



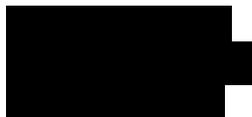
**Review of Scientific Literature Relevant to the  
Food/Feed and Environmental Risk Assessment of  
Event MIR162 Maize**

**Literature Review**

**TEST GUIDELINE(S):**

Not Applicable

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

EU	European Union
ISAAA	International Service for the Acquisition of Agri-Biotech Applications
PICO/PECO	Population, Intervention/Exposure, Comparator, Outcomes

## 1.0 OBJECTIVE

The purpose of this systematic literature search is to identify literature and/or information on MIR162 maize that is relevant to the risk assessment of genetically modified organisms. Maize plants derived from transformation event MIR162 contain the transgene *vip3Aa20*, which encodes the insecticidal protein Vip3Aa20, and the transgene *pmi*, which encodes the enzyme phosphomannose isomerase (PMI). Vip3Aa20 is a variant of the native Vip3Aa1 protein from the soil bacterium *Bacillus thuringiensis* strain AB88, and is active against certain lepidopteran pests of maize, including *Spodoptera frugiperda* and *Helicoverpa zea*. The transgene *pmi* (also known as *manA*) was derived from *Escherichia coli* strain K-12. PMI enables transformed plant cells to utilize mannose as a primary carbon source; it was used as a selectable marker in the development of MIR162 maize.

This report defines the 1) review question; 2) the search strategy; and 3) the explicit methods for selecting and categorizing the records. The results of the selection process are reported including consideration of the implications of any findings. This report aims to comply with the EFSA explanatory note on literature searching for GMO applications (EFSA 2019).

## 2.0 FORMULATING REVIEW QUESTIONS AND CLARIFYING THEIR PURPOSE

### 2.1 Review Question

The review question associated with this literature search was:

Do either food/feed products derived from MIR162 maize or the intended trait have adverse effects on human and/or animal health and/or the environment?

This review question follows the PICO/PECO structure with key elements “Population, Intervention/Exposure, Comparator, Outcomes” (Table 1).

**TABLE 1** Review question in PICO/PECO structure

Element	Components of Review Question
Population	Human and animal health and the environment
Intervention/Exposure	MIR162 maize derived food/feed products, Vip3Aa20 and PMI and closely related variants
Comparator	conventional counterpart (if applicable)
Outcome	adverse effects

### 2.2 Eligibility/Inclusion Criteria

Tables 2 and 3 summarize the eligibility/inclusion criteria for establishing relevance of retrieved records. Table 2 provides high level key concepts for inclusion/exclusion and Table 3 provides more explicit information on the information/data requirements concept. The eligibility/inclusion criteria are provided in the order of importance or ease of finding information on the criteria within a publication. The first failed eligibility/inclusion criterion was used as the primary reason for exclusion, and the remaining criteria were not assessed. Internet pages were screened first by date range June 1, 2018 to June 30, 2019. Pages without dates were evaluated further using the criteria in Tables 2 and 3.

**TABLE 2 Eligibility/Inclusion Criteria to Establish Relevance**

Concepts	Criteria	Comment
Intervention/exposure	MIR162 maize, derived food/feed products, and/or the intended trait(s)	Intended traits include Vip3Aa20 and PMI and closely related variants. Closely related variants of Vip3Aa20 include Vip3Aa19 and other Vip3Aa1 proteins. MIR604 PMI is a closely related variant of PMI.
Information/data requirements	Data inform one or more information/data requirement(s) 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 MIR162 maize (information/data requirements provided in Table 3) were considered relevant. Based on the scope of the application certain information/data requirements are excluded. These are also detailed in Table 3. Publications addressing issues such as benefits, socio-economics, ethics, crop protection, detection methods, efficacy, public perception and risk communication were excluded using this criterion, as they are not relevant to the risk assessment as defined in this document.
Scope of GMO application	The pathways and level of exposure to the GMO, derived food/feed products, and the intended trait(s) addressed in the publication are relevant for the intended uses of the GMO and derived food/feed products under regulatory review	The scope of the application associated with this literature review is import and processing for food/feed uses. Therefore, publications must address pathways and levels of exposure relevant to the scope of the application to be included.
Reporting format	Original/primary data are presented in the publication or it is a risk assessment from a relevant key organization (such as regulatory agencies and risk assessment bodies involved in the risk assessment of GMOs)	Records that do not present original/primary data (e.g. reviews, editorials, position papers) were excluded. Reviews were only included if they present data that are not available from a primary research study. Risk assessments performed and reported by relevant key organizations were included if they address MIR162 maize, Vip3Aa20, or PMI and closely related variants.
Previously risk assessed publications	As indicated by EFSA, a publication should be included if it has not been previously risk assessed by EFSA and/or its GMO Panel and is not cited/referenced in an EFSA/GMO Panel output	If a publication has previously been considered by EFSA it was excluded. Any cited/referenced publications contained within documents produced by EFSA and/or its GMO Panel was also excluded.
Access	Full-text document is accessible	If potentially relevant full-text documents could not be obtained, then they were listed in a table with a description of the (unsuccessful) methods that have been used to try to obtain a copy.

Concepts	Criteria	Comment
Population	Human and animal health, and/or the environment are addressed as general protection goals	All of the information/data requirements categories described in Table 3 are thought to inform the risk assessment related to human and animal health, and/or the environment. Therefore, if a publication meets the inclusion criteria described in this Table and is relevant to the information/data requirements in Table 3 it was considered relevant.
Outcomes	Effects/impacts on human and animal health, and/or the environment are addressed	All of the information/data requirements categories described in Table 3 are thought to inform the risk assessment related to human and animal health, and/or the environment. Therefore, if a publication meets the inclusion criteria described in this Table and is relevant to the information/data requirements in Table 3 it was considered relevant.
Comparator	If the publication is a comparative study that uses plant material as a test material, eligible publications must report a non-GM variety	Publications that address MIR162 maize must also include a conventional counterpart as a comparator in those cases where comparative analysis is conducted and plant material is used as test material. Any uncertainties about the appropriateness of the comparator was addressed in the assessment of the publication.
Plant species	The publication addresses the same plant species as the GMO under consideration	This literature review aims at determining the safe use of the intended traits(s) of MIR162 maize. Therefore, GMOs that contain the same transgenic proteins, but are introduced into another plant species may be included. For certain types of data, the presence of Vip3Aa20 and PMI in a different plant species will not impact the assessment of MIR162 maize. Those types of data are identified in Table 3.
Target pest/organisms	Target pests/organisms addressed in the study are established in the EU	Records related to the intervention/exposure and target pests/organisms were excluded because the scope of the application is import for food/feed uses and this would be relevant for cultivation applications only
Reporting format	A study should only be presented once, but if it is presented in more than one publication, all publications should be listed and grouped.	Duplicate publications were excluded at the initial screening stage. Only one copy of a study was presented even if it is reported in different publications.
Date of information	For internet pages only, the date of the information presented should be within the date range of the literature review (from June 1, 2018 through the date the search was conducted).	Documents returned from the searches of the webpages that were out of date were excluded.

**TABLE 3 Overview of Main Categories of Information/Data Requirements**

Expert knowledge on data used in the risk assessment of the GMO is required but the list below provides some examples of relevant data/information.

Information/data requirement	Non-exhaustive list of specific information/data requirements
Molecular characterization of the genetic modification of MIR162 maize	<ul style="list-style-type: none"> <li>• Information on the insert including: sequence, size, copy number, genetic element arrangement, deletions, location, sequence similarity searches, analysis of open reading frames</li> <li>• Expression data of inserted/modified sequences</li> <li>• Genetic stability</li> <li>• Molecular and biochemical characterization of the protein(s) such as: primary structure, molecular weight, post-translational modifications</li> <li>• Assessment of enzymatic activity including substrate specificity and reaction products with respect to safety and/or nutritional balance</li> <li>• Data on the equivalence between plant-produced and microbially-produced proteins</li> </ul>
Agronomic, phenotypic and compositional characterization of the MIR162 maize	<ul style="list-style-type: none"> <li>• Comparative assessment of agronomic and phenotypic characteristics under field or controlled conditions</li> <li>• Comparative analysis of key nutritional constituents were only considered relevant if generated on MIR162 maize material.</li> </ul>
Toxicological assessment of newly expressed protein(s), new constituents other than proteins, and the whole GM food/feed	<ul style="list-style-type: none"> <li>• Amino acid sequence comparison between the newly expressed protein(s) and toxic proteins</li> <li>• Stability of the protein(s) under relevant processing and storage conditions</li> <li>• Investigation of proteolytic susceptibility of the newly expressed proteins</li> <li>• Toxicity studies</li> <li>• Feeding studies that used plant material must use MIR162 maize as the source of plant material to be considered relevant</li> </ul>
Allergenicity assessment of the newly expressed protein and the GM food/feed, and adjuvanticity	<ul style="list-style-type: none"> <li>• Amino acid sequence comparison between the newly expressed protein and known allergens or celiac disease peptide sequences</li> <li>• Serum screening</li> <li>• Pepsin susceptibility testing</li> <li>• <i>In vivo</i> tests in animal models</li> <li>• Expression data for endogenous allergens in maize</li> <li>• Comparison of newly expressed proteins to known strong adjuvants</li> </ul>
Nutritional assessment of the newly expressed protein(s), other new constituents, as well as potential alterations in the total diet of the consumer or the animal	<ul style="list-style-type: none"> <li>• Anticipated dietary intake of food/feed from MIR162 maize and the resulting nutritional impact</li> <li>• Comparative growth performance studies with young rapidly growing animal species. If the diet contains plant material the source of the plant material must be MIR162 to be considered relevant.</li> </ul>

Information/data requirement	Non-exhaustive list of specific information/data requirements
Post-market monitoring	<ul style="list-style-type: none"> <li>Description of mechanisms for determining actual changes to overall dietary intake patterns of the GM food, to what extent this has occurred and whether or not the product induces known (side) effects or unexpected side effects</li> <li>Information on the reliability, sensitivity and specificity of the post market monitoring</li> </ul>
Persistence and invasiveness assessment, including plant-to-plant gene transfer	<ul style="list-style-type: none"> <li>Measurements of volunteer occurrence and establishment</li> <li>Replacement capacity</li> <li>Fitness of the GM plant in various environmental conditions – if Vip3Aa20, PMI or closely related variants are expressed in a different plant species then the publication may be considered relevant.</li> </ul>
Assessment of plant to micro-organism gene transfer	<ul style="list-style-type: none"> <li>Homology searches at nucleotide level between the GM event and microorganisms. Publications would have to utilize sequence from MIR162 maize specifically to be considered relevant</li> </ul>
Assessment of interactions with target organisms	<ul style="list-style-type: none"> <li>Excluded based on the scope of the application. The scope of this application covers the import, processing and food and feed use of MIR162 maize in the EU. According to the EFSA ERA Guidance (EFSA, 2010): “<i>resistance development is only relevant for applications with scope cultivation of GM plants and not for applications restricted to import and processing of GM plants and their products</i>” (EFSA, 2010). Therefore, an assessment of the potential resistance development in target organisms resulting from the import, processing and food and feed use MIR162 maize is not relevant for this application.</li> </ul>
Assessment of interactions with nontarget organisms	<ul style="list-style-type: none"> <li>The EFSA ERA Guidance (EFSA, 2010) states that: “in cases where the application does not include cultivation in the EU, direct environmental exposure of NTOs to the GM plant is via accidental release into the environment of seeds or propagules during transportation and processing. This may result in sporadic occurrence of feral plants and therefore exposure of NTO populations is likely to be negligible. The ERA will then focus on indirect exposure to products of the GM plant (e.g. through manure and faeces from animals fed the GM plant, and other by-products of industrial processes)”. Therefore, any publications that discuss direct exposure in test protein(s) and laboratory studies or field survey data can be considered not relevant based on scope of application.</li> </ul>
Assessment of interactions with biogeochemical and abiotic processes	<ul style="list-style-type: none"> <li>Excluded based on the scope of the application. The scope of this application covers the import, processing and food and feed use of MIR162 maize in the EU. According to the EFSA ERA Guidance (EFSA, 2010): “<i>applications concerning food/feed uses and import and processing do not require scientific information on possible environmental effects associated with the cultivation of the plant</i>” therefore, an assessment of the impacts of MIR162 maize on biogeochemical processes resulting from specific cultivation, management and harvesting techniques is not relevant given the scope of this application.</li> </ul>

Information/data requirement	Non-exhaustive list of specific information/data requirements
Assessment of impact of specific cultivation, management and harvesting techniques	<ul style="list-style-type: none"> <li>Excluded based on the scope of the application. The scope of this application covers the import, processing and food and feed use of MIR162 maize in the EU. Cultivation of MIR162 maize in the EU is not included in the scope. According to the EFSA ERA guidance (EFSA 2010): “for GM plants for import and processing that are not intended for cultivation in the EU, there is no need for an ERA for altered cultivation, management and harvesting techniques”. Therefore, an assessment of impact of specific cultivation, management and harvesting techniques of MIR162 maize is not relevant for this application.</li> </ul>
Risk mitigation	<ul style="list-style-type: none"> <li>Excluded based on the scope of the application. Risk mitigation measures such as high dose/refuge strategy, isolation distance from protected habitats hosting species of conservation concern that are at risk, integrated pest/weed management are only relevant to cultivation. The scope of this application covers the import, processing and food and feed use of MIR162 maize.</li> </ul>
Post-market environmental monitoring	<ul style="list-style-type: none"> <li>Excluded based on the scope of the application. Monitoring such as insect resistance is relevant only to cultivation. The scope of this application covers the import, processing and food and feed use of MIR162 maize.</li> </ul>

## **3.0 SEARCHING FOR/IDENTIFYING RELEVANT PUBLICATIONS**

### **3.1 Electronic Bibliographic Databases**

To search for different types of publications and unpublished work that could provide information on the review question, multidisciplinary citation databases which include grey literature (i.e. not peer reviewed) were used. Medline, Agricola, CAB Abstracts, and BIOSIS Previews (provided by Ovid Technologies) were searched. Each of the databases has a thesaurus. Searching these databases fulfills the requirement to search a minimum of at least two multi-disciplinary/large databases.

These databases were selected based on their coverage of scientific literature for relevant subjects including, but not limited to, biomedicine, plant diseases, agriculture, life sciences, pesticides, human health and nutrition, animal health, plant science, biotechnology and environmental studies. Detailed information (e.g., list of subjects covered, coverage dates, update schedule, and sources for data) regarding each of the databases searched can be obtained upon request. The document types in these databases include: journal articles, technical letters and notes, conference proceedings, book chapters, reports, and articles in press.

### **3.2 Internet Searches**

#### **3.2.1 Key organizations**

The internet pages of regulatory agencies and risk assessment bodies listed below (Table 4) were searched for documents related to MIR162 maize.

**TABLE 4 Key Organizations Pages Included in the Search**

<b>Regulatory agency name</b>	<b>URL</b>
US Environmental Protection Agency	<a href="https://www.epa.gov/ingredients-used-pesticide-products/current-and-previously-registered-section-3-plant-incorporated">https://www.epa.gov/ingredients-used-pesticide-products/current-and-previously-registered-section-3-plant-incorporated</a>
US Department of Agriculture	<a href="https://www.aphis.usda.gov/aphis/ourfocus/biotechnology">https://www.aphis.usda.gov/aphis/ourfocus/biotechnology</a>
US Food and Drug Administration	<a href="https://www.accessdata.fda.gov/scripts/fdcc/?set=Biocon">https://www.accessdata.fda.gov/scripts/fdcc/?set=Biocon</a>
Canadian Food Inspection Agency	<a href="http://www.inspection.gc.ca/plants/plants-with-novel-traits/notices-of-submission/eng/1300143491851/1300143550790">http://www.inspection.gc.ca/plants/plants-with-novel-traits/notices-of-submission/eng/1300143491851/1300143550790</a>
Health Canada*	<a href="https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products.html">https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products.html</a>
Food Standards Australia New Zealand	<a href="http://www.foodstandards.gov.au/consumer/gmfood/applications/Pages/default.aspx">http://www.foodstandards.gov.au/consumer/gmfood/applications/Pages/default.aspx</a>
Office of the Gene Technology Regulator	<a href="http://www.ogtr.gov.au/">http://www.ogtr.gov.au/</a>
Intersecretarial Commission on Biosafety of GMOs	<a href="http://www.conacyt.gob.mx/cibiogem/index.php/cibiogem">http://www.conacyt.gob.mx/cibiogem/index.php/cibiogem</a>
National Technical Commission on Biosafety	<a href="http://ctnbio.mcti.gov.br/">http://ctnbio.mcti.gov.br/</a>
National Advisory Commission on Agriculture Biotechnology**	<a href="https://www.argentina.gob.ar/agroindustria/alimentos-y-bioeconomia/ogm-comerciales">https://www.argentina.gob.ar/agroindustria/alimentos-y-bioeconomia/ogm-comerciales</a>
Ministry of Environment, Forest and Climate change	<a href="http://moef.gov.in/">http://moef.gov.in/</a>
Ministry of Agriculture, Forestry and Fisheries	<a href="http://www.maff.go.jp/e/">http://www.maff.go.jp/e/</a>
European Food Safety Authority	<a href="http://www.efsa.europa.eu/">http://www.efsa.europa.eu/</a>

\*Also searches Environment and Climate Change Canada

\*\*The traditional website search method was ineffective. Therefore, this webpage was searched using the find function <control F>.

### **3.2.2 Web-based search engines and databases**

General search engines such as GOOGLE Scholar and web-based databases known to contain information specifically on effects of GMOs were not searched. The search of the databases and key organization websites is considered to provide an adequately comprehensive search of literature.

### **3.2.3 Manual searches**

#### **3.2.3.1 Checking reference lists**

If any reviews, methodological publications, guidelines and scientific opinions from regulatory agencies were retrieved using the search strategy and classified as relevant to the review question, then the reference lists from those records were manually searched for new records (June 2018 through the date the search was conducted) that meet the eligibility/inclusion criteria.

#### **3.2.3.2 Hand searching**

Hand searching was not conducted. The search of the databases and key organization websites is considered to provide an adequately comprehensive search of literature.

#### **3.2.3.3 Citation searching**

Citation searching was not conducted. The search of the databases and key organization websites is considered to provide an adequately comprehensive search of literature.

## **3.3 Constructing the Search Strategy**

### **3.3.1 Database searching**

#### **3.3.1.1 Approaches to develop searches**

The “lumping” approach was utilized. A single search strategy was developed to capture all categories of information of interest in one search. This strategy was used because previous experience indicates that a manageable number of studies was returned.

#### **3.3.1.2 Search terms**

##### **Identifying search terms**

Search terms were identified by:

- Assessing subject indexing terms of relevant publications recorded in those electronic bibliographic databases that use thesauri
  - All publications returned from literature search reports that aim to comply with the EFSA explanatory note dated 2017 (EFSA 2017) and deemed relevant to the review questions were examined to determine the subject indexing terms associated with it.

- Seeking suggestions from experts and stakeholders
  - The search terms were developed using a multi-disciplinary team (i.e. risk assessors, information specialists, regulatory affairs managers).

### **Free-text terms and subject indexing terms**

The searches with the Ovid platform utilized the keyword search in the advanced search window. The keyword search uses a default set of fields designated .mp, which vary by database. Therefore, Ovid uses the term “keyword” to indicate that it is executing a multi-field search. In each database the specific fields searched are a different combination of free-text and controlled vocabulary fields, with Ovid switching automatically to the appropriate fields when a database is selected.<sup>1</sup>

In Ovid, the fields used in the .mp keyword search are word searchable, therefore any search only has to find a single word in a controlled vocabulary field that contains phrases to return as search results all references indexed to that subject heading. Thus, a search strategy which includes “genetic\*” will return the following (highlighted below):

- **Genetically modified** foods or **genetic engineering** in the Subject Headings field in Agricola,
- Zea mays: species, maize, common, **genetically modified**, strain-Bt10 [Gramineae] in the Organism field in BIOSIS Previews,
- **Genetically engineered** organisms in the Subject Headings field in CAB Abstracts,
- Plants, **Genetically Modified** / ge [Genetics] or **Genetic Engineering** in MeSH Subject Headings in Medline

Subsequent combining of terms, (genetic\* AND (modif\* OR engineer\*)) (in bold), yields all references with these headings to be in the final results for that search set. Therefore, it is not necessary to search each exact controlled phrase in order to return all references for each of the specific headings.

<sup>1</sup> In Agricola the .mp fields are: free-text—abstract; geographic area; identifier; meeting information; map information; note; original title; personal name as subject; title—and controlled vocabulary—category code; subject heading.

In BIOSIS Previews the .mp fields are: free-text—abstract; book title; gene name; miscellaneous descriptors; methods & equipment; original language book title; title—and controlled vocabulary—biosystematic codes; chemicals & biochemicals; concept codes; diseases; geopolitical locations; major concepts; organisms; parts, structure & systems of organisms; sequence data; super taxa; taxa notes; time.

In CAB Abstracts the .mp fields are: free-text—abstract; identifiers; original title; title—and controlled vocabulary—broad terms; geographic location; organism descriptors; subject headings.

In Medline the .mp fields are: free-text—abstract; keyword heading word; original title; synonyms; title; unique identifier—and controlled vocabulary—floating sub-heading word; name of substance word; organism supplementary concept word; protocol supplementary concept word; rare disease supplementary concept word; subject heading word.

Appendix A provides 1) the search history (including the full strategy used and fields searched as run in the database) and number of publications identified (line by line) for each bibliographic database prior to de-duplication and 2) the subject indexing used by each database as shown within the brackets after each search term.

### **3.3.1.3 Free-text searching functions**

The search terms were selected to incorporate a wide variety of synonymous and related terms. Truncation and wildcards were used where appropriate to capture different conventions in spelling and variation in the endings of terms.

### **3.3.1.4 Search strings**

Search strings were combined with Boolean and proximity operators appropriate for the scope of the review.

### **3.3.1.5 Key elements of review questions to use for best result**

A very large number of publications were returned using only the four key elements of Event, Intended trait, newly expressed protein(s), and Trade Name. To prevent a very large number of publications from being returned while still achieving sensitivity, additional key elements were added to the search strategy. Sensitivity was defined as the ability to return the previously deemed relevant articles with the new search string. ‘A very large number’ is not defined in the Explanatory Note (EFSA 2019); however, the number returned with other search strategies (e.g. (Event OR Intended Trait OR Newly Expressed Protein(s) OR Trade Name) or (Event OR Trade name OR ((Intended Trait OR Newly Expressed Protein(s)) AND (Plant Species or GMO)))) was so large that it could not be de-duplicated by the search platform.

Therefore, the search structure included the following search concepts/key elements; Event, Trade Name, Newly Expressed Protein(s), or Intended Trait in the same publications as terms describing plant species and/or GMO general terms. The search strategy employed was:

- Event OR Trade name OR (Newly Expressed Protein(s) AND (GMO general OR Plant Species)) OR (Intended Trait – Insecticidal AND (GMO general AND Plant Species)) OR GMO general × Intended Traits

The search strategy employed captured literature relevant to MIR162 maize and is provided in Table 5. The same search string was used in all databases. Since the Ovid search platform simultaneously searches free-text and subject headings there is no disadvantage to using all search terms in all databases. For example, if ‘Genetically engineered organisms’ is a subject heading in CAB Abstracts but not in Agricola including this term in the search of the Agricola databases still allows for free-text searching of this term.

**TABLE 5 Search String Strategy**

1	Topic	MIR162 OR MIR 162 OR SYN-IR162-4	Event MIR162
2	Topic	Agrisure* ADJ2 Viptera*	Trade name for MIR162
3	Topic	Vip3AA20* OR Vip3 AA20* OR Vip3 AA 20* OR Vip3A A 20*	Newly expressed protein in MIR162 (insecticidal)
4	Topic	Phosphomannoisomerase OR Mannose 6-phosphate isomerase OR Phosphomannoseisomerase OR Phosphomannose isomerase OR 9023-88-5 OR AAA24109 OR EC 5.3.1.8 OR E.C. 5.3.1.8	Newly expressed protein in MIR162 (selectable marker)
5		#3 OR #4	
6	Topic	(Insect OR Insects OR lepidoptera* OR pest OR pests OR noctuidae OR earworm* OR ear worm* OR armyworm* OR army worm* OR cutworm* OR cut worm* OR Helicoverpa OR H zea OR Spodoptera OR S frugiperda OR S exigua OR Striacosta OR S albicosta OR Agrotis OR A ipsilon OR Feltia OR F jaculifera OR Pseudaletia OR P unipuncta OR CEW OR FAW OR WBC) ADJ2 (toleran* OR resistan* OR protect* OR control*) OR Bacillus thuringiensis OR B thuringiensis	Intended traits - insecticidal
7		GMO* OR LMO* OR GM OR GE OR transgen* OR ((genetic* OR living OR biotech*) ADJ3 (modif* OR transform* OR manipul* OR improv* OR engineer* OR deriv*))	GMO general
8		Maize* OR corn* OR Zea mays OR Z mays	Plant species
9		((Bt OR Bacillus thuringiensis OR B thuringiensis) ADJ5 (maize* OR corn* OR mays)) OR Btmaize* OR Btcorn*	GMO general x intended traits
10		#5 AND (#7 OR #8)	Newly expressed proteins AND (GMO general OR plant species)
11		#6 AND (#7 AND #8)	Intended trait - insecticidal AND (GMO general AND Plant species)
12		#1 OR #2 OR #10 OR #11 OR #9	Event OR Trade name OR (Newly expressed protein AND (GMO general OR Plant species)) OR (Intended trait - insecticidal AND (GMO general AND Plant species)) OR GMO general × Intended trait

### 3.3.1.6 Use of multiple languages

The search terms used were in the English language or utilized the Roman alphabet. For the event name and trade name it is unlikely that there are translations because they are not words in the English language.

### 3.3.1.7 Time period

Due to the use of multiple (i.e. 4) multi-disciplinary databases and redundancy in coverage it is unlikely that late addition of a publication would be missed. Therefore, the returned literature was limited to that which was published between June 1, 2018 and June 30, 2019 (see Table 8).

### 3.3.1.8 Internet searching of regulatory agency webpages

The search terms selected are the event and protein names from the International Service for the Acquisition of Agri-Biotech Applications (ISAAA) (Table 6). The descriptions and information for the top 50 hits or 10% of the total hits (whichever is greater) for each search term/web page were collected.

**TABLE 6** Nomenclature for the single event and newly expressed protein(s) from the ISAAA database for use in searching regulatory agency web pages

Event	Search term	Concepts/Key Elements
MIR162	MIR162	Event name
MIR162	Vip3Aa20	Newly expressed protein
MIR162	Phosphomannose isomerase	Newly expressed protein

### 3.4 Reference Publications

Previously conducted literature reviews have successfully returned literature relevant to the risk assessment of MIR162 maize. The search strategy defined in this report was run and the reference publications listed below in Table 7 were returned. Therefore, the search terms selected are suitable to retrieve and/or identify the already known literature on the intervention/exposure of MIR162 maize.

The reference publications utilized are identified in Table 7 (X indicates that the publication was retrieved in the database). The percentage of publications retrieved in each database is provided.

**TABLE 7**      **Reference publications**

<b>Data/Information requirement</b>	<b>Reference</b>	<b>Medline</b>	<b>CAB Abstracts</b>	<b>BIOSIS</b>	<b>Agricola</b>
Assessment of interactions with nontarget organisms	Pellegrino E, Bedini S, Nuti M, Ercoli L, 2018. Impact of genetically engineered maize on agronomic, environmental and toxicological traits: a meta-analysis of 21 years of field data. Scientific Reports	X		X	
Molecular characterization of the genetic modification of the GMO	Long N, Bottoms J, Meghji MR, Hart H, Que Q, Pulliam D, 2017. Corn event MIR162. Official Gazette of the United States Patent & Trademark Office Patents			X	
	Percentage of records returned	50% (1/2)	0 (0/2)	100% (2/2)	0 (0/2)

## **4.0 SUMMARIZING AND REPORTING THE DATA, AND CONSIDERING THE IMPLICATIONS OF THE FINDINGS**

### **4.1 Selecting Publications**

#### **4.1.1 Database records**

The process for selecting relevant publications was conducted in two stages. The first stage required a rapid assessment of titles and abstracts. Those records that were clearly not relevant from reviewing the title only were excluded from further review. For those records that appeared relevant or had unclear relevance the abstracts were reviewed. Those records that were clearly not relevant from reviewing the abstract were excluded from further review, while records that are relevant or have unclear relevance were reviewed in Stage 2.

Two independent reviewers examined the records for inclusion/exclusion for each eligible information/data requirement at all stages of review. Reviews and selections were conducted independently. During the rapid assessment process (Stage 1), only records that were deemed clearly not relevant by both reviewers were excluded from further review.

The reviewers met to discuss their disagreements and further refined their understanding of the criteria for relevance. The reviewers independently re-reviewed the potential relevance of those titles upon which they disagreed. Documents with vague and generic titles were moved forward for full-length document review.

A kappa test was performed after the title/abstract publication selection (stage 1) and before initiating the full-text screening process. The kappa test score was 0.663. The reviewers adopted a broad inclusion criteria to ensure that all potentially relevant publications were captured. At the completion of stage 1 there were 276 records retrieved from the databases (with duplicates removed). There were 274 agreements, including agreement regarding two manuscripts at the title/abstract phase which were subsequently moved to stage two. There were two disagreements due to conservative reviewer judgement rather than narrower reviewer judgement; these two publications proceeded to the next phase of review (review of the full documents).

Full-length articles were reviewed in Stage 2. A reason for exclusion is provided for any records that were deemed not relevant in Stage 2. Any relevant records identified in Stage 2 were subjected to reliability assessments and evaluations of the implications of those records on the food and feed or environmental risk assessments. Reviewers came to a consensus on all records.

#### **4.1.2 Records from key organizations**

The records returned from searching the websites of key organizations were considered relevant if they were risk assessments, scientific opinions/reports concerning the commercial release of GMO being examined or documents on the biology of the crop of interest. The regulatory agency webpages that were searched do not post primary data; therefore all other document types are not considered relevant.

The format of records returned from regulatory agency websites did not meet the format required to assess them using the two stage process followed for the database records. When the website records were published in English, they were assessed by two independent reviewers. Due to format the full-text documents were assessed to determine relevance. When the website records were not published in English a single reviewer that speaks the language of those documents determined if they should be classified as a risk assessment, scientific opinion/report or document on the biology of the crop of interest. If a document was classified as one of these document types then it was translated to English and two independent reviewers determined if it met the other criteria for inclusion. Only if records were classified as one of the relevant document types and excluded based on other eligibility criteria was the rationale for its exclusion provided. Internet pages with URLs that lead to meaningless or no information (broken links) were also excluded.

## **4.2 Summarizing and Reporting the Data**

This report provides detail about the search process and its results. The methodological framework in this report involves summarising and reporting the literature, and applying meaning to the results as outlined in the Explanatory Note (EFSA 2019).

## **4.3 Results of the Publication Selection Process**

For electronic bibliographic databases, the date on which the search was conducted, the date of the most recent update of the database, the service provider used, date span of the search, any limits applied to the search (e.g. study types, dates, languages) and the total number of records retrieved before and after removing duplicates were recorded. Additionally, the line by line strategy with the number of publications identified per line is presented. See Appendix A.

**TABLE 8 Electronic bibliographic database search details**

Database	Search Date	Service provider	Date span of the search	Any limits applied to the search	Total number of records retrieved after removing duplicates
Agricola	05/07/2019	Ovid Technologies	01/06/2018 to 30/06/2019	Dates	4
BIOSIS Previews	05/07/2019	Ovid Technologies	01/06/2018 to 30/06/2019	Dates	92
CAB Abstracts	05/07/2019	Ovid Technologies	01/06/2018 to 30/06/2019	Dates	57
Medline	05/07/2019	Ovid Technologies	01/06/2018 to 30/06/2019	Dates	123

For records from websites the following were recorded (if available): the website name and service publisher used, justification for choosing the source, the URL, the date on which the search was conducted, the date of the most recent website update at the time it was searched, the date span of the search, the search terms used, any limits to the search, and the number of relevant records retrieved.

TABLE 6 contains the search terms used as a series of single searches for regulatory agency web pages.

For records from reference lists from manual searches, the following was recorded: the bibliographic details of the documents whose reference lists were scanned and the number of relevant bibliographic references retrieved.

**TABLE 9 Regulatory agency webpage search details**

Regulatory agency name	URL	Date of Search	Date of Most Recent Website Update	Date Span of Search	Total number of records retrieved after removing duplicates	Number of relevant records
US Environmental Protection Agency	<a href="https://www.epa.gov/ingredients-used-pesticide-products/current-and-previously-registered-section-3-plant-incorporated">https://www.epa.gov/ingredients-used-pesticide-products/current-and-previously-registered-section-3-plant-incorporated</a>	7/23/2019	10/24/2018	June 1, 2018 to June 30, 2019	1	0
US Department of Agriculture	<a href="https://www.aphis.usda.gov/aphis/ourfocus/biotechnology">https://www.aphis.usda.gov/aphis/ourfocus/biotechnology</a>	7/23/2019	No update information provided	June 1, 2018 to June 30, 2019	34	0
US Food and Drug Administration	<a href="https://www.accessdata.fda.gov/scripts/fdcc/?set=Biocon">https://www.accessdata.fda.gov/scripts/fdcc/?set=Biocon</a>	7/23/2019	5/9/2019	June 1, 2018 to June 30, 2019	6	0

Regulatory agency name	URL	Date of Search	Date of Most Recent Website Update	Date Span of Search	Total number of records retrieved after removing duplicates	Number of relevant records
Canadian Food Inspection Agency	<a href="http://www.inspection.gc.ca/plants/plants-with-novel-traits/notices-of-submission/eng/1300143491851/1300143550790">http://www.inspection.gc.ca/plants/plants-with-novel-traits/notices-of-submission/eng/1300143491851/1300143550790</a>	7/24/2019	1/17/2019	June 1, 2018 to June 30, 2019	9	0
Health Canada	<a href="https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products.html">https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products.html</a>	7/24/2019	1/24/2019	June 1, 2018 to June 30, 2019	15	0
Food Standards Australia New Zealand	<a href="http://www.foodstandards.gov.au/consumer/gmfood/applications/Pages/default.aspx">http://www.foodstandards.gov.au/consumer/gmfood/applications/Pages/default.aspx</a>	7/25/2019	No update information provided	June 1, 2018 to June 30, 2019	41	2
Office of the Gene Technology Regulator	<a href="http://www.ogtr.gov.au/">http://www.ogtr.gov.au/</a>	7/25/2019	7/25/2019	June 1, 2018 to June 30, 2019	11	0
Intersecretarial Commission on Biosafety of GMOs	<a href="http://www.conacyt.gob.mx/cibiogem/index.php/cibiogem">http://www.conacyt.gob.mx/cibiogem/index.php/cibiogem</a>	7/19/2019	No update information provided	June 1, 2018 to June 30, 2019	4	0
National Technical Commission on Biosafety	<a href="http://ctnbio.mcti.gov.br/">http://ctnbio.mcti.gov.br/</a>	7/17/2019	No update information provided	June 1, 2018 to June 30, 2019	91	0
National Advisory Commission on Agriculture Biotechnology	<a href="https://www.argentina.gob.ar/agroindustria/alimentos-y-bioeconomia/ogm-comerciales">https://www.argentina.gob.ar/agroindustria/alimentos-y-bioeconomia/ogm-comerciales</a>	8/6/2019	No update information provided	June 1, 2018 to June 30, 2019	5	0
Ministry of Environment, Forest and Climate change	<a href="http://moef.gov.in/">http://moef.gov.in/</a>	7/23/2019	No update information provided	June 1, 2018 to June 30, 2019	0	0
Ministry of Agriculture, Forestry and Fisheries	<a href="http://www.maff.go.jp/e/">http://www.maff.go.jp/e/</a>	7/19/2019	No update information provided	June 1, 2018 to June 30, 2019	73	0
European Food Safety Authority	<a href="http://www.efsa.europa.eu/">http://www.efsa.europa.eu/</a>	7/25/2019	No update information provided	June 1, 2018 to June 30, 2019	7	0

The results of the selection process are recorded in Table 10 and a flow chart of the publication selection process is shown in Figure 1.

**TABLE 10 Results of the publication selection process, for each review question and or group of information/data requirements searched**

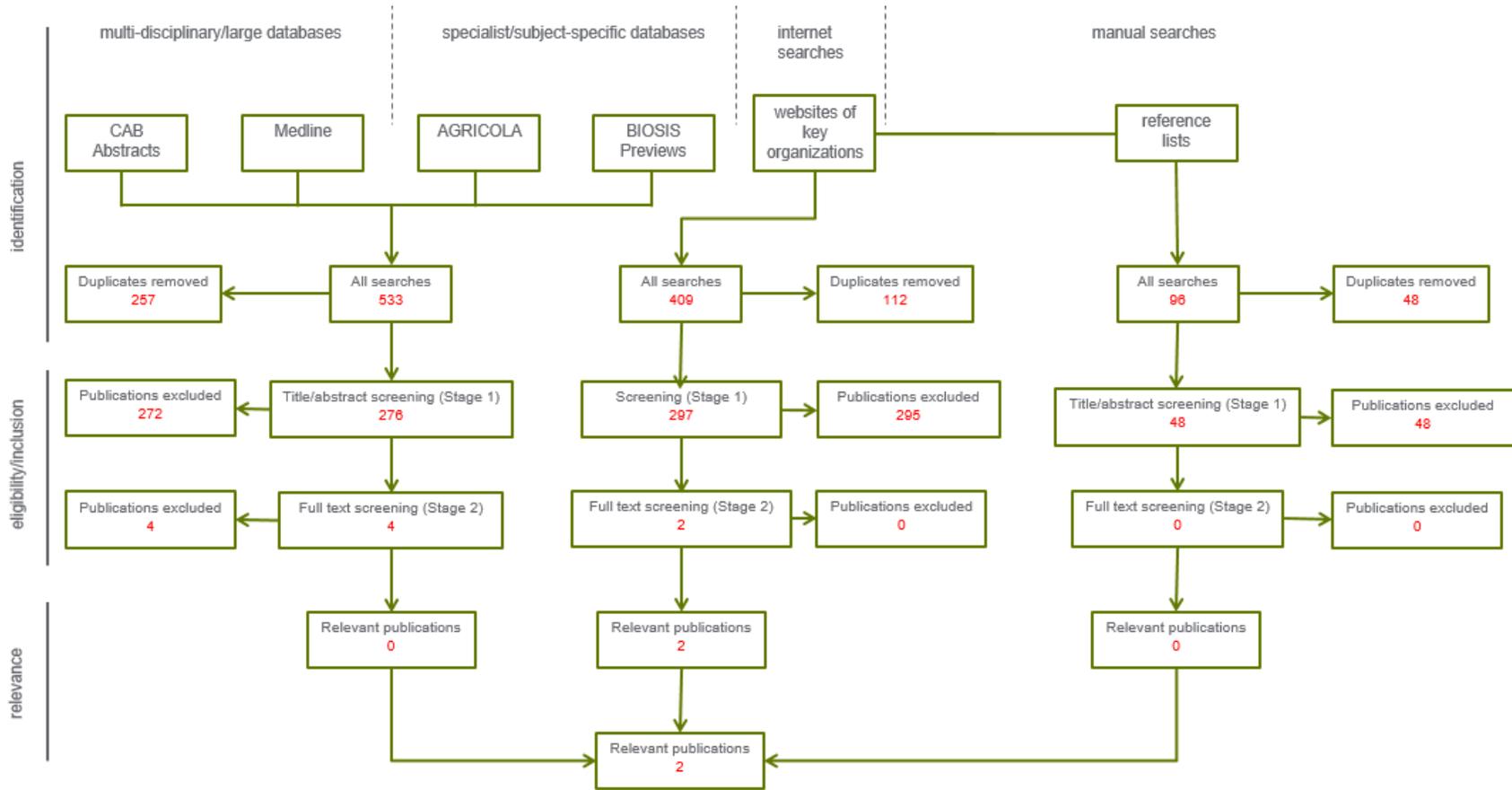
Review question and/or category of information/data requirement(s) captured in the search	Number of publications
Publications identified after all* searches of the scientific literature (excluding duplicates)	621
Database results identified	276
Internet results identified	297
**References from relevant database results identified	48
Publications excluded from the search results after screening of title and abstracts*** (stage 1)	615
Database results excluded	272
Internet results excluded	295
References from relevant database results excluded	48
Publications screened using full-text (stage 2)	4
Database results screened	4
Internet results screened	0
References from relevant database results screened (all already excluded)	0
Publications excluded after full-text screening	4
Database results full-text excluded	4
Internet results full-text excluded	0
References from relevant database results full-text excluded (all already excluded)	0
Unobtainable publications	0
Unclear publications	0
Publications considered relevant	2
Database results relevant	0
Internet results relevant	2
References from relevant database results relevant	0

\*Both from electronic bibliographic databases and other sources of scientific literature.

\*\*There were additional record titles (48) reviewed from the references of relevant internet documents retrieved from searching regulatory agency websites. These were excluded from search results after screening of titles. There were no relevant records found among these references.

\*\*\*Due to the formatting of records (e.g. lack of abstracts) from the websites of key organizations the stage 1 review was performed by a first scanning through the documents.

**FIGURE 1** Flow chart of the publication selection process



#### 4.4 Relevant Publications

A list of the full bibliographic references for all relevant internet publications, ordered by category of information/data requirement is recorded in Table 11. There were no relevant full-text documents retrieved from database searching.

**TABLE 11 Report of all relevant publications retrieved after assessment of internet documents**

List of bibliographic references for all relevant publications, classified by category of information/data requirements\*

Category of information/data requirement(s)	Study (Author(s) and year)	Title	Source
Risk Assessment	Australia New Zealand Food Authority, no date provided (FSANZ 2019a)	Supporting document 1 Safety assessment report (at Approval) Application A1060 Food derived from Insect-protected Corn Line 5307	<a href="http://www.foodstandards.gov.au/code/applications/Documents/A1060%20GM%20Corn%20Line%205307%20AppR%20SD1%20Safety%20Assess.s.doc">http://www.foodstandards.gov.au/code/applications/Documents/A1060%20GM%20Corn%20Line%205307%20AppR%20SD1%20Safety%20Assess.s.doc</a>
Risk Assessment	Australia New Zealand Food Authority, no date provided (FSANZ 2019b)	Supporting Document 1 Application A1060 – Food Derived From Insect-Protected Corn Line 5307 Safety Assessment Report	<a href="http://www.foodstandards.gov.au/code/applications/Documents/A1060%20GM%20Corn%20Line%205307%20AR%20SD1%20Safety%20Assess.pdf">http://www.foodstandards.gov.au/code/applications/Documents/A1060%20GM%20Corn%20Line%205307%20AR%20SD1%20Safety%20Assess.pdf</a>

FSANZ provided the same document but in two different formats (.doc and .pdf), which are the documents shown above. Therefore, of the 2 relevant internet results, 1 appears to be a document duplicate. The duplicate document was kept because it was counted in the original search results.

#### 4.5 Excluded Publications After Detailed Assessment of Full-Text Documents

A list of the full bibliographic references for all excluded studies retrieved from database searching after detailed assessment of full-text documents for relevance (i.e. stage 2), with justification for their exclusion, is recorded in Table 12.

**TABLE 12 Report of publications excluded from the risk assessment after detailed assessment of full-text documents**

List of bibliographic references for all studies excluded from the risk assessment, classified by authors			
Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria
Agapito-Tenfen SZ et al. 2018	Systematic miRNome profiling reveals differential microRNAs in transgenic maize metabolism	Environmental Sciences Europe	Intervention/exposure not relevant
Bernillon S et al. 2018	Characterization of GMO or glyphosate effects on the composition of maize grain and maize-based diet for rat feeding	Metabolomics	Intervention/exposure not relevant
Carzoli AK et al. 2018	Risks and opportunities of GM crops: Bt maize example	Global Food Security	Reporting format – no primary data
Oliveira MR et al. 2018	Nutritional composition and aerobic stability of wheat and corn silages stored under different environmental conditions	Semina: Ciencias Agrarias	Intervention/exposure not relevant

#### **4.6 Unobtainable Publications**

No publications were considered unobtainable.

#### **4.7 Unclear Publications**

No publications were classified as unclear.

#### **4.8 Full-Text Documents**

Full text documents for all relevant publications were compiled using a reference management software (.RIS format) and accompany this final report.

#### **4.9 Narrative Synthesis/Summary of Relevant Publications**

A narrative synthesis/summary of the relevant studies describing their overall volume, strength and direction per main category of information/data requirements was not reported because this literature review was conducted for annual PMEM reports on GMOs authorized in the EU market and therefore it is not required.

#### **4.10 Implications of Relevant Publications on Risk Assessment**

The implications of the relevant publications on the risk assessment was assessed by considering whether the record presents new hazards, modified exposure pathways or new scientific uncertainties.

There were no relevant publications retrieved after detailed assessment of full-text documents for relevance.

The record reliability and its implication on the risk assessment was recorded in Table 13.

**TABLE 13 Report of the reliability and implications for the risk assessment of all relevant publications retrieved after assessment of internet documents.**

List of bibliographic references for all relevant publications, classified by category of information/data requirements

Category of information/data requirement(s)	Publication (Author(s) and year)	Summary of reliability appraisal	Implications for the risk assessment
Risk assessment or scientific opinion	Australia New Zealand Food Authority, no date provided (FSANZ 2019a)	Not assignable because no or insufficient information is reported in the document	This document is considered a risk assessment based on a data package provided by the sponsor company, and contains their conclusions related to specific protection goals. The information provided in this document does not change the conclusion of the risk assessment for MIR162 maize.
Risk assessment or scientific opinion	Australia New Zealand Food Authority, no date provided (FSANZ 2019b)	Not assignable because no or insufficient information is reported in the document	This document is considered a risk assessment based on a data package provided by the sponsor company, and contains their conclusions related to specific protection goals. The information provided in this document does not change the conclusion of the risk assessment for MIR162 maize.

## **5.0 RECORDS TO BE MAINTAINED**

Records maintained include, but are not be limited to, documentation of database search dates, database update dates, resolution of differences of opinion on records, the protocol, and any protocol amendments or deviations.

## **6.0 ARCHIVING OF STUDY RECORDS**

The protocol amendments, deviations, raw data, related documentation, and final report are archived at Syngenta in Research Triangle Park, NC, USA.

## 7.0 REFERENCES

- Agapito-Tenfen SZ, Vilperte V, Traavik TI, Nodari RO. 2018. Systematic miRNome profiling reveals differential microRNAs in transgenic maize metabolism. *Environmental Sciences Europe* 30: 37.
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- EFSA. 2010. Scientific Opinion on the environmental risk assessment of genetically modified plants. *The EFSA Journal* 8: 1-111.
- EFSA. 2017. 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 authorized in the EU market. EFSA supporting publications 2017:EN-1207.
- EFSA. 2019. 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 authorized in the EU market. EFSA supporting publications 2019:EN-1614.
- FSANZ. 2019a. *Supporting document 1 Safety assessment report (at Approval) Application A1060 Food derived from Insect-protected Corn Line 5307*. Canberra, Australia: Food Standards Australia New Zealand.  
<http://www.foodstandards.gov.au/code/applications/Documents/A1060%20GM%20Corn%20Line%205307%20AppR%20SD1%20Safety%20Assess.doc> (Accessed July 25, 2019)
- FSANZ. 2019b. *Supporting document 1 Safety assessment report (at Approval) Application A1060 Food derived from Insect-protected Corn Line 5307*. Canberra, Australia: Food Standards Australia New Zealand.  
<http://www.foodstandards.gov.au/code/applications/Documents/A1060%20GM%20Corn%20Line%205307%20AR%20SD1%20Safety%20Assess.pdf> (Accessed July 25, 2019)
- Oliveira MR, Bueno AVI, Leao GFM, Neumann M, Jobim CC. 2018. Nutritional composition and aerobic stability of wheat and corn silages stored under different environmental conditions. *Semina: Ciencias Agrarias* 39: 253-260.

## APPENDICES SECTION

## **APPENDIX A Search history and subject indexing**

Ovid<sup>®</sup> Terms were searched individually line by line, however when the proximity operator adj2 is used the Ovid platform displays the terms on one line as a group such as (term,term2,term3)adj2 (term4,term5,term6)

Search My Workspace

▼ Search History (99)

<input type="checkbox"/>	# ▲	Searches	Results	Type	Actions	Annotations
<input type="checkbox"/>	1	MIR162.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	21	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	2	MIR 162.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	3	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	3	SYN-IR162-4.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	4	1 or 2 or 3	24	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	5	(Agrisure* adj2 Viptera*).mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	13	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	6	Vip3AA20*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	12	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	7	Vip3 AA20*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	8	Vip3 AA 20*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	9	Vip3A A 20*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	10	6 or 7 or 8 or 9	12	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	11	Phosphomannoisomerase.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	3	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	12	Mannose 6-phosphate isomerase.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	37	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	13	Phosphomannoseisomerase.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	14	Phosphomannose isomerase.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	103	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	15	9023-88-5.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	16	AAA24109.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	
<input type="checkbox"/>	17	"EC 5.3.1.8".mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	4	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	18	"E.C. 5.3.1.8".mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	4	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	19	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18	134	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	20	10 or 19	146	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	21	Insect.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	177763	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	22	Insects.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	230884	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	23	lepidoptera*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	35470	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	24	pest.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	64918	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	25	pests.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	333774	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	26	noctuidae.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	7094	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	27	earworm*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	978	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	28	ear worm*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	39	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	29	armyworm*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	2864	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
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<input type="checkbox"/>	34	H zea.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	414	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	35	Spodoptera.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	7735	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	36	S frugiperda.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	418	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	37	S exigua.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	475	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
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<input type="checkbox"/>	41	A ipsilon.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	80	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
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<input type="checkbox"/>	43	F jaculifera.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	<input type="checkbox"/>
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<input type="checkbox"/>	49	21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48	446012	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
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<input type="checkbox"/>	51	resistan*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	251371	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	52	protect*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	241546	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	53	control*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	857102	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	54	50 or 51 or 52 or 53	1281835	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	55	((Insect or Insects or lepidoptera* or pest or pests or noctuidae or earworm* or ear worm* or armyworm* or army worm* or cutworm* or cut worm* or Helicoverpa or H zea or Spodoptera or S frugiperda or S exigua or Striacosta or S albicosta or Agrotis or A ipsilon or Feltia or F jaculifera or Pseudaletia or P unipuncta or CEW or FAW or WBC) adj2 (toleran* or resistan* or protect* or control*).mp.	115569	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
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	abstract, heading words]				<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	67	64 or 65 or 66	662300	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	69	transform*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	141448	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	72	engineer*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	128290	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	73	deriv*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	246682	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	76	59 or 60 or 61 or 62 or 63 or 75	94562	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	77	Maize*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	61237	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	87	corn*.mp. [mp=meeting information, title, original title, map information, note, abstract, heading words]	117864	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	89	86 or 87 or 88	157523	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	90	((Bt or Bacillus thuringiensis or B thuringiensis) adj5 (maize* or corn* or mays)).mp.	1108	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	1	MIR162.mp. [mp=abstract, original language book title (non-english), book title (english), title, heading words]	75	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>	<a href="#">Contract</a>
<input type="checkbox"/>	2	MIR 162.mp. [mp=abstract, original language book title (non-english), book title (english), title, heading words]	13	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>	
<input type="checkbox"/>	3	SYN-IR162-4.mp. [mp=abstract, original language book title (non-english), book title (english), title, heading words]	0	Advanced	<a href="#">Save</a>   <a href="#">More</a>	<input type="checkbox"/>	
<input type="checkbox"/>	4	1 or 2 or 3	84	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>	
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	identifiers, cabicodes]				<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	72	engineer*.mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]	180782	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	93	90 or 91 or 92	2094	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	94	76 or 81	634060	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
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<input type="checkbox"/>	98	4 or 5 or 93 or 95 or 97	3387	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	99	limit 98 to yr="2018 -Current"	117	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	

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<input type="checkbox"/>	1	MIR162.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	35	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<a href="#">Contract</a>
<input type="checkbox"/>	2	MIR 162.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	5	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
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<input type="checkbox"/>	4	1 or 2 or 3	40	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	5	(Agrisure* adj2 Viptera*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	7	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
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<input type="checkbox"/>	63	transgen*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	203553	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	64	genetic*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	3759461	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	65	living.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	364100	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	66	biotech*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	62321	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	67	64 or 65 or 66	4124516	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	68	modif*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1047629	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	69	transform*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	574187	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	70	manipulat*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	183413	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	71	improv*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2286228	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	72	engineer*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	236269	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	
<input type="checkbox"/>	73	deriv*.mp. [mp=title, abstract, original title, name of substance word, subject	1848979	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	

	heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]					
<input type="checkbox"/>	74 68 or 69 or 70 or 71 or 72 or 73	5452274	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	75 ((genetic* or living or biotech*) adj3 (modif* or transform* or manipulat* or improv* or engineer* or deriv*)).mp.	145956	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	76 59 or 60 or 61 or 62 or 63 or 75	376730	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	77 Maize*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	28823	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	78 corn*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	198845	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	79 Zea mays.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	33939	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	80 Z mays.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	320	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	81 77 or 78 or 79 or 80	230809	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	82 Bt.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	13496	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	83 Bacillus thuringiensis.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	8333	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	84 B thuringiensis.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2202	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	85 82 or 83 or 84	19627	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	86 maize*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	28823	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	87 corn*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	198845	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	88 mays.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	34163	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	89 86 or 87 or 88	230993	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	90 ((Bt or Bacillus thuringiensis or B thuringiensis) adj5 (maize* or corn* or mays)).mp.	742	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	91 Btmaize*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	0	Advanced	<a href="#">Save</a>	<a href="#">More</a>	
<input type="checkbox"/>	92 Btcorn*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	0	Advanced	<a href="#">Save</a>	<a href="#">More</a>	
<input type="checkbox"/>	93 90 or 91 or 92	742	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	94 76 or 81	600773	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	95 20 and 94	74	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	96 76 and 81	6766	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	
<input type="checkbox"/>	97 58 and 96	1057	Advanced	<a href="#">Display Results</a>	<a href="#">More</a>	

<input type="checkbox"/>	98	4 or 5 or 93 or 95 or 97	1325	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>
<input type="checkbox"/>	99	limit 98 to yr="2018 -Current"	123	Advanced	<a href="#">Display Results</a>   <a href="#">More</a>	<input type="checkbox"/>

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