Title

Summary of the Literature Review for MS8, RF3 and MS8 x RF3 *Brassica napus*
October 1, 2020 – September 30, 2021

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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Electronic database search	[redacted]
Agency website search	[redacted]
Manual search **(reference list from review articles)**	[redacted]
Stage 1 assessment	[redacted]
Stage 2 assessment	Food and Feed safety [redacted] Molecular characterization [redacted] Environmental safety [redacted]
Report	[redacted]

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MS8 x RF3 *Brassica napus* (*B. napus*) is a stacked trait product generated through conventional breeding of MS8 *B. napus* (OECD identifier ACS-BNØØ5-8) and RF3 *B. napus* (OECD identifier ACS-BNØØ3-6). MS8 *B. napus* (male sterile line) was produced by means of *Agrobacterium*-mediated transformation using vector pTHW107. MS8 *B. napus* contains the *barnase* gene (origin *Bacillus amyloliquefaciens*), coding for the Barnase protein. The *barnase* gene is driven by the Pta29 promoter that restricts gene expression to the tapetal cells during anther development. Expression of Barnase in the tapetal cells of MS8 *B. napus* results in lack of viable pollen and male sterility. MS8 *B. napus* also contains the *bar* gene (origin *Streptomyces hygroscopicus*) coding for phosphinothricin acetyltransferase (PAT/*bar*) conferring tolerance to glufosinate-ammonium. The *bar* gene is driven by the PssuAt plant promoter that is active in all green tissues of the plant. RF3 *B. napus* (fertility restorer line) was produced by means of *Agrobacterium*-mediated transformation using vector pTHW118. RF3 *B. napus* contains the *barstar* gene (origin *Bacillus amyloliquefaciens*), coding for the Barstar protein, which is an inhibitor of the Barnase protein. The *barstar* gene is driven by the Pta29 promoter that restricts gene expression to the tapetal cells during anther development. Expression of the Barstar protein in the tapetal cells leads to restoration of fertility after crossing to a male sterile (MS) *B. napus* line. RF3 *B. napus* also contains the *bar* gene (origin *Streptomyces hygroscopicus*) coding for phosphinothricin acetyltransferase (PAT/*bar*) conferring tolerance to glufosinate-ammonium. The *bar* gene is driven by the PssuAt plant promoter that is active in all green tissues of the plant. MS8 x RF3 *B. napus* plants are fully fertile hybrids and express the PAT/*bar* protein which confers tolerance to glufosinate-ammonium. The OECD identifier of MS8 x RF3 *B. napus* is ACS-BNØØ5-8 x ACS-BNØØ3-6.

A scoping review was performed for MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins, PAT/*bar*, Barnase and Barstar. The objective of this scoping review was to determine if there were studies about the molecular characterization of MS8, RF3 or MS8 x RF3 *B. napus*, or their effect on food and feed safety or environmental safety, that might require in-depth examination. A set of broad literature searches was performed using several bibliographic databases covering scientific literature from October 1, 2020 to September 30, 2021. Additional sources of information, such as web pages of food safety, agriculture, and biotechnology-related authorities were searched for the same time window, along with the bibliographies of relevant reviews. The references identified were evaluated for potential relevance to the scoping review questions according to pre-defined criteria.

These literature searches identified a total of 876 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of 4 publications were progressed for detailed assessment.

One of the four publications were determined to be relevant after detailed review. The relevant article did not constitute new data on molecular characterization of MS8, RF3 and MS8 x RF3 *B. napus* or their newly expressed proteins, PAT/*bar*, Barnase and Barstar, nor did it suggest any potential adverse effects on human and animal health or on the environment. No evidence was identified that would warrant conducting a systematic review.

In summary, these literature searches and review of the retrieved articles identified one relevant publication that supports the existing safety assessment of MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins Barstar, Barnase and PAT/*bar*.

1. INTRODUCTION

MS8 x RF3 *Brassica napus* (*B. napus*) is a stacked trait product generated through conventional breeding of MS8 *B. napus* (OECD identifier ACS-BNØØ5-8) and RF3 *B. napus* (OECD identifier ACS-BNØØ3-6). MS8 *B. napus* (male sterile line) was produced by means of *Agrobacterium*-mediated transformation using vector pTHW107. MS8 *B. napus* contains the *barnase* gene (origin *Bacillus amyloliquefaciens*), coding for the Barnase protein. The *barnase* gene is driven by the Pta29 promoter that restricts gene expression to the tapetal cells during anther development. Expression of Barnase in the tapetal cells of MS8 *B. napus* results in lack of viable pollen and male sterility. MS8 *B. napus* also contains the *bar* gene (origin *Streptomyces hygroscopicus*) coding for phosphinothricin acetyltransferase (PAT/*bar*) conferring tolerance to glufosinate-ammonium. The *bar* gene is driven by the PssuAt plant promoter that is active in all green tissues of the plant. RF3 *B. napus* (fertility restorer line) was produced by means of *Agrobacterium*-mediated transformation using vector pTHW118. RF3 *B. napus* contains the *barstar* gene (origin *Bacillus amyloliquefaciens*), coding for the Barstar protein, which is an inhibitor of the Barnase protein. The *barstar* gene is driven by the Pta29 promoter that restricts gene expression to the tapetal cells during anther development. Expression of the Barstar protein in the tapetal cells leads to restoration of fertility after crossing to a male sterile (MS) *B. napus* line. RF3 *B. napus* also contains the *bar* gene (origin *Streptomyces hygroscopicus*) coding for phosphinothricin acetyltransferase (PAT/*bar*) conferring tolerance to glufosinate-ammonium. The *bar* gene is driven by the PssuAt plant promoter that is active in all green tissues of the plant. MS8 x RF3 *B. napus* plants are fully fertile hybrids and express the PAT/*bar* protein which confers tolerance to glufosinate-ammonium. The OECD identifier of MS8 x RF3 *B. napus* is ACS-BNØØ5-8 x ACS-BNØØ3-6.

The objective of the literature searches described here was to determine if there were studies published between October 1, 2020 and September 30, 2021 that mention the molecular characterization of MS8, RF3 or MS8 x RF3 *B. napus*, and/or any adverse effect of MS8, RF3 or MS8 x RF3 *B. napus* 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 MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins, PAT/*bar*, Barnase and Barstar. The search terms also included relevant synonyms, trade name and intended traits, 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 MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins, PAT/*bar*, Barnase and Barstar, in order to identify any specific issues related to food or feed safety, molecular characterization or environmental safety that might require in-depth examination.

2.2. Review questions

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

Question 1: Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins PAT/*bar*, Barnase and Barstar?

Key elements:

Population: Human health; animal health; environmental safety
Exposure: MS8, RF3 and MS8 x RF3 *B. napus*, derived food/feed products, newly expressed proteins in MS8, RF3 and MS8 x RF3 *B. napus*
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 MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins PAT/*bar*, Barnase and Barstar in *B. napus*?

Key elements:

Population: MS8, RF3 and MS8 x RF3 *B. napus* and newly expressed proteins in MS8, RF3 and MS8 x RF3 *B. napus*
Outcome: Molecular characterization (which would indicate the information/data requirement for molecular characteristics)

2.3. Criteria for relevance

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

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

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

Concepts	Criteria	Comment
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

Concepts	Criteria	Comment
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(s), 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

Concepts	Criteria	Comment
Reporting format	The publication presents original/primary data, or it is a risk assessment from a relevant key organisation (such as regulatory agencies and risk assessment bodies involved in the risk assessment of GMOs)	This permits the exclusion of publications that do not present original/primary data (e.g., editorials, position papers), and the inclusion of relevant risk assessments performed and reported by relevant key organisations. Reviews should only be included if they present data that are not available from a primary research study
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 publications

Two publications were used to validate the search profile:

- Naegeli, H.; Birch, A. N.; Casacuberta, J.; Schrijver, A. de; Gralak, M. A.; Guerche, P.; Jones, H.; Manachini, B.; Messean, A.; Nielsen, E. E.; Nogue, F.; Robaglia, C.; Rostoks, N.; Sweet, J.; Tebbe, C.; Visioli, F.; Wal, J. M.; Ardizzone, M.; Devos, Y.; Paraskevopoulos, K.; de Schrijver, A. (2017) Assessment of genetically modified oilseed rape MS8, RF3 and MS8 x RF3 for renewal of authorisation under regulation (EC) No 1829/2003 (application EFSA-GMO-RX-004). *EFSA Journal* **15(11):**e05067

- Zhang CJ; Yook MJ; Park HR; Lim SH; Kim JW; Nah G; Song HR; Jo BH; Roh KH; Park S; Kim DS (2018). Assessment of potential environmental risks of transgene flow in smallholder farming systems in Asia: *Brassica napus* as a case study in Korea. The Science of the total environment Vol 640-641, pp 688-695

Naegeli *et al* (2017) was selected because it mentions the event names (MS8 x RF3, MS8 and RF3), the crop (oilseed rape) and one of the intended traits (herbicide tolerance). Zhang *et al* (2018) was selected because even though it is not directly relevant for MS8 x RF3 *B. napus* or the single events, it refers to the plant species (*B. napus*) and the specific herbicide tolerance (glufosinate). Since both these articles were published before the current search period, the search profile was tested without applying the time limit used in the final search profile (UP>=20201001 and UP<=20210930).

3. SEARCH METHODS AND OUTCOMES

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

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

3.1. Time window and date of the literature search

The database searches were performed on October 26, 2021. Only documents updated between October 1, 2020 and September 30, 2021, 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 profile was designed to cover the stack and the single events. It covers event name, newly expressed proteins and intended traits. Since the 'intended trait' profile produced too many results when used on its own, it was combined with additonal profiles: a 'general GMO' profile and a 'plant species' profile. The reference publications (Section 2.4) were identified by the search profile, confirming the validity of the applied search strategy. See Table 2 for a detailed search profile.

Table 2: Search profile for database search

Set	Search string	Concepts
1	MS8 or MS8x or MS-8 or MS-8x or ACS(w)BNØØ5-8 or ACS(w)BN005-8 or ACS(w)BNOO5-8 or ACSBNØØ5-8 or ACSBN005-8 or ACSBNOO5-8 or ACS(w)BNØØ5-8x or ACS(w)BN005-8x or ACS(w)BNOO5-8x or ACSBNØØ5-8x or ACSBN005-8x or ACSBNOO5-8x	Event name MS8
2	RF3 or xRF3 or RF-3 or xRF-3 or ACS(w)BNØØ3-6 or ACS(w)BN003-6 or ACS(w)BNOO3-6 or ACSBNØØ3-6 or ACSBN003-6 or ACSBNOO3-6 or xACS(w)BNØØ3-6 or xACS(w)BN003-6 or xACS(w)BNOO3-6 or xACSBNØØ3-6 or xACSBN003-6 or xACSBNOO3-6	Event name RF3
3	MS8XRF3 or MS(w)8XRF-3 or MS8.time#.RF3 or ACS(w)BNØØ5(w)8xACS(w)BNØØ3-6 or ACS(w)BN005(w)8xACS-BN003-6 or ACS(w)BNOO5(w)8xACS(w)BNOO3-6	Event name MS8 x RF3
4	1 or 2 or 3	Event name MS8, RF3, MS8 x RF3
5	invigor or invigorr or invigortm or in(w)vigor or in(w)vigorr or in(w)vigortm or in(w)vigorrtm	Trade name MS8, RF3, MS8 x RF3
6	barnase or RNase(w)Ba or (bacterial(w)RiboNuclease and ((Bacillus or b)(w)amyloliquefaciens)) or P00648 or IPR001887 or barstar or	Newly expressed proteins MS8, RF3, MS8 x RF3

Set	Search string	Concepts
	barnase(w)inhibitor or IPR000468 or ((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	
7	(herbicid? or bialaphos or basta or glufosinate or phosphinothricin or liberty)(5a)(resist? or toleran? or protect?) or male(3a)steril? or (fertil?(3a)restor?) or restor?(w)line or pollination(w)control	Intended traits MS8, RF3, MS8 x RF3
8	((*BRASSICA* or B)(w)(*napus* or juncea)) OR RAPE? or CANOLA# OR OILSEED(w)RAPE OR oil(w)seed(w)rape or colza	Plant species
9	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3w)(modif? OR transform? OR manipulat? OR improv? OR engineer?)) or (stacked(w)(gene# or trait# or event#))	GMO general
10	7 and 8 and 9	Intended traits MS8, RF3, MS8 x RF3 AND Plant species AND GMO general
11	4 or 5 or 6 or 10	Event name MS8, RF3, MS8 x RF3 OR Trade name MS8, RF3, MS8 x RF3 OR Newly expressed proteins MS8, RF3, MS8 x RF3 OR (Intended traits MS8, RF3, MS8 x RF3 AND Plant species AND GMO general)

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

- **Agricola**: title (TI), controlled term (CT), supplementary term (ST), abstract (AB), named person (NA), corporate name (CO), note (NTE), geographic term, CABA and other fields (GT)

- **Biosis**: title (TI), abstract (AB), biosystematic codes (BC), chemical name (CN), controlled term (CT), gene name (GEN), geographic term (GT), organism (ORGN) and supplementary term (ST); as well as CAS Registry Numbers (RN)

- **CA-Plus**: title (TI), supplementary term (ST), index term (IT) and abstract (AB); as well as CAS Registry Numbers

- **CABA**: title (TI), controlled term (CT), supplementary term (ST), broader term (BT), abstract (AB), organism name (ORGN) and geographic term (GT); as well as CAS Registry Numbers

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

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

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

Database	Events	New proteins	Intended traits	Plant species	GM plants
Agricola	None	None	"HERBICIDE RESISTANCE" "MALE STERILITY"	"*BRASSICA NAPUS*" CANOLA	"TRANSGENIC PLANTS"
Biosis	None	None	No terms for herbicide resistance "MALE STERILITY"	None	None
CABA	None	None	"HERBICIDE RESISTANCE" "MALE STERILITY"	RAPE	"TRANSGENIC PLANTS"
CAS	None	None	"HERBICIDE RESISTANCE" No terms for male sterility	CANOLA "*BRASSICA NAPUS*"	"GENETICALLY MODIFIED PLANTS"
Medline	None	None	"HERBICIDE RESISTANCE" No terms for male sterility	*BRASSICA NAPUS*	"PLANTS, GENETICALLY MODIFIED"

The search results were limited to documents updated between October 1, 2020 and September 30, 2021 (UP>=20201001 and UP<=20210930), and to non-patent documents (not P/DT). To ensure that documents with indexing errors where two document types (DTs) (one eligible and one ineligible) were attached to a single record were not missed, documents with both 'journal' and 'patent' as document type were also kept. These putative documents would be identified with (P/DT AND J/DT) in CABA and CAPlus.

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

See Appendix 2 for a complete search history.

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

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Database Provider	STN International	STN International	STN International	STN International	STN International
Coverage	1970-present	1926-present	1973-present	1907-present	1946-present

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Date of search	26 Oct 2021	26 Oct 2021	26 Oct 2021	26 Oct 2021	26 Oct 2021
Datespan of the search	1 Oct 2020 – 30 Sept 2021	1 Oct 2020 – 30 Sept 2021	1 Oct 2020 – 30 Sept 2021	1 Oct 2020 – 30 Sept 2021	1 Oct 2020 – 30 Sept 2021
Latest database update	11 Oct 2021	20 Oct 2021	19 Oct 2021	25 Oct 2021	24 Oct 2021
Number of records retrieved	82	171	131	467	239
Number of records after duplicate removal	70	118	87	362	239
Number of *relevant* records after rapid assessment	0	0	0	4	0

4. INTERNET and MANUAL SEARCHES

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

A search of the web pages of food safety, agriculture, and biotechnology-related authorities was conducted. Search results were manually examined for relevant records that were either published during the time period under consideration (date span of search: October 1, 2020 to September 30, 2021) or refer to relevant records published during this time frame. Relevance of results were determined based on the criteria listed in Table 1 and they were summarized in Table 5.
All web pages searched were justified by their recommendation in the EFSA 2019 explanatory note[1]. Of the 13 key organisations cited in the EFSA 2019 explanatory note[1], two (Environment and Climate Change Canada and Intersecretarial Commission on Biosafety of GMOs (CIBIOGEM)) are not involved in the risk assessment of GM plants. The US-EPA website was excluded, since MS8, RF3 and MS8 x RF3 *B. napus* do not contain an insect-resistant trait. The Genetic Engineering Approval Committee (GEAC) website was excluded, since this agency has only regulated GM cotton products. The CTNBio (Brazil) and CONABIA (Argentina) websites were excluded, since these agencies do not regulate any GM products for canola. The Ministry of Agriculture, Forestry and Fisheries (MAFF) website of Japan was not searched because this website only includes a list of authorized single and stacked events, there are no reports regarding safety assessments. Therefore, the internet search was limited to 6 key organisations relevant for MS8, RF3 and MS8 x RF3 *B. napus*.

Search terms consisted of MS8 Canola OR MS8 Oilseed OR MS8 *Brassica* OR RF3 Canola OR RF3 Oilseed OR RF3 *Brassica* OR ACS-BN005-8 OR ACS-BN003-6 for MS8, RF3 and MS8 x RF3 *B. napus* and Barstar, Barnase and PAT/*bar* OR phosphinothricin for proteins in MS8, RF3 and MS8 x RF3 *B. napus* (all searched singly, with no search limits applied).

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

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
US Department of Agriculture (USDA)	https://www.usda.gov/	Oct 22 2021	Oct 22 2021	0
US Food and Drug Administration (FDA)	https://www.fda.gov/	Oct 22 2021	Oct 22 2021	0
Health Canada	https://www.canada.ca/en/health-canada.html	Sept 2021	Oct 21 2021	0
Canadian Food Inspection Agency (CFIA)	https://www.canada.ca/en/food-inspection-agency.html	Sept 2021	Oct 21 2021	0
Food Standards Australia New Zealand (FSANZ)	http://www.foodstandards.gov.au/Pages/default.aspx	Oct 10 2021	Oct 10 2021	0
Office of the Gene Technology Regulator (OGTR) Australia	http://www.ogtr.gov.au/	Oct 10 2021	Oct 10 2021	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, 2020 and September 30, 2021. The resulting number of relevant studies found within the bibliographies of these review articles is given in Table 6.

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

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
1	Golnar AJ, Ruell E, Lloyd AL, Pepin KM. 2021	Embracing Dynamic Models for Gene Drive Management.	Trends Biotechnol. 2021 Mar;39(3):211-214. doi: 10.1016/j.tibtech.2020.08.011. Epub 2020 Sep 30. PMID: 33010965.	0
2	Gupta S, Kumar A, Patel R, Kumar V. 2021	Genetically modified crop regulations: scope and opportunity using the CRISPR-Cas9 genome editing approach.	Mol Biol Rep. 2021 May;48(5):4851-4863. doi: 10.1007/s11033-021-06477-9. Epub 2021 Jun 10. PMID: 34114124.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
3	Hadrup N, Frederiksen M, Wedebye EB, Nikolov NG, Carøe TK, Sørli JB, Frydendall KB, Liguori B, Sejbaek CS, Wolkoff P, Flachs EM, Schlünssen V, Meyer HW, Clausen PA, Hougaard KS. 2021	Asthma-inducing potential of 28 substances in spray cleaning products-Assessed by quantitative structure activity relationship (QSAR) testing and literature review.	J Appl Toxicol. 2021 Jul 11. doi:10.1002/jat.4215. Epub ahead of print. PMID: 34247391.	0
4	Kumar V, Guleria P. 2020	Application of DNA-Nanosensor for Environmental Monitoring: Recent Advances and Perspectives.	Curr Pollut Rep. 2020 Dec 12:1-21. doi: 10.1007/s40726-020-00165-1. Epub ahead of print. PMID: 33344145; PMCID: PMC7732738.	0
5	Hameed A, Mehmood MA, Shahid M, Fatma S, Khan A, Ali S. 2020	Prospects for potato genome editing to engineer resistance against viruses and cold-induced sweetening.	GM Crops Food. 2020 Oct 1;11(4):185-205. doi: 10.1080/21645698.2019.1631115. Epub 2019 Jul 6. PMID: 31280681; PMCID: PMC7518746.	0
6	Leska A, Nowak A, Nowak I, Górczyńska A. 2021	Effects of Insecticides and Microbiological Contaminants on *Apis mellifera*.	Health. Molecules. 2021 Aug 22;26(16):5080. doi: 10.3390/molecules26165080. PMID: 34443668; PMCID: PMC8398688	0
7	Madzak C. 2021	*Yarrowia lipolytica* Strains and Their Biotechnological Applications: How Natural Biodiversity and Metabolic Engineering Could Contribute to Cell Factories Improvement.	J Fungi (Basel). 2021 Jul 10;7(7):548. doi: 10.3390/jof7070548. PMID: 34356927; PMCID: PMC8307478.	0
8	Menz J, Modrzejewski D, Hartung F, Wilhelm R, Sprink T. 2020	Genome Edited Crops Touch the Market: A View on the Global Development and Regulatory Environment.	Front Plant Sci. 2020 Oct 9;11:586027. doi: 10.3389/fpls.2020.586027. PMID:33163013; PMCID: PMC7581933.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
9	Mushtaq M, Ahmad Dar A, Skalicky M, Tyagi A, Bhagat N, Basu U, Bhat BA, Zaid A, Ali S, Dar TU, Rai GK, Wani SH, Habib-Ur-Rahman M, Hejnak V, Vachova P, Brestic M, Çığ A, Çığ F, Erman M, El Sabagh A. 2021	CRISPR-Based Genome Editing Tools: Insights into Technological Breakthroughs and Future Challenges.	Genes (Basel). 2021 May 24;12(6):797. doi: 10.3390/genes12060797. PMID: 34073848; PMCID: PMC8225059.	0
10	Okoli AS, Blix T, Myhr AI, Xu W, Xu X. 2021	Sustainable use of CRISPR/Cas in fish aquaculture: the biosafety perspective.	Transgenic Res. 2021 Jul 25. doi:10.1007/s11248-021-00274-7. Epub ahead of print. PMID: 34304349.	0
11	Teferra TF. 2021	Should we still worry about the safety of GMO foods? Why and why not? A review.	Food Sci Nutr. 2021 Jul 27;9(9):5324-5331. doi: 10.1002/fsn3.2499. PMID: 34532037; PMCID: PMC8441473.	0
12	Turnbull C, Lillemo M, Hvoslef-Eide TAK. 2021	Global Regulation of Genetically Modified Crops Amid the Gene Edited Crop Boom - A Review. .	Front Plant Sci. 2021 Feb 24;12:630396. doi: 10.3389/fpls.2021.630396. PMID: 33719302; PMCID: PMC7943453	0
13	Woźniak E, Tyczewska A, Twardowski T. 2021	A Shift Towards Biotechnology: Social Opinion in the EU.	Trends Biotechnol. 2021 Mar;39(3):214-218. doi: 10.1016/j.tibtech.2020.08.001. Epub 2020 Sep 4. PMID: 32896439.	0
14	Zhang Y, Restall J, Crisp P, Godwin I, Liu G. 2021	Current status and prospects of plant genome editing in Australia.	In Vitro Cell Dev Biol Plant. 2021 May 24:1-10. doi: 10.1007/s11627-021-10188-y. Epub ahead of print. PMID: 34054265; PMCID: PMC8143062.	0

5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS

The database searches (Section 3) identified a total of 1090 references, which were reduced to 876 after removal of duplicates (Table 4). No additional studies were identified in the manual searches (Section 4).

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

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

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

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

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

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

5.2. Detailed assessment of eligible references (Stage 2)

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

Table 7 gives an overview of the reference selection process and results of the detailed assessment.

Table 7: Results of the publication selection process

Total number of publications retrieved after all searches of the scientific literature (excluding duplicates)	876
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	872
Total number of full-text documents assessed in detail	4
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	3
Total number of unobtainable/unclear publications	0
Total number of relevant publications	1

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

Table 8: Report of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s)

Main category of information/data requirement	Study (Author(s) and year)	Title	Source
Food and Feed Safety	Mao Deqian, Wang Yanping, Wang Qian, Du Kehe, Hu Yichun, Li Min, Yang Xiaoguang, Yang Lichen (2020)	Digestive stability in simulated gastric fluid of EPSPS protein and PAT protein	Weisheng Yanjiu (2020), 49(3), 114-118 CODEN: WEYAEM; ISSN: 1000-8020 URL: https://wsyj.cbpt.cnki.net/

Table 9: Report of publications excluded from the risk assessment after detailed assessment of full-text documents

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Naegeli Hanspeter, Bresson Jean-Louis, Dalmay Tamas, Dewhurst Ian Crawford, Epstein Michelle M., Firbank Leslie George, Guerche Philippe, Hejatko Jan, Moreno Francisco Javier, Mullins Ewen, Nogue Fabien, Rostoks Nils, Sanchez Serrano Jose Juan, Savoini Giovanni, Veromann Eve, Veronesi Fabio, Ardizzone Michele, Lanzoni Anna, Paraskevopoulos Konstantinos (2020)	Statement complementing the EFSA Scientific Opinion on application (EFSA-GMO-NL-2009-75) for placing on the market of genetically modified oilseed rape Ms8 × Rf3 × GT73 and subcombinations, which have not been authorised previously (i.e. Ms8 × GT73 and Rf3 × GT73) independently of their origin, for food and feed uses, import and processing, with the exception of isolated seed protein for food, under Regulation (EC) No 1829/2003, taking into consideration additional information	EFSA Journal (2020), 18(7), e06200 CODEN: EJFOA6; ISSN: 1831-4732	EFSA publication on the safety assessment of oilseed rape MS8 x RF3 x GT73 and subcombinations MS8 x GT73 and RF3 x GT73. The publication is not related to MS8, RF3, or MS8 x RF3 *B. napus*

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Naegeli Hanspeter, Bresson Jean-Louis, Dalmay Tamas, Dewhurst Ian Crawford, Epstein Michelle M., Firbank Leslie George, Guerche Philippe, Hejatko Jan, Moreno Francisco Javier, Mullins Ewen, Nogue Fabien, Rostoks Nils, Sanchez Serrano Jose Juan, Savoini Giovanni, Veromann Eve, Veronesi Fabio, Alvarez Fernando, Ardizzone Michele, De Sanctis Giacomo, Devos Yann, Fernandez-Dumont Antonio, Gennaro Andrea, Gomez Ruiz Jose Angel, Lanzoni Anna, Neri Franco Maria, Papadopoulou Nikoletta, Paraskevopoulos Konstantinos (2020)	Assessment of genetically modified oilseed rape MS11 for food and feed uses, import and processing, under Regulation (EC) No 1829/2003 (application EFSA-GMO -BE-2016-138)	EFSA Journal (2020), 18(5), e06112 CODEN: EJFOA6; ISSN: 1831-4732	The publication is describing the EFSA safety assessment of oilseed rape MS11 and is not related to MS8, RF3, or MS8 x RF3 *B. napus*
Kim Il Ryong, Lim Hye Song, Choi Wonkyun, Kang Da In, Lee Sang Yeol, Lee Jung Ro (2020)	Monitoring living modified canola using an efficient multiplex PCR assay in natural environments in South Korea	Applied Sciences (2020), 10(21), 7721 CODEN: ASPCC7; ISSN: 2076-3417 URL: http://www.mdpi.com/journal/applsci/	The authors have established a multiplex PCR method to detect seven single GM canola events that would cover the 15 approved GM canola events in South Korea. The publication is not relevant to the environmental risk assessment of MS8, RF3 or MS8 x RF3 *B. napus*.

Table 10: Report of unobtainable/unclear publications

Study (Author(s) and year)	Title	Source	Description of (unsuccessful) methods used to try and obtain a copy of the publication
No publications in this category.			

Table 11: Summary report for all relevant publications retrieved after detailed assessment of full-text documents for relevance and report of the reliability and implications for the risk assessment: 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	Summary of reliability appraisal	Implications for risk assessment
Food and Feed Safety	Mao Deqian, Wang Yanping, Wang Qian, Du Kehe, Hu Yichun, Li Min, Yang Xiaoguang, Yang Lichen (2020)	PAT/*bar*	None	Not applicable	Not assignable	The publication confirms rapid digestion of the PAT/*bar* protein in simulated gastric fluid and thereby supports the safety of MS8, RF3 and MS8 x RF3 *B. napus*.

6. NARRATIVE SYNTHESIS/SUMMARY OF RELEVANT STUDIES

A total of four publications were selected during Stage 1 evaluation (rapid assessment based on title and abstract). After Stage 2 evaluation (detailed review based on full text), it was determined that 1 publication was relevant for the safety assessment of the MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins PAT/*bar*, Barnase and Barstar.

In the publication identified as relevant, Mao *et al.* 2020, the degradation of the PAT/*bar* protein in simulated gastric fluid at different digestion time points was analysed. The results indicate that the PAT/*bar* protein is rapidly digested in simulated gastric fluid. The data and knowledge generated from this study confirm the safety of MS8, RF3 or MS8 x RF3 *B. napus*.

Table 11 lists the relevant publication along with a summary of any adverse effects reported and the reliability of the publications.

7. CONCLUSION

The literature searches performed for MS8, RF3 and MS8 x RF3 *B. napus* and their newly expressed proteins, PAT/*bar*, Barnase and Barstar, for the period from October 1, 2020 to September 30, 2021, identified a total of 876 unique publications (after duplicate removal). A total of four publications were progressed for detailed assessment after excluding 872 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract).

The four publications that progressed to Stage 2 were evaluated in detail, based on full text, for potential relevance, following the pre-established criteria listed in Table 1. One relevant reference with bearing on molecular characterization, human and animal safety, or environmental safety was identified. The data and knowledge generated from this study does not impact the safety assessment of MS8, RF3 or MS8 x RF3 *B. napus*. 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	Agriculture Online Access is a bibliographic database containing selected worldwide literature of agriculture and related fields. AGRICOLA is the locator and bibliographic access and control system of the National Agricultural Library (NAL) collections and also includes records from other cooperating institutions. Coverage of the database includes agricultural economics and rural sociology, agricultural production, animal sciences, chemistry, entomology, food and human nutrition, forestry, natural resources, pesticides, plant science, soils and fertilizers, and water resources. Also covered are related areas such as biology and biotechnology, botany, ecology, and natural history. The database draws on bibliographies, serial articles, book chapters, monographs, computer files, serials, maps, audiovisuals, and reports. Bibliographic information, abstracts, geographic terms, controlled terms, and supplementary terms are searchable.
STN	BIOSIS	BIOSIS Previews® is the largest and most comprehensive life science database in the world. Amongst others subject coverage includes Agriculture, Biochemistry, Biophysics, Botany, Environmental Biology, Physiology, Toxicology. Sources include periodicals, journals, conference proceedings, reviews, reports, patents, and short communications. Nearly 6,000 life source journals, 1,500 international meetings as well as review articles, books, and monographs are reviewed for inclusion. Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are all searchable.
STN	CABA/CAB	The CAB Abstracts database covers worldwide literature from all areas of agriculture and related sciences including Agriculture, Agricultural chemicals, Animal sciences and production, Crop protection, Crop sciences and production, Environment, Soils and fertilizers. Sources for CABA include journals, books, reports, published theses, conference proceedings, and patents. Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are searchable.
STN	CAS-CA/CAPLUS	The Chemical Abstracts (CA) database covers all areas of Biochemistry, Chemistry and Chemical engineering, and related sciences. Sources include over 8,000 journals, patents from 38 national patent offices and two international patent organizations, technical reports, books, conference proceedings, and dissertations. Electronic only journals and Web preprints are also covered. Bibliographic terms, indexing terms, roles, CAS Registry Numbers, International Patent Classification, and abstracts are searchable.

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

Appendix 2: Search history

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     FILE 'MEDLINE' ENTERED AT 10:32:32 ON 26 OCT 2021
L1          309 SEA MS8 OR MS8X OR MS-8 OR MS-8X OR ACS(W)BN005-8 OR ACS(W)BNOO
                5-8 OR ACSBN005-8 OR ACSBNOO5-8 OR ACS(W)BN005-8X OR ACS(W)BNOO
                5-8X OR ACSBN005-8X OR ACSBNOO5-8X
L2          286 SEA RF3 OR XRF3 OR RF-3 OR XRF-3 OR ACS(W)BN003-6 OR ACS(W)BNOO
                3-6 OR ACSBN003-6 OR ACSBNOO3-6 OR XACS(W)BN003-6 OR XACS(W)BNO
                O3-6 OR XACSBNÃ˜Ã˜3-6 OR XACSBN003-6 OR XACSBNOO3-6
L3            7 SEA MS8XRF3 OR MS(W)8XRF-3 OR MS8(W)TIME#(W)RF3 OR ACS(W)BN005(
                W)8XACS-BN003-6 OR ACS(W)BNOO5(W)8XACS(W)BNOO3-6
L4          585 SEA L1 OR L2 OR L3
L5          166 SEA INVIGOR OR INVIGORR OR INVIGORTM OR IN(W)VIGOR OR IN(W)VIGO
                RR OR IN(W)VIGORTM OR IN(W)VIGORRTM
L6          625 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND
                ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887
L7          360 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468
L8         1464 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
L9          203 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L10        2307 SEA (L6 OR L7 OR L8 OR L9)
L11        3354 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
                PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR
                PROTECT?)
L12        9246 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE
                OR POLLINATION(W)CONTROL
L13       12558 SEA (L11 OR L12)
L14       23236 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA#
                OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA
L15     3822157 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3W)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?)) OR (STACKED(W)(GENE# OR TRAIT# OR EVENT#))
L16         405 SEA L13 AND L14 AND L15
L17        3430 SEA L4 OR L5 OR L10 OR L16
L18         415 SEA L17 AND PY>=2019
L19         239 SEA L18 AND UP>=20201001 AND UP<=20210930

     FILE 'BIOSIS' ENTERED AT 10:33:45 ON 26 OCT 2021
L20         327 SEA MS8 OR MS8X OR MS-8 OR MS-8X OR ACS(W)BN005-8 OR ACS(W)BNOO
                5-8 OR ACSBN005-8 OR ACSBNOO5-8 OR ACS(W)BN005-8X OR ACS(W)BNOO
                5-8X OR ACSBN005-8X OR ACSBNOO5-8X
L21         376 SEA RF3 OR XRF3 OR RF-3 OR XRF-3 OR ACS(W)BN003-6 OR ACS(W)BNOO
                3-6 OR ACSBN003-6 OR ACSBNOO3-6 OR XACS(W)BN003-6 OR XACS(W)BNO
                O3-6 OR XACSBNÃ˜Ã˜3-6 OR XACSBN003-6 OR XACSBNOO3-6
L22           6 SEA MS8XRF3 OR MS(W)8XRF-3 OR MS8(W)TIME#(W)RF3 OR ACS(W)BN005(
                W)8XACS-BN003-6 OR ACS(W)BNOO5(W)8XACS(W)BNOO3-6
L23         691 SEA L20 OR L21 OR L22
L24          59 SEA INVIGOR OR INVIGORR OR INVIGORTM OR IN(W)VIGOR OR IN(W)VIGO
                RR OR IN(W)VIGORTM OR IN(W)VIGORRTM
L25         752 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND
                ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887
L26         352 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468
L27        2842 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
L28         332 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L29        3800 SEA (L25 OR L26 OR L27 OR L28)
L30        9919 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
                PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR
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              PROTECT?)
L31       16319 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE
                OR POLLINATION(W)CONTROL
L32       26128 SEA (L30 OR L31)
L33       47300 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA#
                OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA
L34      445827 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3W)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?)) OR (STACKED(W)(GENE# OR TRAIT# OR EVENT#))
L35         456 SEA L32 AND L33 AND L34
L36        4935 SEA L23 OR L24 OR L29 OR L35
L37         378 SEA L36 AND PY>=2019
L38         171 SEA L37 AND UP>=20201001 AND UP<=20210930

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L39          94 SEA MS8 OR MS8X OR MS-8 OR MS-8X OR ACS(W)BN005-8 OR ACS(W)BNOO
                5-8 OR ACSBN005-8 OR ACSBNOO5-8 OR ACS(W)BN005-8X OR ACS(W)BNOO
                5-8X OR ACSBN005-8X OR ACSBNOO5-8X
L40         105 SEA RF3 OR XRF3 OR RF-3 OR XRF-3 OR ACS(W)BN003-6 OR ACS(W)BNOO
                3-6 OR ACSBN003-6 OR ACSBNOO3-6 OR XACS(W)BN003-6 OR XACS(W)BNO
                O3-6 OR XACSBNÃ˜Ã˜3-6 OR XACSBN003-6 OR XACSBNOO3-6
L41           3 SEA MS8XRF3 OR MS(W)8XRF-3 OR MS8(W)TIME#(W)RF3 OR ACS(W)BN005(
                W)8XACS-BN003-6 OR ACS(W)BNOO5(W)8XACS(W)BNOO3-6
L42         191 SEA L39 OR L40 OR L41
L43         128 SEA INVIGOR OR INVIGORR OR INVIGORTM OR IN(W)VIGOR OR IN(W)VIGO
                RR OR IN(W)VIGORTM OR IN(W)VIGORRTM
L44         103 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND
                ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887
L45          52 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468
L46         779 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
L47         252 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L48         976 SEA (L44 OR L45 OR L46 OR L47)
L49        8217 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
                PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR
                PROTECT?)
L50        7951 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE
                OR POLLINATION(W)CONTROL
L51       16101 SEA (L49 OR L50)
L52       27109 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA#
                OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA
L53      101526 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3W)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?)) OR (STACKED(W)(GENE# OR TRAIT# OR EVENT#))
L54         299 SEA L51 AND L52 AND L53
L55        1550 SEA L42 OR L43 OR L48 OR L54
L56         133 SEA L55 AND PY>=2019
L57          82 SEA L56 AND UP>=20201001 AND UP<=20210930

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                5-8 OR ACSBN005-8 OR ACSBNOO5-8 OR ACS(W)BN005-8X OR ACS(W)BNOO
                5-8X OR ACSBN005-8X OR ACSBNOO5-8X
L59         265 SEA RF3 OR XRF3 OR RF-3 OR XRF-3 OR ACS(W)BN003-6 OR ACS(W)BNOO
                3-6 OR ACSBN003-6 OR ACSBNOO3-6 OR XACS(W)BN003-6 OR XACS(W)BNO
                O3-6 OR XACSBNÃ˜Ã˜3-6 OR XACSBN003-6 OR XACSBNOO3-6
L60          17 SEA MS8XRF3 OR MS(W)8XRF-3 OR MS8(W)TIME#(W)RF3 OR ACS(W)BN005(
                W)8XACS-BN003-6 OR ACS(W)BNOO5(W)8XACS(W)BNOO3-6
L61         488 SEA L58 OR L59 OR L60
L62         260 SEA INVIGOR OR INVIGORR OR INVIGORTM OR IN(W)VIGOR OR IN(W)VIGO
                RR OR IN(W)VIGORTM OR IN(W)VIGORRTM
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L63         148 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND
                ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887
L64          64 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468
L65        1541 SEA ((BAR OR PAT)(2A)(GENE# OR PROTEIN# OR ENZYME#)) OR
                PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR
                PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE
L66         378 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L67        1774 SEA (L63 OR L64 OR L65 OR L66)
L68       18346 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
                PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR
                PROTECT?)
L69       24538 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE
                OR POLLINATION(W)CONTROL
L70       42674 SEA (L68 OR L69)
L71       71221 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA#
                OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA
L72      181148 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3W)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?)) OR (STACKED(W)(GENE# OR TRAIT# OR EVENT#))
L73         726 SEA L70 AND L71 AND L72
L74        3152 SEA L61 OR L62 OR L67 OR L73
L75         246 SEA L74 AND PY>=2019
L76         131 SEA L75 AND UP>=20201001 AND UP<=20210930
L77         131 SEA L76 NOT P/DT
L78           0 SEA L76 AND (P/DT AND J/DT)
L79         131 SEA L77 OR L78

     FILE 'HCAPLUS' ENTERED AT 10:36:56 ON 26 OCT 2021
L80         395 SEA MS8 OR MS8X OR MS-8 OR MS-8X OR ACS(W)BN005-8 OR ACS(W)BNOO
                5-8 OR ACSBN005-8 OR ACSBNOO5-8 OR ACS(W)BN005-8X OR ACS(W)BNOO
                5-8X OR ACSBN005-8X OR ACSBNOO5-8X
L81        1107 SEA RF3 OR XRF3 OR RF-3 OR XRF-3 OR ACS(W)BN003-6 OR ACS(W)BNOO
                3-6 OR ACSBN003-6 OR ACSBNOO3-6 OR XACS(W)BN003-6 OR XACS(W)BNO
                O3-6 OR XACSBNÃ˜Ã˜3-6 OR XACSBN003-6 OR XACSBNOO3-6
L82          13 SEA MS8XRF3 OR MS(W)8XRF-3 OR MS8(W)TIME#(W)RF3 OR ACS(W)BN005(
                W)8XACS-BN003-6 OR ACS(W)BNOO5(W)8XACS(W)BNOO3-6
L83        1475 SEA L80 OR L81 OR L82
L84           9 SEA INVIGOR OR INVIGORR OR INVIGORTM OR IN(W)VIGOR OR IN(W)VIGO
                RR OR IN(W)VIGORTM OR IN(W)VIGORRTM
L85        1266 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND
                ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887
L86         624 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468
L87        5215 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
L88         783 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
                N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
                ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L89        6910 SEA (L85 OR L86 OR L87 OR L88)
L90       28025 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
                PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR
                PROTECT?)
L91       24224 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE
                OR POLLINATION(W)CONTROL
L92       41106 SEA (L90 OR L91)
L93      107143 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA#
                OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA
L94      622541 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3W)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?)) OR (STACKED(W)(GENE# OR TRAIT# OR EVENT#))
L95        1268 SEA L92 AND L93 AND L94
L96        9464 SEA L83 OR L84 OR L89 OR L95
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L97         1516 SEA L96 AND PY>=2019
L98          610 SEA L97 AND UP>=20201001 AND UP<=20210930
L99          467 SEA L98 NOT P/DT
L100           0 SEA L98 AND (P/DT AND J/DT)
L101         467 SEA L99 OR L100

     FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 10:38:07 ON 26
     OCT 2021
L102         876 DUP REM L19 L38 L57 L79 L101 (214 DUPLICATES REMOVED)
                     ANSWERS '1-239' FROM FILE MEDLINE
                     ANSWERS '240-357' FROM FILE BIOSIS
                     ANSWERS '358-427' FROM FILE AGRICOLA
                     ANSWERS '428-514' FROM FILE CABA
                     ANSWERS '515-876' FROM FILE HCAPLUS
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