

Title

**Summary of the Literature Review for
MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *Brassica napus*
August 17, 2021 – June 30, 2022**

Final Report

Data or guideline requirement

Explanatory note on literature searching
conducted in the context of GMO applications for (renewed) market authorization
and annual post-market environmental monitoring reports on GMOs authorised in the EU market.
EFSA supporting publications 2019:EN-1614

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<p>Report</p>	<p>██████████ ██████████ ██████████ ██████████ ██████████ ██████████</p>

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SUMMARY

MS8 x RF3 x GT73 is a genetically modified (GM) *Brassica napus* (*B. napus*) stacked trait product designed to provide tolerance to glyphosate and glufosinate herbicides. MS8 x RF3 x GT73 *B. napus* was obtained by traditional breeding of MS8, RF3 and GT73. MS8 *B. napus* contains the *barnase* gene (origin *Bacillus amyloliquefaciens*) coding for the Barnase protein, conferring male sterility. RF3 *B. napus* contains the *barstar* gene (origin *Bacillus amyloliquefaciens*) coding for the Barstar protein, an inhibitor of Barnase. Both MS8 and RF3 contain the *bar* gene (origin *Streptomyces hygroscopicus*) coding for the phosphinothricin acetyl transferase (PAT/*bar*) protein conferring tolerance to glufosinate-ammonium. GT73 *B. napus* contains the *goxv247* gene (origin *Ochrobactrum anthropi* strain LBAA) coding for the glyphosate oxidoreductase (GOXv247) protein and the *cp4 epsps* gene (origin *Agrobacterium* sp. strain CP4) coding for the 5-enolpyruvylshikimate-3-phosphate synthase (CP4 EPSPS) protein. Together, these 2 proteins are responsible for conferring tolerance to glyphosate. The OECD identifier for this product is ACS-BNØØ5-8 x ACS-BNØØ3-6 x MON-ØØØ73-7.

A scoping review was performed for MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus* and their newly expressed proteins, CP4 EPSPS, GOXv247, PAT/*bar*, Barnase and Barstar. The objective of this scoping review was to determine if there were studies about the molecular characterization of MS8 x RF3 x GT73, MS8 x GT73 or RF3 x GT73 *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 August 17, 2021 to June 30, 2022. Additional sources of information, such as web pages of food safety, agriculture, and biotechnology-related authorities were searched for the same time window, along with the bibliographies of relevant reviews. The references identified were evaluated for potential relevance to the scoping review questions according to pre-defined criteria.

These literature searches identified a total of 63 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of 4 publications were progressed for detailed assessment.

None of the 4 publications were determined to be relevant after detailed review. There was no new data on molecular characterization of MS8 x RF3 x GT73, MS8 x GT73 or RF3 x GT73 *B. napus*, or the CP4 EPSPS, GOXv247, PAT/*bar*, Barnase and Barstar proteins, that would 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 did not identify relevant publications regarding the safety assessment of MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus*.

1. INTRODUCTION

MS8 x RF3 x GT73 is a genetically modified (GM) *Brassica napus* (*B. napus*) stacked trait product designed to provide tolerance to glyphosate and glufosinate herbicides. MS8 x RF3 x GT73 *B. napus* was obtained by traditional breeding of MS8, RF3 and GT73. MS8 *B. napus* contains the *barnase* gene (origin *Bacillus amyloliquefaciens*) coding for the Barnase protein, conferring male sterility. RF3 *B. napus* contains the *barstar* gene (origin *Bacillus amyloliquefaciens*) coding for the Barstar protein, an inhibitor of Barnase. Both MS8 and RF3 contain the *bar* gene (origin *Streptomyces hygroscopicus*) coding for the phosphinothricin acetyl transferase (PAT/*bar*) protein conferring tolerance to glufosinate-ammonium. GT73 *B. napus* contains the *goxv247* gene (origin *Ochrobactrum anthropi* strain LBAA) coding for the glyphosate oxidoreductase (GOXv247) protein and the *cp4 epsps* gene (origin *Agrobacterium* sp. strain CP4) coding for the 5-enolpyruvylshikimate-3-phosphate synthase (CP4 EPSPS) protein. Together, these 2 proteins are responsible for conferring tolerance to glyphosate. The OECD identifier for this product is ACS-BNØØ5-8 x ACS-BNØØ3-6 x MON-ØØØ73-7.

The objective of the literature searches described here was to determine if there were studies published between August 17, 2021 and June 30, 2022 that mention the molecular characterization of the MS8 x RF3 x GT73, MS8 x GT73 or RF3 x GT73 *B. napus*, and/or any adverse effect of MS8 x RF3 x GT73, MS8 x GT73 or RF3 x GT73 *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 the MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus* and their newly expressed proteins, CP4 EPSPS, GOXv247, 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 the MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus* and their newly expressed proteins, CP4 EPSPS, GOXv247, 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 note¹.

Question 1: Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the MS8 x RF3 x GT73, MS8 x GT73 or RF3 x GT73 *B. napus* and their newly expressed proteins CP4 EPSPS, GOXv247, PAT/*bar*, Barnase and Barstar?

Key elements:

Population: Human health; animal health; environmental safety

Exposure: MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus*, derived food/feed products, newly expressed proteins in MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *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 the MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus* and its newly expressed proteins CP4 EPSPS, GOXv247, PAT/*bar*, Barnase and Barstar in *B. napus*?

Key elements:

Population: MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus* and newly expressed proteins in MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *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 note¹ and are described in [Table 1](#).

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

Concepts	Criteria	Comment
Key elements of review questions with PECO structure		
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 publication

Two publications related to MS8 x RF3 x GT73 *B. napus* were known before the start of the search and used to test and validate the search strategy:

- Naegeli, H.; Birch, A. N.; Casacuberta, J.; Schrijver, A. de; Gralak, M. A.; Guerche, P.; Jones, H.; Manachini, B.; Messean, A.; Nielsen, E. E.; Nogue, F.; Robaglia, C.; Rostoks, N.; Sweet, J.; Tebbe, C.; Visioli, F.; Wal, J. M.; 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
- Lv JinYang; Huang QianXin; Sun YanYan; Qu GaoPing; Guo Yuan; Zhang XiaoJuan; Zhao HuiXian; Hu ShengWu; Lv, J. Y.; Huang, Q. X.; Sun, Y. Y.; Qu, G. P.; Guo, Y.; Zhang, X. J.; Zhao, H. X.; Hu, S. W. (2018). Male sterility of an AHAS-mutant induced by tribenuron-methyl solution correlated with the decrease of AHAS activity in *Brassica napus*. *Frontiers in Plant Science* 9:62

Although none of these articles are directly relevant for MS8 x RF3 x GT73 *B. napus*, they were selected as reference publications because the first one mentions two of the event names (MS8 and RF3), the same traits (male sterility and herbicide tolerance) and the same crop (*B. napus*); while the second one mentions one of the intended traits (male sterility). Since these references were published before the current search period, the search profile was tested without applying the time limit used in the final search profile (UP>=20211001 and UP<=20220630).

3. SEARCH METHODS AND OUTCOMES

The search strategies used here followed the 2019 EFSA explanatory note on literature searching conducted in the context of GMO applications and post-market environmental monitoring activities¹. The search strategies were designed to be broad and sensitive enough to capture any relevant publications, if available.

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

3.1. Time window and date of the literature search

The database searches were performed on August 22, 2022. Only documents updated between August 17, 2021 and June 30, 2022, were considered in the search. The dates of most recent database updates are provided in [Table 3](#).

3.2. Databases used in the literature search

All searches were performed in the host STN (Scientific and Technical Information Network), an online database service operated jointly by CAS and FIZ Karlsruhe. STN provides access to a broad range of databases from the most renowned database producers worldwide.

The searches described here were performed in five databases: three multidisciplinary/large databases (Biosis, Medline and CA-Plus) and two subject-specific databases focused on agriculture-related topics (Agricola and CABA).

See [Appendix 1](#) for detailed database descriptions.

3.3. Search strategy

The search profile was designed to cover stack event name, stack trade names, stack newly expressed proteins and stack intended traits. Since the 'stack trade names' profile element identified too many documents when used on its own, it was combine with a 'crop' profile element.. The reference publication ([Section 2.4](#)) was identified by the search profiles, confirming the validity of the applied search strategy. See [Table 2](#) for a detailed search profile.

Table 2: Search profile for database search

Set	Search string	Concepts
1	MS8 or MS8x or ACS(w)BN005(w)8 or ACSBN005(w)8 or ACS(w)BN005(w)8x or ACSBN005(w)8x or ACSBN005 or ACSBN005x or BN005 or BN005x	Event name MS8
2	RF3 or xRF3 or RF3x or xRF3x or ACS(w)BN003(w)6 or xACS(w)BN003(w)6 or ACS(w)BN003(w)6x or xACS(w)BN003(w)6x or BN003 or xBN003 or BN003x or xBN003x	Event name RF3
3	GT73 or RT73 or MON(w)00073(w)7 or MON(w)00073(w)7 or xGT73 or xRT73 or xMON(w)00073(w)7 or xMON(w)00073(w)7	Event name GT73
4	MS8XRF3XGT73 or ACS(w)BN005(w)8xACS(w)BN003(w)6XGT73 or BN005xBN003xGT73	Event name stack

5	(1 and 2) or (1 and 3) or (2 and 3) or (1 and 2 and 3) or 4	Event name all
6	invigor or invigorrr or invigortm invigorrtm or in(w)vigor or in(w)vigorrr or in(w)vigortm or in(w)vigorrtm or Roundup?	Trade name all
7	barnase or RNase(w)Ba or (bacterial(w)RiboNuclease and ((Bacillus or b)(w)amyloliquefaciens)) or P00648 or IPR001887 or barstar or 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 s phosphinothricin(w)n(w)acetyltransferase or phosphinothricin(2w)acetyltransferase or phosphinothricin(2w)acetyl(w)transferase or phosphinothricinacetyl(w)transferase	Newly expressed proteins RS8
8	barstar or 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 s phosphinothricin(w)n(w)acetyltransferase or phosphinothricin(2w)acetyltransferase or phosphinothricin(2w)acetyl(w)transferase or phosphinothricinacetyl(w)transferase	Newly expressed proteins RF3
9	((CP4(w)EPSPS or aroA(w)CP4) or (EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYOLSHIKAMATE or ENOYLPYRUVYOLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE) or (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC or ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE) or (ENOL(W)PYRUVYOLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE) or (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)) (2A)(CP4 or aroA)) or (glyphosate(w)oxidase or GOX or GOXv247)	Newly expressed proteins GT73
10	(7 and 9) or (8 and 9) or (7 and 8 and 9)	Newly expressed proteins all
11	((herbicid? or bialaphos or basta or glufosinate or phosphinothricin or liberty)(5a)(resist? or toleran? or protect?)) and (male(3a)steril? or (fertil?(3a)restor?) or restor?(w)line or pollination(w)control) and ((herbicid? or GL!PHOSATE# or GL!FOSATE# OR G360 or g(w)360 or	Intended traits all

	roundup? or round(w)up?)(5a)(resist? or toleran? or protect?))	
12	((BRASSICA or B)(w)(napus or juncea)) OR RAPE? or CANOLA# OR OILSEED(w)RAPE OR oil(w)seed(w)rape or colza	Crop name
13	s 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#))	GM general
14	6 and (12 or 13)	Trade name all and (crop name or GM general)
14	11 and 12 and 13	Inteded traits all and crop name and GM general
15	5 or 14 or 10 or 14	Event name all OR (Trade name all and (crop name or GM general)) OR (Newly expressed proteins all) OR (Intended traits all and crop name and GM 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"	" <i>BRASSICA NAPUS</i> " 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 " <i>BRASSICA NAPUS</i> "	"GENETICALLY MODIFIED PLANTS"
Medline	None	None	"HERBICIDE RESISTANCE" No terms for male sterility	<i>BRASSICA NAPUS</i>	"PLANTS, GENETICALLY MODIFIED"

The search results were limited to documents updated between August 17, 2021 and June 30, 2022 (UP>=20210817 and UP<=20220630), and to non-patent documents (not P/DT). To ensure that documents with indexing errors where two document types (DTs) (one eligible and one ineligible) were attached to a single record were not missed, documents with both 'journal' and 'patent' as document type were also kept. These putative documents would be identified with (P/DT AND J/DT) in CABA and CAPlus.

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

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

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

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Database Provider	STN International				
Coverage	1970-present	1926-present	1973-present	1907-present	1946-present
Date of search	22 Aug 2022				
Datespan of the search	1 Oct 2021 – 30 Jun 2022				

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Latest database update	8 Aug 2022	17 Aug 2022	16 Aug 2022	21 Aug 2022	21 Aug 2022
Number of records retrieved	9	18	12	20	24
Number of records after duplicate removal	7	13	6	13	24
Number of relevant records after rapid assessment	0	0	2	1	1

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: August 17, 2021 to June 30, 2022) or refer to relevant records published during this time frame. Relevance of results were determined based on the criteria listed in [Table 1](#) and they were summarized in [Table 5](#).

All web pages searched were justified by their recommendation in the EFSA 2019 explanatory note¹. Of the 13 key organisations cited in the EFSA 2019 explanatory note¹, Environment and Climate Change Canada and Intersecretarial Commission on Biosafety of GMOs (CIBIOGEM) were excluded, since they are not involved in the risk assessment of GM plants. The US-EPA website was excluded, since MS8 x RF3 x GT73 *B. napus* does not contain an insect-resistant trait. The USDA, FDA, CFIA, Health Canada, FSANZ and MAFF websites were excluded, since these agencies do not regulate GM stacked products obtained by conventional breeding techniques. 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 have not regulated any GM products for canola. Therefore, the internet search was limited to 1 key organisation relevant for MS8 x RF3 x GT73 *B. napus*. Search terms consisted of MS8 x RF3 x GT73, ACS-BNØ05-8 x ACS-BNØ03-6 x MON-ØØØ73-7, CP4 EPSPS, 5-enolpyruvyl shikimate-3-phosphate synthase, GOXv247, GOX, glyphosate oxidoreductase, PAT/*bar*, Phosphinothricin, Barnase and Barstar (all searched singly, with no search limits applied).

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

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
Office of the Gene Technology Regulator (OGTR) Australia	http://www.ogtr.gov.au/	8/1/2022	8/29/2022	0

4.2. Manual searches of reference lists of recent review articles

Recent review articles as sources of reference lists to search for potentially relevant studies were identified via searches of PubMed.gov for general terms such as “GMO” or “GM crops” in the titles and abstracts. The search of PubMed.gov was also restricted to recent reviews published between August 17, 2021 and June 30, 2022. The resulting number of relevant studies found within the bibliographies of these review articles is given in [Table 6](#).

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

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
1	Ahmad A, Munawar N, Khan Z, Qusmani AT, Khan SH, Jamil A, Ashraf S, Ghouri MZ, Aslam S, Mubarik MS, Munir A, Sultan Q, Abd-Elsalam KA, Qari SH. 2021	An Outlook on Global Regulatory Landscape for Genome-Edited Crops	Int J Mol Sci. 2021 Oct 29;22(21):11753.	0
2	Halder K, Chaudhuri A, Abdin MZ, Majee M, Datta A. 2022	RNA Interference for Improving Disease Resistance in Plants and Its Relevance in This Clustered Regularly Interspaced Short Palindromic Repeats-Dominated Era in Terms of dsRNA-Based Biopesticides	Front Plant Sci. 2022 May 13;13:885128.	0
3	Kawall K. 2021	The Generic Risks and the Potential of SDN-1 Applications in Crop Plants	Plants (Basel). 2021 Oct 22;10(11):2259.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
4	Lafiandra D, Sestili F, Sissons M, Kiszonas A, Morris CF. 2022	Increasing the Versatility of Durum Wheat through Modifications of Protein and Starch Composition and Grain Hardness	Foods. 2022 May 24;11(11):1532.	0
5	Nagamine A, Ezura H. 2022	Genome Editing for Improving Crop Nutrition	Front Genome Ed. 2022 Feb 9;4:850104.	0
6	Niraula PM, Fondong VN. 2021	Development and Adoption of Genetically Engineered Plants for Virus Resistance: Advances, Opportunities and Challenges	Plants (Basel). 2021 Oct 29;10(11):2339.	0
7	Okoli AS, Blix T, Myhr AI, Xu W, Xu X. 2022	Sustainable use of CRISPR/Cas in fish aquaculture: the biosafety perspective	Transgenic Res. 2022 Feb;31(1):1-21.	0
8	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
9	Then C. 2022	Deficiencies in the Risk Assessment of Genetically Engineered Bt Cowpea Approved for Cultivation in Nigeria: A Critical Review	Plants (Basel). 2022 Jan 29;11(3):380.	0
10	Van Vu T. 2022	Genome editing and beyond: what does it mean for the future of plant breeding?	Planta. 2022 May 19;255(6):130.	0

5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS

The database searches ([Section 3](#)) identified a total of 83 references, which were reduced to 63 after removal of duplicates ([Table 4](#)). No additional studies were identified in the manual searches ([Section 4](#)).

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

All references identified in the database searches described in [Section 3](#) were assessed for relevance based on information in their title and abstract by two reviewers independently. If opinions of relevance

differed, the discrepancies were discussed between the reviewers and if a disagreement persisted, the publication under the discussion was transferred to Stage 2 for detailed evaluation by the experts. In this search, both evaluator were in 100 % agreement and therefore there was no need to resolve any disagreements about relevance.

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 tolerant GM crops, other insect resistant GM crops, unrelated topics, etc.

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

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

5.2. Detailed assessment of eligible references (Stage 2)

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

In the relevance assessment of the literature review for MS8 X RF3 X GT73 *B. napus*, reviewers agreed in 100% of the Stage 2 evaluations.

[Table 7](#) gives an overview of the reference selection process and results of the detailed assessment.

Table 7: Results of the publication selection process

Total number of publications retrieved after all searches of the scientific literature (excluding duplicates)	63
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	59
Total number of full-text documents assessed in detail	4
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	4
Total number of unobtainable/unclear publications	0
Total number of relevant publications	0

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

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

Main category of information/data requirement	Study (Author(s) and year)	Title	Source
No publications in this category.			

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

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Mackie, S. J. W. (2021)	Comparison of RF3 <i>B. juncea</i> to RF3 <i>B. napus</i> .	Food and Nutrition Sciences (2021), Volume 12, Number 11, pp. 1041-1061, 40 refs. ISSN: 2157-944X; 2157-9458 DOI: https://doi.org/10.4236/fns.2021.1211077 Published by: Scientific Research Publishing, Irvine	The MS8 x GT73, RF3 x GT73, and MS8 x RF3 x GT73 events are not considered.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Mazur M., Sieradzki Z., Krol B., Kwiatek K. (2022)	Analysis of feed in terms of the presence of genetically modified oilseed rape .	Medycyna Weterynaryjna (2022), Volume 78, Number 2, pp. 95-97, 12 refs. ISSN: 0025-8628 DOI: https://doi.org/10.21521/mw.6604 Published by: Polskie Towarzystwo Nauk Weterynaryjnych, Lublin	The paper evaluated the presence of genetically modified rape in feed used in feeding farm animals in Poland. The MS8 x GT73, RF3 x GT73, and MS8 x RF3 x GT73 events are not considered.
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 MS8 x GT73, RF3 x GT73, and MS8 x RF3 x GT73 events are not considered.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Jezierska-Tys Stefania, Joniec Jolanta, Bednarz Joanna, Mocek-Plociniak Agnieszka, GalAzka Anna, Furtak Karolina (2021)	Microbial activity and community level physiological profiles (CLPP) of soil under the cultivation of spring rape with the Roundup 360 SL herbicide.	Journal of environmental health science + engineering, (2021 Dec) Vol. 19, No. 2, pp. 2013-2026. Electronic Publication Date: 12 Nov 2021 Journal code: 101613643. ISSN: 2052-336X. Report No.: PMC-PMC8638805.	The authors conduct a comprehensive assessment of the condition of soils treated with glyphosate. The authors concluded that cultivation of specific plant varieties may reduce the negative effect of herbicides. The MS8 x GT73, RF3 x GT73, and MS8 x RF3 x GT73 events are not considered.

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 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	Implications for risk assessment
No publications in this category.					

6. NARRATIVE SYNTHESIS/SUMMARY OF RELEVANT STUDIES

A total of 4 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 publications were relevant for the safety assessment of the MS8 x RF3 x GT73, MS8 x GT73 or RF3 x GT73 *B. napus* and their newly expressed proteins CP4 EPSPS, GOXv247, PAT/*bar*, Barnase and Barstar.

7. CONCLUSION

The literature searches performed for MS8 x RF3 x GT73, MS8 x GT73 and RF3 x GT73 *B. napus* and their newly expressed proteins, CP4 EPSPS, GOXv247, PAT/*bar*, Barnase and Barstar, for the period from August 17, 2021 to June 30, 2022, identified a total of 63 unique publications (after duplicate removal). A total of 4 publications were progressed for detailed assessment after excluding 59 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract).

The 4 publications that progressed to Stage 2 were evaluated in detail, based on full text, for potential relevance, following the pre-established criteria listed in [Table 1](#). No relevant references with bearing on molecular characterization, human and animal safety, or environmental safety were identified. No issues or topics were identified that would trigger or warrant more specific question formulation.

8. REFERENCES

No.	Author(s), title, source, edition, year, pages
-----	------------------------------------------------

- | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Devos Y, Guajardo IM, Alvarez F and Glanville J. Explanatory note on literature searching conducted in the context of GMO applications for (renewed) market authorisation and annual post-market environmental monitoring reports on GMOs authorised in the EU market. EFSA supporting publications 2019:EN-1614. 62 pages. doi:10.2903/sp.efsa.2019.EN-1614. |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

9. APPENDICES

Appendix 1: Database descriptions

Host	File	Description
STN	AGRICOLA	<p>Agriculture Online Access is a bibliographic database containing selected worldwide literature of agriculture and related fields. AGRICOLA is the locator and bibliographic access and control system of the National Agricultural Library (NAL) collections and also includes records from other cooperating institutions. Coverage of the database includes agricultural economics and rural sociology, agricultural production, animal sciences, chemistry, entomology, food and human nutrition, forestry, natural resources, pesticides, plant science, soils and fertilizers, and water resources. Also covered are related areas such as biology and biotechnology, botany, ecology, and natural history.</p> <p>The database draws on bibliographies, serial articles, book chapters, monographs, computer files, serials, maps, audiovisuals, and reports. Bibliographic information, abstracts, geographic terms, controlled terms, and supplementary terms are searchable.</p>
STN	BIOSIS	<p>BIOSIS Previews® is the largest and most comprehensive life science database in the world. Amongst others subject coverage includes Agriculture, Biochemistry, Biophysics, Botany, Environmental Biology, Physiology, Toxicology.</p> <p>Sources include periodicals, journals, conference proceedings, reviews, reports, patents, and short communications. Nearly 6,000 life source journals, 1,500 international meetings as well as review articles, books, and monographs are reviewed for inclusion.</p> <p>Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are all searchable.</p>
STN	CABA/CAB	<p>The CAB Abstracts database covers worldwide literature from all areas of agriculture and related sciences including Agriculture, Agricultural chemicals, Animal sciences and production, Crop protection, Crop sciences and production, Environment, Soils and fertilizers.</p> <p>Sources for CABA include journals, books, reports, published theses, conference proceedings, and patents.</p> <p>Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are searchable.</p>
STN	CAS-CA/CAPLUS	<p>The Chemical Abstracts (CA) database covers all areas of Biochemistry, Chemistry and Chemical engineering, and related sciences.</p> <p>Sources include over 8,000 journals, patents from 38 national patent offices and two international patent organizations, technical reports, books, conference proceedings, and dissertations. Electronic only journals and Web preprints are also covered.</p> <p>Bibliographic terms, indexing terms, roles, CAS Registry Numbers, International Patent Classification, and abstracts are searchable.</p>

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

Appendix 2: Search history

FILE 'MEDLINE' ENTERED AT 17:01:53 ON 22 AUG 2022
CHARGED TO COST=88866696

L1 81 SEA MS8 OR MS8X OR ACS(W)BN005(W)8 OR ACSBN005(W)8 OR ACS(W)BN005(W)8X OR ACSBN005(W)8X OR ACSBN005 OR ACSBN005X OR BN005 OR BN005X

L2 177 SEA RF3 OR XRF3 OR RF3X OR XRF3X OR ACS(W)BN003(W)6 OR XACS(W)BN003(W)6 OR ACS(W)BN003(W)6X OR XACS(W)BN003(W)6X OR BN003 OR XBN003 OR BN003X OR XBN003X

L3 32 SEA GT73 OR RT73 OR MON(W)00073(W)7 OR MON(W)00073(W)7 OR XGT73 OR XRT73 OR XMON(W)00073(W)7 OR XMON(W)00073(W)7

L4 0 SEA MS8XRF3XGT73 OR ACS(W)BN005(W)8XACS(W)BN003(W)6XGT73 OR BN005XBN003XGT73

L5 13 SEA (L1 AND L2) OR (L2 AND L3) OR (L1 AND L3) OR (L1 AND L2 AND L3) OR L4

L6 167 SEA INVIGOR OR INVIGORR OR INVIGORTM INVIGORRTM OR IN(W)VIGOR OR IN(W)VIGORR OR IN(W)VIGORTM OR IN(W)VIGORRTM

L7 1375 SEA ROUNDUP?

L8 1540 SEA L6 OR L7

L9 640 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887

L10 367 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468

L11 1524 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

L12 204 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L13 1598 SEA (L11 OR L12)

L14 125 SEA CP4(W)EPSPS OR AROA(W)CP4

L15 4282 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L16 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L17 402 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L18 504 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L19 973 SEA CP4 OR AROA

L20 160 SEA L14 OR ((L15 OR L16 OR L17 OR L18))(2A)L19)

L21 2237 SEA GLYPHOSATE(W)OXIDASE OR GOX OR GOXV247

L22 1963 SEA L10 OR L13

L23 2382 SEA L9 OR L10 OR L13

L24 2395 SEA L20 OR L21

L25 4 SEA (L22 AND L24) OR (L23 AND L24) OR (L22 AND L23 AND L24)

L26 3589 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L27 9623 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINER OR POLLINATION(W)CONTROL

L28 3771 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L29 3313 SEA (L26 OR L27) AND L28

L30 24442 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA# OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA

L31 4024411 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#))

L32 403 SEA L8 AND (L30 OR L31)
L33 188 SEA L29 AND L30 AND L31
L34 595 SEA L5 OR L25 OR L32 OR L33
L35 62 SEA L34 AND PY>=2020
L36 24 SEA L35 AND UP>=20210817 AND UP<=20220630

FILE 'BIOSIS' ENTERED AT 17:02:07 ON 22 AUG 2022
CHARGED TO COST=88866696

L37 118 SEA MS8 OR MS8X OR ACS(W)BN005(W)8 OR ACSBN005(W)8 OR ACS(W)BN005(W)8X OR ACSBN005(W)8X OR ACSBN005 OR ACSBN005X OR BN005 OR BN005X

L38 275 SEA RF3 OR XRF3 OR RF3X OR XRF3X OR ACS(W)BN003(W)6 OR XACS(W)BN003(W)6 OR ACS(W)BN003(W)6X OR XACS(W)BN003(W)6X OR BN003 OR XBN003 OR BN003X OR XBN003X

L39 52 SEA GT73 OR RT73 OR MON(W)00073(W)7 OR MON(W)00073(W)7 OR XGT73 OR XRT73 OR XMON(W)00073(W)7 OR XMON(W)00073(W)7

L40 0 SEA MS8XRF3XGT73 OR ACS(W)BN005(W)8XACS(W)BN003(W)6XGT73 OR BN005XBN003XGT73

L41 19 SEA (L37 AND L38) OR (L38 AND L39) OR (L37 AND L39) OR (L37 AND L38 AND L39) OR L40

L42 60 SEA INVIGOR OR INVIGORR OR INVIGORTM INVIGORRTM OR IN(W)VIGOR OR IN(W)VIGORR OR IN(W)VIGORTM OR IN(W)VIGORRTM

L43 1792 SEA ROUNDUP?
L44 1850 SEA L42 OR L43
L45 760 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND ((BACILLUS OR B)(W)AMYLOLIQUFACIENS)) OR P00648 OR IPR001887

L46 354 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468

L47 2905 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

L48 334 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L49 3009 SEA (L47 OR L48)
L50 195 SEA CP4(W)EPSPS OR AROA(W)CP4
L51 5113 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV OYLSHIKAMATE OR ENOYLPYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L52 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUV OYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L53 746 SEA (ENOL(W)PYRUV OYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUV OYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L54 28 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUV OYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L55 1350 SEA CP4 OR AROA
L56 247 SEA L50 OR ((L51 OR L52 OR L53 OR L54))(2A)L55)
L57 1512 SEA GLYPHOSATE(W)OXIDASE OR GOX OR GOXV247
L58 3357 SEA L46 OR L49
L59 3873 SEA L45 OR L46 OR L49
L60 1753 SEA L56 OR L57
L61 25 SEA (L58 AND L60) OR (L59 AND L60) OR (L58 AND L59 AND L60)
L62 10286 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L63 16717 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE OR POLLINATION(W)CONTROL

L64 11502 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360

OR ROUNDUP? OR ROUND(W)UP?)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L65 9871 SEA (L62 OR L63) AND L64

L66 48810 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA# OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA

L67 458484 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#))

L68 612 SEA L44 AND (L66 OR L67)

L69 360 SEA L65 AND L66 AND L67

L70 991 SEA L41 OR L61 OR L68 OR L69

L71 43 SEA L70 AND PY>=2020

L72 18 SEA L71 AND UP>=20210817 AND UP<=20220630

FILE 'AGRICOLA' ENTERED AT 17:02:21 ON 22 AUG 2022

CHARGED TO COST=88866696

L73 51 SEA MS8 OR MS8X OR ACS(W)BN005(W)8 OR ACSBN005(W)8 OR ACS(W)BN005(W)8X OR ACSBN005(W)8X OR ACSBN005 OR ACSBN005X OR BN005 OR BN005X

L74 85 SEA RF3 OR XRF3 OR RF3X OR XRF3X OR ACS(W)BN003(W)6 OR XACS(W)BN003(W)6 OR ACS(W)BN003(W)6X OR XACS(W)BN003(W)6X OR BN003 OR XBN003 OR BN003X OR XBN003X

L75 28 SEA GT73 OR RT73 OR MON(W)00073(W)7 OR MON(W)00073(W)7 OR XGT73 OR XRT73 OR XMON(W)00073(W)7 OR XMON(W)00073(W)7

L76 0 SEA MS8XRF3XGT73 OR ACS(W)BN005(W)8XACS(W)BN003(W)6XGT73 OR BN005XBN003XGT73

L77 11 SEA (L73 AND L74) OR (L74 AND L75) OR (L73 AND L75) OR (L73 AND L74 AND L75) OR L76

L78 136 SEA INVIGOR OR INVIGORR OR INVIGORTM INVIGORRTM OR IN(W)VIGOR OR IN(W)VIGORR OR IN(W)VIGORTM OR IN(W)VIGORRTM

L79 1374 SEA ROUNDUP?

L80 1510 SEA L78 OR L79

L81 114 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND ((BACILLUS OR B)(W)AMYLLOLIQUEFACIENS)) OR P00648 OR IPR001887

L82 57 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468

L83 815 SEA ((BAR OR PAT)(2A)(GENE# OR PROTEIN# OR ENZYME#)) OR PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE

L84 255 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L85 896 SEA (L83 OR L84)

L86 122 SEA CP4(W)EPSPS OR AROA(W)CP4

L87 727 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKIMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L88 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L89 333 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L90 265 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L91 435 SEA CP4 OR AROA

L92 144 SEA L86 OR (((L87 OR L88 OR L89 OR L90))(2A)L91)

L93 1212 SEA GLYPHOSATE(W)OXIDASE OR GOX OR GOXV247

L94 953 SEA L82 OR L85

L95 1026 SEA L81 OR L82 OR L85

L96 1355 SEA L92 OR L93

L97 11 SEA (L94 AND L96) OR (L95 AND L96) OR (L94 AND L95 AND L96)

L98 8711 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L99 8473 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE OR POLLINATION(W)CONTROL

L100 9209 SEA (HERBICID? OR GL!PHOSATE# OR GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L101 8527 SEA (L98 OR L99) AND L100

L102 29097 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA# OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA

L103 108804 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#))

L104 438 SEA L80 AND (L102 OR L103)

L105 246 SEA L101 AND L102 AND L103

L106 693 SEA L77 OR L97 OR L104 OR L105

L107 27 SEA L106 AND PY>=2020

L108 9 SEA L107 AND UP>=20210817 AND UP<=20220630

FILE 'CABA' ENTERED AT 11:02:39 ON 22 AUG 2022

CHARGED TO COST=88866696

L109 132 SEA MS8 OR MS8X OR ACS(W)BN005(W)8 OR ACSBN005(W)8 OR ACS(W)BN005(W)8X OR ACSBN005(W)8X OR ACSBN005 OR ACSBN005X OR BN005 OR BN005X

L110 221 SEA RF3 OR XRF3 OR RF3X OR XRF3X OR ACS(W)BN003(W)6 OR XACS(W)BN003(W)6 OR ACS(W)BN003(W)6X OR XACS(W)BN003(W)6X OR BN003 OR XBN003 OR BN003X OR XBN003X

L111 57 SEA GT73 OR RT73 OR MON(W)00073(W)7 OR MON(W)00073(W)7 OR XGT73 OR XRT73 OR XMON(W)00073(W)7 OR XMON(W)00073(W)7

L112 0 SEA MS8XRF3XGT73 OR ACS(W)BN005(W)8XACS(W)BN003(W)6XGT73 OR BN005XBN003XGT73

L113 29 SEA (L109 AND L110) OR (L110 AND L111) OR (L109 AND L111) OR (L109 AND L110 AND L111) OR L112

L114 277 SEA INVIGOR OR INVIGORR OR INVIGORTM INVIGORRTM OR IN(W)VIGOR OR IN(W)VIGORR OR IN(W)VIGORTM OR IN(W)VIGORRTM

L115 3195 SEA ROUNDUP?

L116 3468 SEA L114 OR L115

L117 155 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887

L118 68 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468

L119 1587 SEA ((BAR OR PAT)(2A)(GENE# OR PROTEIN# OR ENZYME#)) OR PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE

L120 381 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L121 1690 SEA (L119 OR L120)

L122 265 SEA CP4(W)EPSPS OR AOA(W)CP4

L123 1204 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKIMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L124 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L125 463 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L126 192 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L127 790 SEA CP4 OR AOA

L128 294 SEA L122 OR ((L123 OR L124 OR L125 OR L126))(2A)L127)
L129 411 SEA GLYPHOSATE(W)OXIDASE OR GOX OR GOXV247
L130 1750 SEA L118 OR L121
L131 1828 SEA L117 OR L118 OR L121
L132 697 SEA L128 OR L129
L133 28 SEA (L130 AND L132) OR (L131 AND L132) OR (L130 AND L131 AND L132)
L134 19074 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR PROTECT?)
L135 25130 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINE OR POLLINATION(W)CONTROL
L136 19855 SEA (HERBICID? OR GLYPHOSATE# OR GLUFOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(RESIST? OR TOLERAN? OR PROTECT?)
L137 18677 SEA (L134 OR L135) AND L136
L138 73800 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA# OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA
L139 190383 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#))
L140 852 SEA L116 AND (L138 OR L139)
L141 603 SEA L137 AND L138 AND L139
L142 1465 SEA L113 OR L133 OR L140 OR L141
L143 57 SEA L142 AND PY>=2020
L144 12 SEA L143 AND UP>=20210817 AND UP<=20220630
L145 12 SEA L144 NOT P/DT
L146 0 SEA L144 AND (P/DT AND J/DT)
L147 12 SEA (L145 OR L146)

FILE 'HCAPLUS' ENTERED AT 11:02:56 ON 22 AUG 2022
CHARGED TO COST=88866696
L148 149 SEA MS8 OR MS8X OR ACS(W)BN005(W)8 OR ACSBN005(W)8 OR ACS(W)BN005(W)8X OR ACSBN005(W)8X OR ACSBN005 OR ACSBN005X OR BN005 OR BN005X
L149 881 SEA RF3 OR XRF3 OR RF3X OR XRF3X OR ACS(W)BN003(W)6 OR XACS(W)BN003(W)6 OR ACS(W)BN003(W)6X OR XACS(W)BN003(W)6X OR BN003 OR XBN003 OR BN003X OR XBN003X
L150 83 SEA GT73 OR RT73 OR MON(W)00073(W)7 OR MON(W)00073(W)7 OR XGT73 OR XRT73 OR XMON(W)00073(W)7 OR XMON(W)00073(W)7
L151 0 SEA MS8XRF3XGT73 OR ACS(W)BN005(W)8XACS(W)BN003(W)6XGT73 OR BN005XBN003XGT73
L152 35 SEA (L148 AND L149) OR (L149 AND L150) OR (L148 AND L150) OR (L148 AND L149 AND L150) OR L151
L153 9 SEA INVIGOR OR INVIGORR OR INVIGORTM INVIGORRTM OR IN(W)VIGOR OR IN(W)VIGORR OR IN(W)VIGORTM OR IN(W)VIGORRTM
L154 3158 SEA ROUNDUP?
L155 3165 SEA L153 OR L154
L156 1295 SEA BARNASE OR RNASE(W)BA OR (BACTERIAL(W)RIBONUCLEASE AND ((BACILLUS OR B)(W)AMYLOLIQUEFACIENS)) OR P00648 OR IPR001887
L157 639 SEA BARSTAR OR BARNASE(W)INHIBITOR OR IPR000468
L158 5436 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
L159 794 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFERASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE
L160 5743 SEA (L158 OR L159)
L161 377 SEA CP4(W)EPSPS OR AROA(W)CP4
L162 4515 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKIMATE OR ENOYLPYRUVOYL(W)SHIKIMATE OR ENOLPYRUVYL(W)SHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)

L163 9 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE)

L164 1111 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)

L165 84 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE)

L166 2107 SEA CP4 OR AROA

L167 514 SEA L161 OR ((L162 OR L163 OR L164 OR L165))(2A)L166)

L168 4947 SEA GLYPHOSATE(W)OXIDASE OR GOX OR GOXV247

L169 6356 SEA L157 OR L160

L170 7167 SEA L156 OR L157 OR L160

L171 5439 SEA L167 OR L168

L172 105 SEA (L169 AND L171) OR (L170 AND L171) OR (L169 AND L170 AND L171)

L173 29256 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR PHOSPHINOTHRICIN OR LIBERTY)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L174 25622 SEA MALE(3A)STERIL? OR (FERTIL?(3A)RESTOR?) OR RESTOR?(W)LINER OR POLLINATION(W)CONTROL

L175 30375 SEA (HERBICID? OR GLYPHOSATE# OR GLUFOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(RESIST? OR TOLERAN? OR PROTECT?)

L176 28712 SEA (L173 OR L174) AND L175

L177 112558 SEA ((BRASSICA OR B)(W)(NAPUS OR JUNCEA)) OR RAPE? OR CANOLA# OR OILSEED(W)RAPE OR OIL(W)SEED(W)RAPE OR COLZA

L178 647307 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#))

L179 1113 SEA L155 AND (L177 OR L178)

L180 1092 SEA L176 AND L177 AND L178

L181 2288 SEA L152 OR L172 OR L179 OR L180

L182 406 SEA L181 AND PY>=2020

L183 43 SEA L182 AND UP>=20210817 AND UP<=20220630

L184 20 SEA L183 NOT P/DT

L185 0 SEA L183 AND (P/DT AND J/DT)

L186 20 SEA (L184 OR L185)

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 11:03:11 ON 22 AUG 2022

CHARGED TO COST=88866696

L187 63 DUP REM L36 L72 L108 L147 L186 (20 DUPLICATES REMOVED)
ANSWERS '1-24' FROM FILE MEDLINE
ANSWERS '25-37' FROM FILE BIOSIS
ANSWERS '38-44' FROM FILE AGRICOLA
ANSWERS '45-50' FROM FILE CABA
ANSWERS '51-63' FROM FILE HCAPLUS