and the articles retrieved were reviewed in a comprehensive and transparent manner. The literature review was performed as recommended in the European Food Safety Authority (EFSA) explanatory note on literature searching conducted in the context of Genetically Modified Organisms (GMO)<sup>1</sup> applications and post-market environmental monitoring activities (2019).

The literature searches were performed for A5547-127 soybean and its newly expressed protein PAT/*pat*. The search terms also included relevant synonyms, 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 A5547-127 soybean and the newly expressed protein PAT/*pat*, in order to identify any issues related to the molecular characterization, food and feed safety or environmental safety that may require a more detailed examination.

### 2.2. Review questions

Review questions were formulated to conform to PECO structure (Population, Exposure, Comparators, Outcome) if possible, and to meet data requirements. They were modeled after the review question examples provided in the EFSA 2019 explanatory note<sup>1</sup>.

**Question 1:** Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of A5547-127 soybean and the PAT/*pat* protein?

**Key elements:**

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

**Exposure:** A5547-127 soybean, derived food/feed products, newly expressed protein in A5547-127 soybean

**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 the molecular characterization of A5547-127 soybean and the PAT/*pat* protein?

**Key elements:**

**Population:** A5547-127 soybean and newly expressed protein in A5547-127 soybean

**Outcome:** Molecular characterization (which would indicate the information/data requirement for molecular characteristics)



### 2.3. Criteria for relevance

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

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

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

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

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 A5547-127 were known before starting the search, therefore, a related publication referring to the same trait (glufosinate tolerance) and the same crop (soybean) was used used to test and validate the search strategy:

- Federici S, Paraskevopoulos K (2018). Risk assessment of new sequencing information for genetically modified soybean A2704-12. EFSA Journal 16(11), e054696

### 3. SEARCH METHODS AND OUTCOMES

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

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

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

The database searches were performed on October 14, 2019. Only documents updated between October 1, 2018 and September 30, 2019, were considered in the search.

#### 3.2. Search strategy

The search profiles were designed to cover event name, trade name, newly expressed proteins and intended traits. Since the 'trade name' profile, 'newly expressed protein' profile and 'intended trait' profile produced too many results when used on their own, they were combined with additional profiles: the 'trade name' profile and the '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 the 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.

See [Appendix 1](#) for a complete search history.

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

Set	Search string	Concepts
1	LL55 or A5547-127 or A5547(w)127 or A(w)5547(w)127 or ACS-GM006-4 or ACS-GM006-4 or ACS-GM006-4 or ACS(w)GM006(w)4 or ACS(w)GM006(w)4 or ACS(w)GM006(w)4 or ACSGM006(w)4 or ACSGM006(w)4 or ACSGM006(w)4	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	(herbicide? or bialaphos or basta or glufosinate or phosphinothricin or liberty?)(5a)(resist? or toleran? or protect?)	Intended trait
5	soy or soya or soja or soybean# or soyabean# or sojabean# or glycine(w)max or g(w)max	Plant species

6	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3a)(modif? OR transform? OR manipulat? OR improv? OR engineer?))	GMO general
7	2 and 5	Trade name AND Plant species
8	3 and 5	Newly expressed protein AND Plant species
9	4 and 5 and 6	Intended trait AND Plant species AND GMO general
10	1 or 7 or 8 or 9	Event name OR (Trade name AND plant species) OR (Newly expressed protein AND Plant species) OR (Intended trait AND Plant species AND GMO general)

### 3.3. 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).

The dates of the most recent database updates are provided in [Table 3](#)  
See [Appendix 2](#) for detailed database descriptions.

**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	14 Oct 2019	14 Oct 2019	14 Oct 2019	14 Oct 2019	14 Oct 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	4 Oct 2019	9 Oct 2019	10 Oct 2019	13 Oct 2019	13 Oct 2019
Number of records identified	21	44	39	42	31

Number of records after duplicate removal	16	30	20	26	31
Number of relevant records after rapid assessment	1	1	3	2	3

#### 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 regulatory authorities for food and feed safety, agriculture and biotechnology was conducted. Search results were manually examined for relevant records that were either published during the time period of October 1, 2018 to September 30, 2019 or refer to relevant records published during this time frame. Relevance of results was determined based on the criteria listed in [Table 1](#) and are summarized in [Table 4](#). All web pages searched chosen based on them being part of the EFSA 2019 explanatory note<sup>1</sup>. Search terms consisted of LL55 or A5547-127 or LibertyLink Soy 55 OR ACS-GMO06-4, PAT/pat or phosphinothricin in A5547-127 soybean. (All searched singly, with no search limits applied).

**Table 4: Search of websites for regulatory authorities for food and feed safety, agriculture, and biotechnology**

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
US Environmental Protection Agency (EPA)	<a href="https://www.epa.gov/">https://www.epa.gov/</a>	Oct 4, 2019	Oct 8, 2019	0
US Department of Agriculture (USDA)	<a href="https://www.usda.gov/">https://www.usda.gov/</a>	Oct 8, 2019	Oct 9, 2019	0
US Food and Drug Administration (FDA)	<a href="https://www.fda.gov/">https://www.fda.gov/</a>	Oct 9, 2019	Oct 9, 2019	0
Health Canada	<a href="https://www.canada.ca/en/health-canada.html">https://www.canada.ca/en/health-canada.html</a>	Oct 7, 2019	Oct 9, 2019	0
Canadian Food Inspection Agency	<a href="https://www.canada.ca/en/food-inspection-agency.html">https://www.canada.ca/en/food-inspection-agency.html</a>	Aug 23, 2019	Oct 9, 2019	0

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
Environment and Climate Change Canada	<a href="https://www.canada.ca/en/services/environment/weather/climatechange.html">https://www.canada.ca/en/services/environment/weather/climatechange.html</a>	Jul 26, 2019	Oct 9, 2019	0
Food Standards Australia New Zealand (FSANZ)	<a href="http://www.foodstandards.gov.au/Pages/default.aspx">http://www.foodstandards.gov.au/Pages/default.aspx</a>	Oct 9, 2019	Oct 9, 2019	0
Office of the Gene Technology Regulator (OGTR)	<a href="http://www.ogtr.gov.au/">http://www.ogtr.gov.au/</a>	Oct 8, 2019	Oct 9, 2019	0
National Technical Commission on Biosafety (CTNBio)	<a href="http://ctnbio.mcti.gov.br/en">http://ctnbio.mcti.gov.br/en</a>	September 2019	Oct 7-21, 2019	0
National Advisory Commission on Agricultural Biotechnology (CONABIA)	<a href="https://www.argentina.gob.ar/agroindustria/bioeconomia/biotechnologia">https://www.argentina.gob.ar/agroindustria/bioeconomia/biotechnologia</a>	Oct 1, 2019	Oct 2, 2019	0
National Food Safety and Quality Service (SENASA)	<a href="https://www.argentina.gob.ar/senasa">https://www.argentina.gob.ar/senasa</a>	Oct 2, 2019	Oct 2, 2019	0
Ministry of Environment, Forest, and Climate Change. Government of India	<a href="http://moef.gov.in/">http://moef.gov.in/</a>	Sept 30, 2019	Oct 9, 2019	0
Ministry of Agriculture, Forestry and Fisheries (MAFF)	<a href="http://www.maff.go.jp/">http://www.maff.go.jp/</a>	Oct 30, 2019	Oct 30, 2019	0
Ministry of Health, Labor and Welfare (MHLW)	<a href="http://www.mhlw.go.jp/">http://www.mhlw.go.jp/</a>	Oct 30, 2019	Oct 30, 2019	0

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

Review articles published between October 1, 2018 and September 30, 2019 served as sources for reference lists to search for potentially relevant studies. The review articles were identified by searching of PubMed.gov for general terms such as “GMO” or “GM crops” in the titles and abstracts. A list of review articles and the resulting number of relevant studies found within the bibliographies is given in [Table 5](#).



**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

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
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

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
18	Rostoks N, GrantiĀta-leviĀta L, leviĀta B, Evelone V, ValciĀta 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, WoĀniak E, Gracz J, KuczyĀski 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 177 references, which were reduced to 123 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 the 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:

- Duplicate entries
- Secondary literature (reviews), other than assessments from regulatory authorities
- 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 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 6](#).

## 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 Characterization, 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 as well as the quality and reliability of the study. Categorization of reliability (as described in the EFSA 2019 explanatory note<sup>1</sup> and reported in [Table 11](#)) 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)	123
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	113
Total number of full-text documents assessed in detail	10
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	10
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 after 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) and year)	Title	Source
No publications 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 <a href="#">Table 1</a>
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., Papadopoulou, N., Paraskevopoulos, K.  2019	Assessment of genetically modified soybean A2704-12 for renewal of authorisation under regulation (EC) No 1829/2003 (application EFSA-GMO -RX-009).	EFSA Journal (2019), Volume 17, Number 1, e05523 p., many ref. ISSN: 1831-4732 DOI: 10.2903/j.efsa.2019.5523 Published by: Wiley, Oxford	The subject of the document is not A5547-127 soybean.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in <a href="#">Table 1</a>
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., Juan, J., Serrano, S., Savoini, G., Veromann, E., Veronesi, F., Alvarez, F., Ardizzone, M., Paraskevopoulos, K.  2018	Assessment of genetically modified soybean MON 89788 for renewal of authorisation under Regulation (EC) No 1829/2003 (application EFSA-GMO -RX-011).	EFSA Journal (2018), Volume 16, Number 11, e05468 p., 6 refs. ISSN: 1831-4732 DOI: 10.2903/j.efsa.2018.5468 Published by: Wiley, Oxford	The subject of the document is not A5547-127 soybean.
Naegeli, H., Bresson, J. L., Dalmay, T., Dewhurst, I. C., Epstein, 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., Dumont, A. F., Papadopoulou, N., Ardizzone, M., Devos, Y., Gennaro, A., Gomez, J. A. R., Lanzoni, A., Neri, F. M., Paraskevopoulos, K.  2019	Assessment of genetically modified soybean MON 87708 x MON 89788 x A5547-127, for food and feed uses, under regulation (EC) no 1829/2003 (application EFSA-GMO-NL-2016-135).	EFSA Journal (2019), Volume 17, Number 7, e05733 p., 53 refs. ISSN: 1831-4732 DOI: 10.2903/j.efsa.2019.5733 Published by: Wiley, Oxford	The subject of the document is a stacked product that includes A5547-127 soybean and other events.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in <a href="#">Table 1</a>
Papineni, Sabitha Fletcher, Dale W. Cromwell, Gary L. Ekmay, Ricardo D.  2017	Comparative performance of broilers fed diets containing DAS-44406-6 and non-transgenic soybean meal.	Poultry Science, (MAY 2017 ) Vol. 96, No. 5, pp. 1244-1249. <a href="http://ps.oxfordjournals.org/">http://ps.oxfordjournals.org/</a> . CODEN: POSCAL. ISSN: 0032-5791. E-ISSN: 1525-3171.	The study did not examine A5547-127 soybean.
Papineni Sabitha Passage Julie K Thomas Johnson Ekmay Ricardo D  2018	Evaluation of 30% DAS-44406-6 soybean meal in a subchronic rat toxicity study.	Regulatory toxicology and pharmacology : RTP, (2018 Apr) Vol. 94, pp. 57-69. Electronic Publication Date: 6 Jan 2018 Journal code: 8214983. E-ISSN: 1096-0295. L-ISSN: 0273-2300.	The study did not examine A5547-127 soybean.
Papineni, Sabitha Christina M Dunville Ekmay Ricardo Jennifer A Murray Johnson Thomas Radha Krishna Sura  2017	Evaluation of the safety of a genetically modified DAS-44406-6 soybean meal and hulls in a 90-day dietary toxicity study in rats	Food and chemical toxicology (2017), pp. 245-252 ISSN: 0278-6915 Published by: Elsevier Ltd Source Note: 2017 Nov., v. 109	The study did not examine A5547-127 soybean.
Herman Rod A Ekmay Ricardo D Schafer Barry W Song Ping Fast Brandon J Papineni Sabitha Shan Guomin Juberg Daland R 2018	Food and feed safety of DAS-44406-6 herbicide - tolerant soybean .	Regulatory toxicology and pharmacology : RTP, (2018 Apr) Vol. 94, pp. 70-74. Electronic Publication Date: 28 Jan 2018 Journal code: 8214983. E-ISSN: 1096-0295. L-ISSN: 0273-2300.	The subject of the document is not A5547-127 soybean.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in <a href="#">Table 1</a>
EFSA Panel on Genetically Modified Organisms Naegeli, H., Birch, A.N., Casacuberta, J., De Schrijver, A. Gralak, M.A., Jones, H., Manachini, B., Messean, A., Nielsen, E.E., Nogue, F., Robaglia, C., Rostoks, N., Sweet, J., Tebbe, C., Visioli, F. Wal, JM., Ardizzone, M., Devos, Y., Gomes, A., Liu, Y., Neri, F. M., Olaru, I.  2017	Scientific Opinion on an application by Dow AgroSciences LLC (EFSA-GMO -NL-2011-91) for the placing on the market of genetically modified herbicide -tolerant soybean DAS-68416-4 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	The subject of the document is not A5547-127 soybean.
EFSA Panel on Genetically Modified Organisms EFSA Panel on Genetically Modified Organisms Naegeli, H., Birch, A.N., Casacuberta, J., De Schrijver, A. Gralak, M.A., Jones, H., Manachini, B., Messean, A., Nielsen, E.E., Nogue, F., Robaglia, C., Rostoks, N., Sweet, J., Tebbe, C., Visioli, F. Wal, JM, Alvarez, F., Ardizzone, M., Liu, Y., Neri, F.M., Ramon, M  2017	Scientific opinion on an application by Dow AgroSciences LLC (EFSA-GMO -NL-2012-106) for the placing on the market of genetically modified herbicide -tolerant soybean DAS-44406-6 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	The subject of the document is not A5547-127 soybean.



Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in <a href="#">Table 1</a>
Qian Zhi-Yong Zhang Shu-Jing Zhang Li Zhang Jing Liu Ying-Hua Zhou Qing-Hong Jiang Shu-Qing Li Shu-Fei  2018	Subchronic toxicity study in rats evaluating genetically modified DAS-81419-2 soybean .	Regulatory toxicology and pharmacology : RTP, (2018 Jul) Vol. 96, pp. 48-56. Electronic Publication Date: 30 Apr 2018 Journal code: 8214983. E-ISSN: 1096-0295. L-ISSN: 0273-2300.	The study did not examine A5547-127 soybean.

**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 AND SUMMARY OF RELEVANT STUDIES

A total of 10 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 these 10 publications were relevant for the safety assessment of A5547-127 soybean and its newly expressed protein PAT/*pat*.

[Table 10](#) and [Table 11](#) list the relevant publications along with a summary of any adverse effects reported and the reliability of the publications.

**Table 10: Summary of all relevant publications retrieved after detailed assessment of full-text documents for relevance (Stage 2): ordered by category of information/data requirement(s)**

Main category of information/data requirement	Study (Author(s) and year)	Intervention/ test materials used	Adverse effects reported	Which adverse effect reported
No publications in this category.				

**Table 11: Report of the reliability and implications for the risk assessment of all relevant publications retrieved after detailed assessment of full-text documents for relevance (Stage 2): ordered by category of information/data requirement(s)**

Main category of information/data requirement	Study (Author(s) and year)	Summary of reliability appraisal	Implications for risk assessment
No publications in this category.			

## 7. CONCLUSION

The literature searches performed for A5547-127 soybean and its newly expressed protein PAT/*pat* for the period from October 1, 2018 to September 30, 2019, identified a total of 123 unique publications. A total of 10 publications were progressed for detailed assessment after excluding 113 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract). These 10 publications were evaluated in detail, based on their full text for potential relevance, following the pre-established criteria. No relevant references with bearing on human and animal safety, molecular characterization or environmental safety were identified. No issues or topics were identified that would trigger or warrant a 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 Search history

FILE 'MEDLINE' ENTERED AT 13:15:05 ON 14 OCT 2019  
CHARGED TO COST=87739302

L1 4 SEA LL55 OR A5547-127 OR A5547(W)127 OR A(W)5547(W)127 OR  
ACS-GM006-4 OR ACS-GM006-4 OR ACS-GMO06-4 OR ACS(W)GM006(W)4  
OR ACS(W)GM006(W)4 OR ACS(W)GMO06(W)4 OR ACSGM006(W)4 OR  
ACSGM006(W)4 OR ACSGMO06(W)4

L2 12038 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 1319 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 1390 SEA (L3 OR L4)

L6 2815 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR  
PROTECT?)

L7 60159 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX

L8 3439531 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 41 SEA L2 AND L7

L10 46 SEA L5 AND L7

L11 207 SEA L6 AND L7 AND L8

L12 281 SEA L1 OR L9 OR L10 OR L11

L13 56 SEA L12 AND PY>=2017

L14 31 SEA L13 AND UP>=20181001 AND UP<=20190930

FILE 'BIOSIS' ENTERED AT 13:15:56 ON 14 OCT 2019  
CHARGED TO COST=87739302

L15 14 SEA LL55 OR A5547-127 OR A5547(W)127 OR A(W)5547(W)127 OR  
ACS-GM006-4 OR ACS-GM006-4 OR ACS-GMO06-4 OR ACS(W)GM006(W)4  
OR ACS(W)GM006(W)4 OR ACS(W)GMO06(W)4 OR ACSGM006(W)4 OR  
ACSGM006(W)4 OR ACSGMO06(W)4

L16 13365 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)  
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM  
OR LLRTM

L17 2643 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

L18 321 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L19 2741 SEA (L17 OR L18)

L20 9051 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR  
PROTECT?)

L21 156463 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX

L22 428692 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?))

L23 103 SEA L16 AND L21

L24 111 SEA L19 AND L21

L25 376 SEA L20 AND L21 AND L22

L26 567 SEA L15 OR L23 OR L24 OR L25  
L27 82 SEA L26 AND PY>=2017  
L28 44 SEA L27 AND UP>=20181001 AND UP<=20190930

FILE 'AGRICOLA' ENTERED AT 13:16:22 ON 14 OCT 2019  
CHARGED TO COST=87739302

L29 6 SEA LL55 OR A5547-127 OR A5547(W)127 OR A(W)5547(W)127 OR  
ACS-GM006-4 OR ACS-GM006-4 OR ACS-GMO06-4 OR ACS(W)GM006(W)4  
OR ACS(W)GM006(W)4 OR ACS(W)GMO06(W)4 OR ACSGM006(W)4 OR  
ACSGM006(W)4 OR ACSGMO06(W)4  
L30 2648 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)  
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM  
OR LLRTM  
L31 710 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  
L32 238 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE  
L33 784 SEA (L31 OR L32)  
L34 7413 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR  
PROTECT?)  
L35 81953 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX  
L36 90274 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?))  
L37 64 SEA L30 AND L35  
L38 38 SEA L33 AND L35  
L39 357 SEA L34 AND L35 AND L36  
L40 449 SEA L29 OR L37 OR L38 OR L39  
L41 45 SEA L40 AND PY>=2017  
L42 21 SEA L41 AND UP>=20181001 AND UP<=20190930

FILE 'CABA' ENTERED AT 13:17:06 ON 14 OCT 2019  
CHARGED TO COST=127480

L43 14 SEA LL55 OR A5547-127 OR A5547(W)127 OR A(W)5547(W)127 OR  
ACS-GM006-4 OR ACS-GM006-4 OR ACS-GMO06-4 OR ACS(W)GM006(W)4  
OR ACS(W)GM006(W)4 OR ACS(W)GMO06(W)4 OR ACSGM006(W)4 OR  
ACSGM006(W)4 OR ACSGMO06(W)4  
L44 4550 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)  
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM  
OR LLRTM  
L45 1437 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  
L46 364 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE  
L47 1535 SEA (L45 OR L46)  
L48 16598 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR  
PROTECT?)  
L49 177358 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX  
L50 165911 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?))  
L51 116 SEA L44 AND L49  
L52 102 SEA L47 AND L49  
L53 701 SEA L48 AND L49 AND L50  
L54 877 SEA L43 OR L51 OR L52 OR L53

L55 82 SEA L54 AND PY>=2017  
L56 39 SEA L55 AND UP>=20181001 AND UP<=20190930  
L57 39 SEA L56 NOT P/DT  
L58 0 SEA L56 AND (P/DT AND J/DT)  
L59 39 SEA L57 OR L58

FILE 'HCAPLUS' ENTERED AT 13:17:47 ON 14 OCT 2019  
CHARGED TO COST=87739302  
L60 19 SEA LL55 OR A5547-127 OR A5547(W)127 OR A(W)5547(W)127 OR  
ACS-GM006-4 OR ACS-GM006-4 OR ACS-GMO06-4 OR ACS(W)GM006(W)4  
OR ACS(W)GM006(W)4 OR ACS(W)GMO06(W)4 OR ACSGM006(W)4 OR  
ACSGM006(W)4 OR ACSGMO06(W)4  
L61 17788 SEA LIBERTYLINK OR LIBERTYLINKTM OR LIBERTYLINKRTM OR LIBERTY(W)  
)LINK OR LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM  
OR LLRTM  
L62 6267 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 744 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI  
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER  
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE  
L64 6547 SEA (L62 OR L63)  
L65 24877 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR  
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR  
PROTECT?)  
L66 370906 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#  
OR GLYCINE(W)MAX OR G(W)MAX  
L67 635818 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?))  
L68 193 SEA L61 AND L66  
L69 462 SEA L64 AND L66  
L70 5210 SEA L65 AND L66 AND L67  
L71 5685 SEA L60 OR L68 OR L69 OR L70  
L72 1461 SEA L71 AND PY>=2017  
L73 356 SEA L72 AND UP>=20181001 AND UP<=20190930  
L74 42 SEA L73 NOT P/DT  
L75 0 SEA L73 AND (P/DT AND J/DT)  
L76 42 SEA L74 OR L75

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 13:18:56 ON 14  
OCT 2019  
CHARGED TO COST=87739302  
L77 123 DUP REM L14 L28 L42 L59 L76 (54 DUPLICATES REMOVED)  
ANSWERS '1-31' FROM FILE MEDLINE  
ANSWERS '32-61' FROM FILE BIOSIS  
ANSWERS '62-77' FROM FILE AGRICOLA  
ANSWERS '78-97' FROM FILE CABA  
ANSWERS '98-123' FROM FILE HCAPLUS

## Appendix 2 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>