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This research has been carried out by Wageningen Food Safety Research, institute within the legal entity Wageningen Research Foundation funded by the Dutch Ministry of Agriculture, Nature and Food Quality in the Statutory Tasks Programme for Food Safety (WOT-02), theme Animal Feed.

Wageningen, April 2020

WFSR report 2020.002

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Klüche, M., P. Bikker, H.J. van Egmond, Y. Hoffmans, J.G.J. Mol, 2020. *Potential presence of pesticide residues in feed, requiring single residue methods (SRM); Probability of exceedance of EU legal residue limits in feed materials imported from non-EU countries, due to differences in legislation between the EU and third countries.* Wageningen, Wageningen Food Safety Research, WFSR report 2020.002. 46 pp.; 1 fig.; 27 tab.; 42 ref.

Project number: 1227186001
BAS-code: WOT-02-004-013
Project title: Juridische eisen met betrekking tot analyse- en bemonsteringsmethoden gebruikt in het opsporingsonderzoek van diervoeders en diervoedergrondstoffen
Project leader: P. Bikker

This report can be downloaded for free at https://doi.org/10.18174/520267 or at www.wur.eu/food-safety-research (under WFSR publications).

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WFSR report 2020.002

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Preface

Wageningen Food Safety Research (WFSR), part of Wageningen University & Research, supports the Dutch government in the implementation of laws and regulations that are needed for safe food and healthy animals, and to guarantee a sustainable environment. Those research tasks that are mandatory by law are called 'statutory research tasks'. Within the context of these tasks, WFSR performs research in the field of food and feed safety.

This report is meant to give competent authorities, and possibly the feed industry, tools to strengthen the risk-based monitoring of pesticides in feed materials originating from outside the EU.

Summary

Pesticides are widely used on food and feed crops to control pests. As a result, residues of pesticides may be present in feed materials. Regulation (EC) No 396/2005 sets maximum residue limits (MRLs) for pesticides in or on food and feed of plant and animal origin (European_Parliament_and_Council, 2005). These MRLs are mostly based on good agricultural practices (GAP) for the EU situation. In countries outside the EU, different GAPs may apply and pesticides which are not or no longer registered in the EU may still be used. As a consequence, feed materials imported from countries outside the EU may contain residues of pesticides that exceed the EU-MRL, irrespective of their application in the EU. The aim of this study was to identify such feed materials, imported from third countries, i.e. countries outside the EU, that may contain higher residues of specific pesticides than permitted in the EU. This study focussed on so-called SRM (single residue method) pesticides which cannot be measured by multi-residue analytical method(s). These pesticides were prioritised because inclusion in monitoring programs may add substantially to the analyses costs in case all feed samples would need to be analysed. A risk-based approach, taking into account, amongst others, the probability of MRL exceedances for different feed materials, could reduce the number of samples to be analysed while still being effective.

The risk-based approach contained the following steps:

1. Selection of SRM pesticides, based on EU MRL information and expert opinions.
2. Inventory of the most relevant feed materials in combination with country of origin. This step was limited to feed materials with a usage-volume above 100,000 tonnes per year in compound feed in the Netherlands.
3. Evaluation of the (potential) use of SRM pesticides in the selected relevant feed materials (crops) using the pesticide manual book.
4. Investigation of the applicable legal limits (EU-MRL's, Codex Alimentarius MRL's and third country MRL's) for the relevant feed material (crop) - pesticide combinations using different databases and legal documents, with help of Dutch embassies/agricultural attachés in third countries.
5. Priority ranking of SRM pesticide - feed material combinations. Priority 1 combinations were defined as SRM pesticide / feed material combinations from third countries with higher MRLs than those in the EU. Priority 2 combinations were defined as pesticide - feed material combinations from third countries showing ambiguities in legislation.

Results of this study showed that 84 "feed material - SRM pesticide - country of origin combinations" were given priority 1, and 22 combinations priority 2.
The results provide a good indication of which SRM pesticide residues may be expected in certain bulk feed materials from certain third countries and can be used to strengthen the risk-based monitoring of pesticides in feed materials in the National Plan Animal Feed. It is recommended to repeat this study after three to five years because the use of pesticide, feed materials and their country of origin may change over time. Also, the study may be expanded to other feed materials and pesticides that can potentially be included in multi-residue methods.

1 Introduction

Pesticides are widely used on food and feed crops to control pests. As a result, residues of pesticides may be present in feed materials. Regulation (EC) No 396/2005 sets maximum residue limits (MRLs) for pesticides in or on food and feed of plant and animal origin. These MRLs are mostly based on good agricultural practise (GAP) for the EU situation. When not approved in the EU, or when application according to GAP does not leave any residue, no residues should be found. In these cases, a default MRL of 0.01 mg/kg applies, unless a higher limit of determination has been specified in the legislation.

The number of pesticides used world-wide is very high and it is challenging if not impossible to analyse all of them in all types of sample materials. Multi residue methods are a cost effective way of covering hundreds of pesticides in one analysis method. However, not all pesticides are amenable to multi-residue methods, due their deviating physical chemical properties. For these pesticides additional dedicated methods are required. Such methods may include only one pesticide, and are therefore referred to as Single Residue Methods (SRM). If several SRM pesticides need to be analysed, several SRM methods may be needed. The time, effort and costs of one SRM method providing information on just one pesticide residue may be similar to that of a multi-residue method covering 100s of pesticides residues. For this reason, monitoring and control of pesticide residues is often done using multi-residue methods and SRM methods are not or only to a very limited extend used. As a consequence, SRM pesticides may remain unnoticed in monitoring and control programs. A well-known example is paraquat that was 'suddenly' found in soybean (products) in 2016, at levels exceeding the EU MRL. As paraquat is not approved for use in the EU, residues are not expected and a an MRL at the level of determination, in this case 0.02 mg/kg applies.

In addition to paraquat, there are a number of other SRM pesticides which are not regularly monitored. Following frequent MRL exceedances of paraquat in feed materials, the question at the start of this project was whether feed materials, imported from third countries, i.e. countries outside the EU, might also contain residues of other pesticides above EU MRLs. These residues may not be detected due to limited monitoring of pesticides which require a SRM. Therefore this project was conducted with the aim to identify feed material-pesticide combinations imported from countries outside the EU that may contain higher residues than permitted in the EU, which are not detected through the multi-residue method.

Member States are obligated to base their official controls on a risk-based approach, as prescribed in Article 9 of Regulation (EU) 2017/625 (European_Parliament_and_Council, 2017). Since not all SRM pesticides can be measured in all feed samples, because of limitations in budget and labour, this project aims to provide a priority list of pesticide residues potentially present in imported feed materials from third countries. The results can be used for the National Plan Animal Feed to strengthen risk-based monitoring, i.e. based on expected occurrence of residues.

Presence of residues above MRLs is not the only concern with regard to pesticides. The European Commission has recognised an increasing trend of trade and use of illegal pesticides within the EU. Plant protection products which either contain unauthorised substances, no active substances at all, products not authorised as such or illegal copies of authorised brand products constitute an increasing concern in the EU. The study of the European Commission on trade of illegal and counterfeit pesticides in the EU revealed that up to 10% of the plant protection products in the EU are illegal according to one of the above mentioned reasons (European_Commission, 2015). Thus, the results of this study may also be relevant for the monitoring of residues of SRM pesticides in feed materials of EU origin.

2 Materials and methods

This chapter firstly, outlines which materials and sources were used to conduct this study and secondly, explains how these materials were used in several steps to ultimately derive a priority list for monitoring of potential pesticide residues in animal feed imported from third countries into the Netherlands.

2.1 Materials and resources

For this study, information was obtained from the resources summarised below.

Pesticide Manual
British Crop Protection Council, 2015 – The Pesticide Manual: A world Compendium, 17th Edition. The pesticide manual is a book which provides information on globally used active ingredients and their potential crop applications. The book contains the most comprehensive information on active ingredients used for worldwide pest control in crops.

Feed material catalogue
Commission Regulation (EU) No 68/2013 (OJ L 29, 30.1.2013, p.1) last amended by Commission Regulation (EU) 2017/1017 of 15 June 2017 (OJ L 159, 21.6.2017, p. 48).
This EU regulation outlines labelling requirements for feed materials. It includes the most comprehensive, although not exhaustive, official list of feed materials publicly available. The feed material catalogue is primarily meant for labelling purposes. It indicates which ingredients may be possibly used within the EU as feed material, but it does not contain information on the practical relevance and use of these materials. Therefore, selection of feed materials was further based on the risk feed model, as indicated below.

Risk feed model
This WFSR excel model (version: RiskFeed_20171130) as described by van der Fels-Klerx et al. (2017) includes the quantities of a number of feed materials used in compound feed in the Netherlands in the years 2013 – 2016 and the volume of compound feed produced. Data are obtained from the Dutch organisations SecureFeed, NEVEDI and CBS. Imported volumes of feed materials in relation to country of origin are also indicated for EU and non-EU countries (third countries). These quantities are based on EUROSTAT data. Because of the quantitative information on import and use of feed materials in the Risk feed model, it was considered suitable for use in the present study.

New Zealand Overview of MRL legislation
This data source provides on a website (New_Zealand_Food_Safety, 2019) manuals on how to extract information on pesticide regulation from several countries.

US Department of Agriculture – Foreign Agriculture Service (FAS)
The FAS (Foreign_Agricultural_Service, ND) of the US department of agriculture provides information on food safety legislation from many countries around the world. The published country reports are checked for information on pesticide regulation for the relevant countries.

FAOLEX Database
The FAOLEX database (FAO, ND) is a comprehensive collection of legislative and policy documents of national laws around the world. The database is checked for information on pesticide regulation for the relevant countries.

EU Pesticide Database
The EU Pesticide Database (European_Commission, 2020) outlines the established pesticide MRLs from Regulation (EC) No 396/2005 in a digital form with the possibility to search for active substances, products or MRLs of pesticides in products.

Codex Alimentarius Pesticide Database
The pesticide database (FAO&WHO, 2020) outlines MRLs for pesticide/ commodity combinations which are adopted by the Codex Alimentarius Commission up to and including its 39th Session of July 2016. MRLs are established for foods and for certain animal feed categories.

2.2 Methods

The following steps explain the approach taken for this project. More in depth- information, including the considerations for certain decisions, have been explained in the results in Chapter 3.

2.2.1 Step 1: Preparation of a list of SRM pesticides

As a first step, an inventory was made of pesticides of which analyses of residues cannot be included in multi-residue methods. For this, information from the EURL of pesticides needing single residue methods (EURL-SRM, CVUA, Stuttgart, Germany) and the experience and knowledge of in-house experts on pesticide residue analyses were used. This resulted in a gross list of 34 SRM pesticides that served as a starting point to be further used in the subsequent steps.

2.2.2 Step 2: Selection of most relevant feed materials

In this second step the most relevant commodities with an importance for animal feed were extracted by using information from the feed material catalogue and the risk feed model (see chapter 2.1). In particular the information from the risk feed model was used as this file provides an estimate of the actual usage of the raw materials in the Netherlands in terms of volumes in the years 2013 – 2017 as well as the countries of origin from which these materials are imported.

2.2.3 Step 3: Identification of crops for application of SRM pesticides

The third step aimed to link the SRM pesticides to the use in relevant crops. The pesticide manual book indicates on which crops the pesticides are applied. This information was extracted and subsequently compared with the information from the Risk Feed model and the feed material catalogue to determine which crops are relevant as source of feed materials. For example, the pesticide captan may be applied on pome fruit, stone fruit, citrus fruit and tomatoes, but only citrus fruit is relevant for animal feed as citrus pulp is included in the risk feed model.

Subsequent combination of step 1 – 3 to derive a list of pesticides related to feed materials, and to the most important non-EU import countries for these feed materials in the period 2013 – 2017.

2.2.4 Step 4: EU-MRLs for the SRM pesticides indicated in Step 1

In this step EU-MRLs for the relevant SRM pesticides from step 1 in agricultural commodities (crops) are summarised. The EU pesticide database was consulted to derive the legal limits. Some of the pesticides from step 1 were excluded as their application on crops was not related to the relevant feed materials.

2.2.5 Step 5: MRLs from Codex Alimentarius

In this step the MRLs as established by Codex Alimentarius were presented for the selected relevant pesticides. Limits from the Codex Alimentarius Database were used as it is an international collection of standards which are commonly accepted and applied in countries which have a less comprehensive food safety and regulatory system compared to the EU (e.g. Latin America). Moreover, in this project

the MRLs established by Codex Alimentarius were also assumed to be applied in countries, for which no information on pesticide regulation or MRLs was found. Codex standards on pesticides refer to different categories of commodities, such as 'Primary Animal Feed Commodities' (e.g. 'Forage Crops', 'Legume Animal Feeds' and 'Straw, Fodder and Forage of Cereal Grains and Grasses'), primary food commodities of animal or plant origin, but also processed foods of plant or animal origin. 'Processed Foods of Plant Origin' is categorized inter alia in 'By-Products, Used for Animal Feeding Purposes, Derived from Fruit and Vegetables' and 'Cereal Grain Milling Fractions' which comprise several products (e.g. citrus pulp, sugar beet pulp, soya bean meal, cotton seed meal, and maize meal) used for animal feeding purposes. Nonetheless, the list of pesticides outlined for these feed materials are either limited to only a few pesticides or not established yet.

2.2.6 Step 6: Consultation of third country legislation on pesticides (MRLs)

For the relevant countries retrieved in 'Result A from step 1 – 3' information on pesticide regulation and MRLs are retrieved. To retrieve information the following three sources are consulted (see above):

- New Zealand Overview of MRL legislation
- US Department of Agriculture – Foreign Agriculture Service (FAS)
- FAOLEX Database

For countries from which no information could be retrieved via these three sources, the NVWA requested the Dutch embassies in the respective third countries (agricultural attachés) to assist in obtaining the correct information.

2.2.7 Step 7: combination and prioritisation

In this step the information on potential use of SRM pesticides on crops, relevant as source of feed materials imported from different countries (step 1-3) is combined with the MRLs for the commodities as applied in the EU (step 4), Codex Alimentarius (step 5) and the relevant import countries (step 6). With this information, a priority list is derived as defined below.

Priority 1:
SRM pesticide / feed material combinations from third countries with higher MRLs than EU limits
Feed materials from third countries with known higher MRLs than EU limits are defined as priority number 1. Higher MRLs in the third countries may be either derived from own legislation or from Codex Alimentarius in case these standards are followed in the third countries.

Priority 2:
Other pesticide / feed material combinations
Combination of pesticide / feed materials are included on the priority list 2 in case of ambiguities, which are explained for each specific case in chapter 3. For example if a third country indicates in general to follow pesticide laws from either one of two countries, without specifying which one is followed in practice, and at least one of these countries has higher MRLs than the EU. Another example is if an MRL in the third country refers to a specific food group rather than to the specific crop and the standard does not outline whether this crop belong to the mentioned food group.

3 Results

The results are presented in the order of the adopted workflow as described in chapter 2. Each of the following subchapters corresponds to one step in the workflow, explaining the main results of each step, how the results were retrieved, and if applicable why and where a certain focus was laid.

3.1 Step 1: Preparation of a list of SRM pesticides

The following list of 34 pesticides includes the SRM pesticides, which were investigated in this study (Table 1). Some pesticides on this list were excluded from this research, for reasons described in the corresponding footnotes of Table 1. Consequently, 27 pesticides were included for further assessment.

Table 1 *List of SRM pesticides investigated upon relevance for potential residues in animal feed. Pesticides in parenthesis were excluded from further assessment for reasons mentioned below.*

Pesticides (active ingredient)		
amitraz	ethephon	mepiquat
amitrole	fenbutatinoxide	methyl-bromide
captan	fentin	(nereistoxin)[1)]
chlormequat	fluazifop / fluazifop-butyl[2)]	nicotine
chlorothalonil	folpet	paraquat
cyhexatin	fosetyl aluminium	(phosphine)[3)]
cyromazine	glufosinate	(trifluoroacetic acid (TFA))[4)]
daminozide	glyphosate	(difluoroacetic acid (DFA))[4)]
dicofol	haloxyfop / haloxyfop-esters[2)]	(chlorate)[5)]
difenzoquat	kasugamycin	(perchlorate)[6)]
diquat	maleic hydrazide	(quartenary ammonium compounds (BAC, DDAC))[7)]
dithianon		

1) Excluded from our assessment, as not indicated in the Pesticide Manual Book (see Chapter 3 – Step 3).

2) The pesticides fluazifop / fluazifop-butyl and haloxyfop / haloxyfop-esters are often applied as butyl-ester. Modern formulations contain the P-isomer (e.g. fluazifop-p and fluazifop-p-butyl), therefore all four forms are considered for this study. Plant conjugates are included in the residue definition, which require a dedicated method for analysis.

3) Phosphine is a fumigant ((highly) volatile substance) which can be formed from the pesticides aluminium phosphide, calcium phosphide, magnesium phosphide and zinc phosphide, excluded from our assessment.

4) TFA and DFA are metabolites that may originate from many pesticides and from other sources as well. At present these metabolites are excluded from our assessment.

5) Strong oxidant with herbicidal/biocidal activity, no longer authorized in EU since 2008 but frequently found, due to chlorinated water used for irrigation or washing. This pesticide is excluded from our present assessment.

6) Mainly found due to use of fertilizers. This pesticide is excluded from our present assessment.

7) Biocides, excluded from our assessment.

3.2 Step 2: Selection of most relevant feed materials

This step identified the most relevant commodities used in the Dutch feed industry. Information was gathered from two sources, the Risk feed model and the feed material catalogue (see Chapter 2.1 and 2.2). Results were included in an excel-file using the feed material categories from the risk feed model. The risk feed model includes a list of 97 feed materials, from which feed materials of animal origin and micronutrients (e.g. minerals and trace elements) were excluded in the present study into pesticide residues. A further prioritisation was based on the use of feed materials in compound feed by

selecting products with a usage volume in the Netherlands above 100,000 tonnes per year in either of the last five years (2013- 2017). The last five years were used to account for annual fluctuations in import and use of agricultural products from different countries. Products with a usage volume above (left column) and below (right column) 100,000 tonnes were distinguished in Table 2.

Table 2 *Feed materials of plant origin above and below an annual usage volume of 100,000 tonnes in compound feed in the Netherlands to be investigated upon relevance for potential residues in animal feed.*

Feed materials with annual use above 100.000 tonnes	Feed materials with annual use below 100.000 tonnes
Cereal grains	**Cereal grains**
Wheat	Rye
Barley	Sorghum
Maize	Buckwheat
Triticale	CCM (Corn Cob Mix)
Oats	Other cereal grains
Cereal grain by-products	**Cereal grain by-products**
Wheat products	Rice by-products
Maize products	By-products other cereal grains
Bakery products[1)]	DDGS (dried distillers grains with solubles)
Oilseed by-products	**Oilseed by-products**
Soya expeller/extracted	Coconut/copra expeller/extracted
Sunflower seed expeller/extracted	Maize germ meal
Palm kernel expeller/extracted	Linseed expeller/extracted
Rapeseed, expeller/extracted	Groundnut expeller/extracted
Maize gluten feed	Cottonseed expeller/extracted
Soya hulls	Soya concentrate
Rumen-protected rapeseed extracted[2)]	Maize gluten meal
Rumen-protected soya extracted[2)]	**Legumes**
Others	Pea
Sugar beet pulp	Lupines
Citrus pulp	Beans
Sugar cane molasses	**Oil seeds**
Beet molasses	Soybean
Vinasse[3)]	Rapeseed
	Linseed
	Sunflower seeds
	Others
	Miscellaneous seeds
	Algae
	Manioc
	Grass-/clover-/alfalfa meal
	Potato protein
	Protapec
	Vegetable oils and fats

1) Bakery products' were excluded as they cannot be related to a specific crop-type.

2) Rumen-protection is a process generally conducted within the Netherlands, but the soybean meal and rapeseed meal used as a source are included in the research.

3) Vinasse is mainly derived from sugar beet and sugar cane molasses.

Products with a usage volume below 100.000 tonnes (right column of Table 2) were excluded from this study. Nonetheless, rapeseed, soybean, and sunflower seed were included since these oil seeds are imported in large quantities and further processed in the Netherlands. The derived rapeseed meal, soybean meal and sunflower seed meal is used in animal feed and may contain residues from pesticides applied in the countries from which the oil seeds were imported.

3.3 Step 3: Identification of crops for application of SRM pesticides

In Step 3 the SRM pesticides from Step 1, except the ones which were already excluded, were linked to agricultural crops with a relevance in the diet of farm animals, using the pesticide manual. Crop names were extracted from this pesticide manual, compared with the feed materials from the risk feed model (see Step 2) and the relevant crops were included in Table 3. Subsequently, pesticide-crop combinations were not studied when the usage-volume of the related feed material was below 100,000 tonnes. For this reason, the following crops were excluded: cotton, potatoes, rye, coconut palms, rice, peanut, linseed, alfalfa, clover, pea, bean, grass seed crops, and manioc.

Table 3 *SRM pesticides with relevance for animal feed ingredients related to agricultural crops relevant as source of feed materials.*

SRM pesticide	Crop application
Amitraz	Citrus fruit, Cotton
Amitrole	Citrus fruit
Captan	Citrus fruit, Potatoes, Maize, Oilseed rape
Chlormequat chloride	Wheat, Rye, Oats, Triticale, Cotton, Sugar cane
Chlorothalonil	Citrus fruit, Coconut palms, Oil palms, Rice, Soybeans, Peanuts, Potatoes, Sugar beet, Cotton, Maize
Cyhexatin	Citrus fruit
Cyromazine	Potatoes
Difenzoquat metilsulfate	Barley, Wheat, Rye, Maize, Flax (linseed)
Diquat dibromide	Cotton, Flax, Alfalfa, Clover, Lupins, Oilseed rape, Soybeans, Peas, Beans, Sunflower, Maize, Rice, Sugar beet, Citrus fruit, Sugar cane
Dithianon	Citrus fruit
Ethephon	Citrus fruit, Sugar beet, Maize, Flax, Cotton
Fenbutatinoxide	Citrus fruit
Fentin acetate	Potatoe, Sugar beet, Beans
Fentin hydroxide	Potatoe, Sugar beet, Soybeans
Fluazifop (fluazifop butyl)	Pea, Clovers, Oilseed rape, Sugar beet, Potatoes, Cotton, Soybeans, Peanuts, Sunflowers, Alfalfa
Fluazifop-P (fluazifop-p-butyl)	Oilseed rape
Folpet	Citrus fruit, Potatoes
Fosetyl aluminium	Citrus fruit
Glufosinate	Oil palm, Potatoes, Sunflowers, Oilseed rape, Maize, Soybeans, Sugar beet
Glyphosate[1)]	Peas, Beans, Oilseed rape, Flax, Soybeans, Maize, Sugar beet, Alfalfa, Cotton, Sorghum
haloxyfop	Sugar beet, Oilseed rape, Potatoes, Flax, Sunflowers, Soybeans
Haloxyfop-P	Sugar beet, Oilseed rape, Potatoes, Flax, Sunflowers, Soybeans
kasugamycin	Rice, Sugar beet, Potatoes
Maleic hydrazide	Potatoes
	Citrus fruits
Mepiquat chloride	Cotton, Grass seed crops, Flax
Paraquat dichloride	Citrus fruit, Coconut palms, Oil palms, Alfalfa, Sugar beet, Cotton, Sugar cane, Soybeans, Sunflowers
Aluminium phosphide (Phosphine)	Wheat, Rye, Barley, Rice, Sorghum, Maize, Peas, Beans, Manioc

1) For Glyphosate, additional crops were added which were not mentioned in the pesticide manual: soybean, maize, sugar beet, alfalfa, cotton and sorghum. This is because these crops can be 'Roundup Ready crops'. These crops are genetically modified to be resistant against the herbicide Roundup containing the active ingredient glyphosate. Being resistant to Roundup, the herbicide can be sprayed on the field to kill other weeds around the crops. As a consequence, Roundup Ready crops may contain glyphosate residues. Roundup Ready wheat is currently under development but not yet included in this study (Roundup_Ready_Crops, 2009), (Wikipedia, 2020).

After this step, seven pesticides were excluded from this study, as they are either not relevant for crop application in general or not applied on crops related to the feed categories mentioned in the risk feed model. The following pesticides were excluded: Daminozide, Dicofol, Methyl bromide, Nicotine, Calcium phosphide (Phosphine), Magnesium phosphide (Phosphine), and Zinc phosphide (Phosphine). The SRM pesticide nereistoxin was not found in the pesticide manual, and consequently also excluded from the research. In total, 27 pesticides remained (Table 3).

3.4 Combination of steps 1-3, with relevant feed materials

This step combined the information gathered in Step 1 to 3 by linking the relevant pesticide-crop combination (Step 3) with the feed materials with an annual usage-volume above 100,000 tonnes (Step 2). Thus, the list created in Step 3 is further narrowed down to only feed materials with the highest commercial usage. This is indicated in the third column of the Table 4. Feed materials with a usage-volume below 100,000 tonnes were included in the fourth column. These were excluded from the present research, but may receive attention in a later stage. All pesticide – crop combinations with derived feed material above 100,000 tonnes were included in the next steps of this study. Three pesticides were excluded in this step:

- Cyromazine, not linked to feed materials with usage-volume above 100,000 tonnes;
- Mepiquat chloride, not linked to feed materials with usage-volume above 100,000 tonnes;
- Aluminium phosphide, applied on stored grains. Pesticide residues will evaporate after this pesticide comes into contact with air. Therefore, the presence of residues was considered highly unlikely.

Table 4 *Combination of SRM pesticides, crops on which these pesticides are being used and derived feed materials that may consequently contain pesticide residues.*

SRM pesticide	Crop application	Derived feed materials with annual usage above 100.000 tonnes	Derived feed materials with annual usage below 100.000 tonnes
Amitraz	Citrus fruit	Citrus pulp	
	Cotton	-	Cottonseed expeller/extracted
Amitrole	Citrus fruit	Citrus pulp	
Captan	Citrus fruit	Citrus pulp	
	Potatoes	-	Potato protein
		-	Protapec
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Oilseed rape	Rapeseed expeller/ extracted	
		Rapeseed*	
Chlormequat chloride	Wheat	Wheat	
		Wheat products	
	Rye	-	Rye
	Oats	Oats	
	Triticale	Triticale	
	Cotton	-	Cottonseed expeller/extracted
	Sugar cane	Sugar cane molasses	
		Vinasse	
Chlorothalonil	Citrus fruit	Citrus pulp	
	Coconut	-	Coconut expeller/extracted
	palms	-	Coconut fat
	Oil palms	Palmkernel expeller/ extracted	
	Rice	-	Rice by-products
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Peanuts	-	Groundnut expeller/extracted
	Potatoes	-	Potato protein
		-	Protapec
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Cotton	-	Cottonseed expeller/extracted
	Maize	Maize	
		Maize products	

SRM pesticide	Crop application	Derived feed materials with annual usage above 100.000 tonnes	Derived feed materials with annual usage below 100.000 tonnes
		Maize gluten feed	
Cyhexatin	Citrus fruit	Citrus pulp	
Cyromazine	Potatoes	-	Potato protein
		-	Protapec
Difenzoquat metilsulfate	Barley	Barley	
	Wheat	Wheat	
		Wheat products	
	Rye	-	Rye
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
Diquat dibromide	Cotton	-	Cottonseed expeller/extracted
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
	Alfalfa	-	Grass-/clover-/alfalfa meal
	Clover	-	Grass-/clover-/alfalfa meal
	Lupine	Lupine	
	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Peas	-	Pea
	Beans	-	Beans
	Sunflower	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Rice	-	Rice by-products
	Sugar beet	Dried beet pulp	
		Vinasse	
		Sugar beet molasses	
	Citrus fruit	Citrus pulp	
	Sugar cane	Molasses	
		Vinasse	
Dithianon	Citrus fruit	Citrus pulp	
Ethephon	Citrus fruit	Citrus pulp	
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
	Cotton	-	Cottonseed expeller/extracted
Fenbutatinoxide	Citrus fruit	Citrus pulp	
Fentin acetate	Potatoes	-	Potato protein
		-	Protapec
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Beans	-	Beans
Fentin hydroxide	Potatoes	-	Potato protein
		-	Protapec
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
Fluazifop (fluazifop butyl)	Pea	-	Pea
	Clovers	-	Grass-/clover-/alfalfa meal
	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Sugar beet	Dried beet pulp	

SRM pesticide	Crop application	Derived feed materials with annual usage above 100.000 tonnes	Derived feed materials with annual usage below 100.000 tonnes
		Vinasse	
		Molasses	
	Potatoes	-	Potato protein
		-	Protapec
	Cotton	-	Cottonseed expeller/extracted
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Peanuts	-	Groundnut expeller/extracted
	Sunflowers	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
	Alfalfa	-	Grass-/clover-/alfalfa meal
Fluazifop-P (fluazifop-p-butyl)	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Potatoes	-	Potato protein
		-	Protapec
	Cotton	-	Cottonseed expeller/extracted
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Citrus fruit	Citrus pulp	
	Sunflower	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
	Alfalfa	-	Grass-/clover-/alfalfa meal
	Pea	-	Pea
	Clovers	-	Grass-/clover-/alfalfa meal
Folpet	Citrus fruit	Citrus pulp	
	Potatoes	-	Potato protein
		-	Protapec
Fosetyl aluminium	Citrus fruit	Citrus pulp	
Glufosinate	Oil palm	Palmkernel expeller/ extracted	
	Potatoes	-	Potato protein
		-	Protapec
	Sunflowers	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
Glyphosate	Peas	-	Pea
	Beans	-	Beans
	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Alfalfa	-	Grass-/clover-/alfalfa meal
	Cotton	-	Cottonseed expeller/extracted
	Sorghum	-	Sorghum
haloxyfop	Sugar beet	Dried beet pulp	
		Vinasse	

SRM pesticide	Crop application	Derived feed materials with annual usage above 100.000 tonnes	Derived feed materials with annual usage below 100.000 tonnes
		Molasses	
	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Potatoes	-	Potato protein
		-	Protapec
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
	Sunflowers	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
Haloxyfop-P	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Oilseed rape	Rapeseed expeller/extracted	
		Rapeseed*	
	Potatoes	-	Potato protein
		-	Protapec
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
	Sunflowers	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
kasugamycin	Rice	-	Rice by-products
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Potatoes	-	Potato protein
		-	Protapec
Maleic hydrazide	Potatoes	-	Potato protein
		-	Protapec
	Citrus fruits	Citrus pulp	
Mepiquat chloride	Cotton	-	Cottonseed expeller/extracted
	Grass seed crops	-	Grass-/clover-/alfalfa meal
	Flax (linseed)	-	Linseed
		-	Linseed expeller/extracted
Paraquat dichloride	Citrus fruit	Citrus pulp	
	Coconut palms	-	Coconut expeller/extracted
		-	Coconut fat
	Oil palms	Palmkernel expeller/ extracted	
	Alfalfa	-	Grass-/clover-/alfalfa meal
	Sugar beet	Dried beet pulp	
		Vinasse	
		Molasses	
	Cotton	-	Cottonseed expeller/extracted
	Sugar cane	Molasses	
		Vinasse	
	Soybeans	Soya expeller/extracted	
		Soya hulls	
		Soybeans*	
	Sunflowers	Sunflowerseed expeller/ extracted	
		Sunflower seed*	
Aluminium phosphide	Wheat	Wheat	
		Wheat products	
	Rye	-	Rye
	Barley	Barley	
	Rice	-	Rice by-products
	Sorghum	-	Sorghum
	Maize	Maize	
		Maize products	
		Maize gluten feed	
	Peas	-	Pea
	Beans	-	Beans
	Manioc	-	Manioc

After these steps, 24 pesticides remained to be investigated. Some of these pesticides have a wide range of crop-applications relevant for the purpose of this study (e.g. chlorothalonil on citrus fruits, oil palms, soybeans, sugar beet and maize; diquat dibromide on lupine, rapeseed, soybeans, maize, sugar beet, citrus fruits and sugar cane), whereas others are limited to only one or a few crops (e.g. amitrole and dithianon, only for citrus fruits). Citrus fruits is a group of crops with a wide range of different pesticides potentially being applied (amitraz, amitrole, captan, chlorothalonil, cyhexatin, diquat, dithianon, ethephon, fenbutatinoxide, fluazifop, fluazifop-P, folpet, fosetyl aluminium, maleic hydrazide, paraquat). The same is true for potatoes. However, this crop is of minor importance in this study since potato-related feed products have a usage-volume below 100,000 tonnes in compound feed.

After linking the pesticides to the relevant feed materials, the next step was to identify the most important import countries for these products. This step was based on the import quantities from third countries in the years 2013-2016, as indicated in the risk feed model and selecting the countries collectively supplying the majority of the import of this feed material. For example for citrus pulp four countries were identified to be the most relevant (Brazil, USA, Mexico, Costa Rica), whereas for maize seven countries were selected (Brazil, Canada, USA, Argentina, Turkey, Serbia and Ukraine). The following tables include the results from linking the relevant feed materials to the import countries. Table 5 shows the crops which were considered relevant for investigation upon pesticide residues, as they have relevant import quantities from third countries (column 2). Column 3 shows which feed materials were excluded as they are largely imported from EU countries.

Table 5 *Crops and derived feed materials largely imported from EU countries or with major imports from third countries outside EU.*

Crop	Feed materials with major non-EU imports (third countries)	Feed materials obtained from EU countries
Barley	Barley	-
Citrus fruit	Citrus pulp	-
Lupine	Lupine	-
Maize	Maize	Maize products
		Maize gluten feed
Oat	-	Oat
Oil palm	Palmkernel expeller/extracted	-
Oilseed rape/ rapeseed	Rapeseed	Rapeseed expeller/ extracted
Soybean	Soya expeller/ extracted	-
	Soya hulls	-
	Soybeans	-
Sugar beet		Dried beet pulp
	-	Sugar beet (molasses)
		Vinasse
Sugar cane	Sugar cane molasses	-
	Vinasse	-
Sunflower	Sunflowerseed expeller/ extracted	-
	Sunflower seeds	-
Triticale	-	Triticale
Wheat	Wheat	Wheat products

For the selected crops, Table 6 presents the relevant non-EU import countries for each of the remaining feed materials and additionally provides the information which SRM pesticide residues may be potentially found on these crops or derived feed materials.

Table 6 *Crops, potentially used SRM pesticides and relevant non-EU import countries for derived feed materials.*

Crop	Feed material	Non-EU import countries	Remarks	Potentially used SRM pesticides
Barley	Barley	Ukraine	-	Difenzoquat metilsulfate
Citrus fruit	Citrus pulp	Brazil USA Mexico Costa Rica	Major import from Brazil and USA, minor import from Mexico and Costa Rica	Amitraz Amitrole Captan Chlorothalonil Cyhexatin Diquat dibromide Ethephon Fenbutatinoxide Fluazifop (fluayzifop-butyl) Fluazifop-P (fluazifop-P-butyl) Folpet Fosetyl aluminium Maleic hydrazide Paraquat dichloride
Lupine	Lupine	Australia Ukraine South Africa Russia	Major import from Australia, minor import from Ukraine, South Africa, Russia	Diquat dibromide
Maize	Maize	Brazil Canada USA Argentina Turkey Serbia Ukraine	Major and constant import from Brasil, Canada, USA, Argentina; fluctuating import from other countries	Captan Chlorothalonil Difenzoquat metilsulfate Diquat dibromide Ethephon Glufosinate Glyphosate
Oil palm	Palmkernel expeller/ extracted	Indonesia Malaysia	Major import from Indonesia	Chlorothalonil Glufosinate Paraquat dichloride
Oilseed rape/ Rapeseed	Rapeseed	Australia Ukraine Argentina Russia Turkey	Major import from Australia, Ukraine and Argentina, followed by Russia and Turkey	Captan Diquat dibromide Fluazifop (fluazifop-butyl) Fluazifop-P (fluazifop-butyl) Glufosinate Glyphosate Haloxyfop Haloxyfop-P
Soybean	Soya expeller/ extracted	Brazil Argentina China Uruguay Russia India USA	Major import from Brazil and Argentina, minor import from China, Uruguay, and Russia, fluctuating import from India and USA.	Chlorothalonil Diquat dibromide Fentin hydroxide Fluazifop (fluazifop-butyl) Fluazifop-P (fluazyifop-P-butyl) Glufosinate Glyphosate Haloxyfop Haloxyfop-P Paraquat dichloride
	Soya hulls	Argentina		Chlorothalonil Diquat dibromide Fentin hydroxide Fluazifop (fluazifop-butyl) Fluazifop-P (fluazyifop-P-butyl) Glufosinate Glyphosate Haloxyfop Haloxyfop-P Paraquat dichloride
	Soybean	USA Brasil Uruguay Canada Paraguay Argentina	Major import from USA and Brasil, followed by Uruguay, Canada, Paraguay, Argentina.	Chlorothalonil Diquat dibromide Fentin hydroxide Fluazifop (fluazifop-butyl) Fluazifop-P (fluazyifop-P-butyl) Glufosinate Glyphosate Haloxyfop Haloxyfop-P Paraquat dichloride

Crop	Feed material	Non-EU import countries	Remarks	Potentially used SRM pesticides
Sugar cane	Sugar cane molasses	India Thailand Pakistan USA Guatemala Nicaragua Mauritius Indonesia Algeria Mexico	Major and constant import from India, Thailand, Pakistan and USA.	Chlormequat chloride Diquat dibromide Paraquat dichloride
	Vinasse	Russia USA	Major import from Russia	Chlormequat chloride Diquat dibromide Paraquat dichloride
Sunflower	Sunflowerseed expeller/ extracted	Ukraine Argentina		Diquat dibromide Fluazifop (fluazifop-butyl) Fluazifop-P (fluazyifop-P-butyl Glufosinate Haloxyfop Haloxyfop-P Paraquat dichloride
	Sunflower seeds	Ukraine Russia China Turkey Argentina		Diquat dibromide Fluazifop (fluazifop-butyl) Fluazifop-P (fluazyifop-P-butyl Glufosinate Haloxyfop Haloxyfop-P Paraquat dichloride
Wheat	Wheat	Ukraine Turkey Russia Serbia Wheat Canada Kazakhstan	Major import from Ukraine, followed by the other countries.	Chlormequat chloride Difenzoquat metilsulfate

In total, 24 different pesticides and 25 different countries were selected, for which MRLs for relevant crops were to be determined. This summed up to 457 pesticide-crop/feed material-country combinations to be investigated. Figure 1 shows the pesticide-crop combinations per country. For example, Algeria has 3 combinations which include sugar cane/sugar cane molasses with the pesticides chlormequat, diquat and paraquat, whereas in China 17 combinations of soybean and sunflower seeds with 10 pesticides had to be investigated.

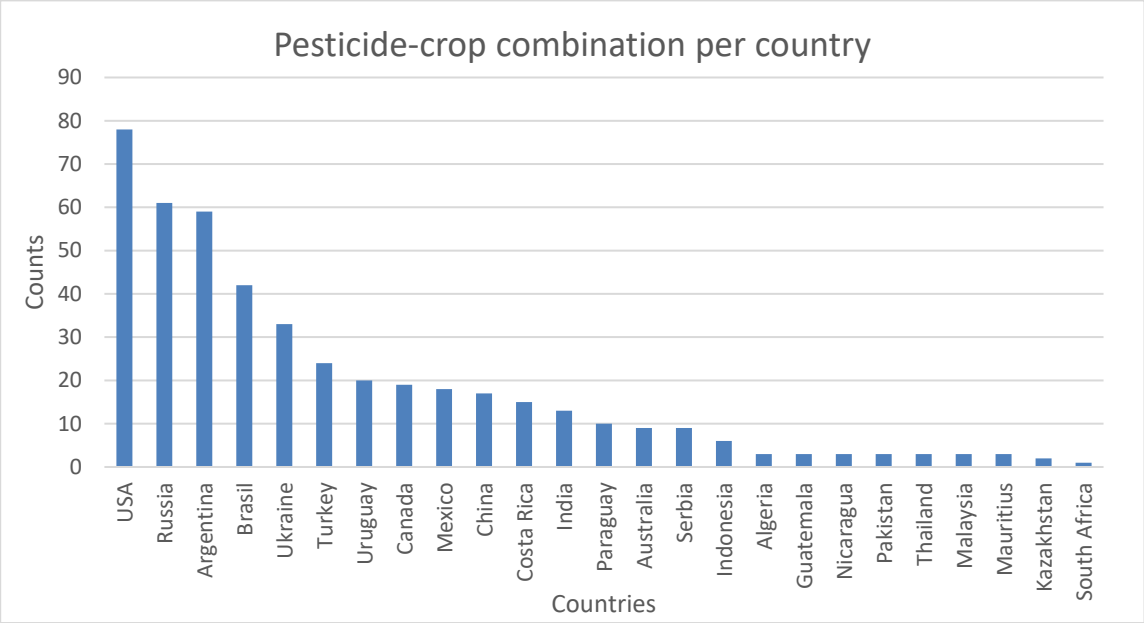

Figure 1 *Pesticide-crop combinations to be investigated per country.*

3.5 Steps 4-7: Legislation (MRL's) and monitoring priorities for each third country

For each of the 457 pesticide-crop/feed material-country combinations the corresponding EU-MRLs, Codex Alimentarius MRLs and third country MRLs were gathered.
Based on these MRLs the pesticide-crop/feed material-country combinations were given a priority score for monitoring:

- Priority 1: Established MRL in country of origin is higher than the legal limit in the EU. Therefore relevant to include in monitoring programs.
- Priority 2: Established MRL in country of origin might be higher than the EU MRL (situation is unclear). Therefore relevant to include in monitoring programs.
- Priority 3: Established MRL in country of origin is equal or lower than the legal limit in the EU. Therefore, no priority for inclusion in monitoring programs. However, the pesticide residues of these combinations may also exceed the national legal MRLs in the country of origin and should not be exempted by default from the general monitoring (see chapter 4).

In the accompanied Excel file, the MRLs of the third countries are marked with colours: priority 1 red, priority 2 yellow and priority 3 green. If no MRL is established in the third country, either not for the pesticide in general or not for the specific pesticide-crop combination and no information was found on whether Codex standards are followed in such cases, then no colour was given.

In the following sections the legislative sources for pesticide regulations and monitoring priorities for pesticide-feed material combinations of each individual country of origin are presented.

3.5.1 USA

The information regarding MRLs in the USA were retrieved from the 'Electronic Code of Federal Regulations' (e-CFR database) (U.S.Government, 2020b), (U.S.Government, 2020a). They are published and regularly updated in the following section:
TITLE 40—Protection of Environment
CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)
SUBCHAPTER E—PESTICIDE PROGRAMS
PART 180—TOLERANCES AND EXEMPTIONS FOR PESTICIDE CHEMICAL RESIDUES IN FOOD

Tolerances for residues on crops are indicated for the specific pesticides. Besides that, the legislation provides 'Crop group tables'. The MRLs for the pesticides are sometimes not specifically provided for a certain crop, but for the whole crop group. For instance sugar beet is included in crop group 1 'Root and Tuber Vegetables' and cereal types are mentioned in group 15 'Cereal Grains'.

In total 24 out of 78 pesticide-crop combinations (31%) have been included on the priority 1 list because of higher legal limits (see Table 7).

Table 7 *Monitoring **priority 1** of pesticide-feed materials combinations from the USA.*

SRM Pesticide	Crop with feed relevance	Feed materials derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlorothalonil	Soybean	Soybean	0.01[2)]	0.2
		Soya expeller/extracted	0.01[2)]	0.2
		Vinasse (may be derived from soybean)	0.01[2)]	0.2
diquat (dibromide)	Citrus fruit	Citrus pulp	0.02	0.05
	Soybean	Soybean	0.3	0.6 for soybean hulls
		Soya expeller/extracted	0.3	0.6 for soybean hulls
		Vinasse (may be derived from soybean)	0.3	0.6 for soybean hulls
	Sugar beet	Vinasse (may be derived from sugar beet)	0.01[2)]	0.02 (group 1)
	Sugar cane	Sugar cane molasses	0.01[2)]	0.2

SRM Pesticide	Crop with feed relevance	Feed materials derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
		Vinasse (may be derived from sugar cane)	0.01[2)]	0.2
fenbutatinoxide	Citrus fruit	Citrus pulp	5.0	20.0; 100 for citrus dried pulp
Fluazifop (fluazifop-butyl)	Citrus fruit	Citrus pulp	0.01[2)]	0.03; 0.40 for citrus dried pulp
Fluazifop-P (fluazifop-P-butyl)	Citrus fruit	Citrus pulp	0.01[2)]	0.03; 0.40 for citrus dried pulp
glufosinate	Maize	Maize	0.1	0.20 for maize; 4.0 for maize forage; 6.0 for maize stover
		Vinasse (may be derived from maize)	0.1	0.20 for maize; 4.0 for maize forage; 6.0 for maize stover
glyphosate	Maize	Maize	1.0	5.0 for maize; 13 for maize forage; 100 for maize stover
		Vinasse (may be derived from maize)	1.0	5.0 for maize; 13 for maize forage; 100 for maize stover
paraquat (dichloride)	Citrus fruit	Citrus pulp	0.02[2)]	0.05
	Soybean	Soybean	0.02[2)]	0.7 for soybean seed; 0.4 for soybean forage; 4.5 for soybean hulls; 10.0 for soybean hay
		Soya expeller/extracted	0.02[2)]	0.7 for soybean seed; 0.4 for soybean forage; 4.5 for soybean hulls; 10.0 for soybean hay
		Vinasse (may be derived from soybean)	0.02[2)]	0.7 for soybean seed; 0.4 for soybean forage; 4.5 for soybean hulls; 10.0 for soybean hay
	Sugar beet	Vinasse (may be derived from sugar beet)	0.02[2)]	0.5 for sugar beet roots; 0.05 for sugar beet tops
	Sugar cane	Sugar cane molasses	0.02[2)]	0.5 for sugar cane; 3.0 for sugar cane molasses
		Vinasse (may be derived from sugar cane)	0.02[2)]	0.5 for sugar cane; 3.0 for sugar cane molasses

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combinations for priority 2 monitoring were identified from the USA.

3.5.2 Russia

Two legislation were derived from Rospotrebnadzor legal texts (Federal_Service_for_Supervision_of_Consumer_Rights_Protection_and_Human_Well-Being, 2020): 'Federal Supervision Service in the Field of Protection of the Rights of Consumers and Human Welfare'. For pesticides the following two standards apply:

- *ГН 1.2.3111-13 от 21 октября 2013 г. N 55 "ГИГИЕНИЧЕСКИЕ НОРМАТИВЫ СОДЕРЖАНИЯ ПЕСТИЦИДОВ В ОБЪЕКТАХ ОКРУЖАЮЩЕЙ СРЕДЫ (ПЕРЕЧЕНЬ)" - Санитарные правила от 08.12.2013 № 55*

English translation (Google Translate):
GN 1.2.3111-13 dated October 21, 2013 N 55 "HYGIENIC STANDARDS FOR THE CONTENT OF PESTICIDES IN THE OBJECTS OF THE ENVIRONMENT (LIST)" - Sanitary regulations dated December 8, 2013 – No. 55

- *от 27.08.2015 № 40 «О внесении изменения № 1 в гигиенический норматив ГН 1.2.3111-13» (Зарегистрировано в Минюсте России 09.09.2015 № 38852) - Санитарные правила от №*

English translation (Google Translate):
No. 40, dated August 27, 2015, "On Amendment No. 1 to the Hygienic Standard GN 1.2.3111-13" (Registered in the Ministry of Justice of Russia September 9, 2015 No. 38852) - Sanitary Regulations

These two documents were only available in Russian. They were read by a WFSR colleague from Latvia. Besides that, the US FAS country report from Russia was consulted which refers to the 'Eurasia Economic Union – New Pesticide MRLs' report which is applicable for Russia and outlines the MRLs in agricultural products. This US report provides a non-official translation of the pesticides MRL in the Eurasian Economic Union.

In total 8 out of 61 pesticide-crop combinations (13%) are included on the priority 1 list because of higher legal limits (see Table 8).

Table 8 ***Monitoring priority 1*** *of pesticide-feed materials combinations from Russia.*

SRM Pesticide	Crop with feed relevance	Feed materials derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlorothalonil	Maize	Vinasse (may be derived from maize)	0.01[2)]	0.1 (cereals)
	Sugar beet	Vinasse (may be derived from sugar beet)	0.01[2)]	0.2
diquat (dibromide)	Sunflower	Sunflower seeds	0.9 for seeds	1.0 for seeds
ethephon	Maize	Vinasse (may be derived from maize)	0.05[2)]	1.0 (cereals)
	Sugar beet	Vinasse (may be derived from sugar beet)	0.05[2)]	0.5
glufosinate	Rapeseed/ oilseed rape	Rapeseed	1.5	5.0
	Sunflower	Sunflower seeds	0.03[2)] for seeds	5.0 for seeds
paraquat (dichloride)	Sunflower	Sunflower seeds	0.02[2)] for seeds	2.0 for seeds

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

Soybean was included on priority 2 list of Russia because certain pesticides were referred to either beans or legumes in general. In most cases, the term 'soybean' is exclusively mentioned in the standard, however, in other cases, soybean is specifically mentioned to be excluded from these two group (beans, legumes) whereas sometimes only the group names (beans, legumes) are mentioned. An explanation which vegetable belong to these two categories is not given in the respective legislation. Therefore, it cannot be concluded, whether soybean is meant to belong to either one or both categories.

In total 6 out of 61 pesticide-crop combinations (10%) are included on this priority 2 list (Table 9).

Table 9 *Monitoring priority 2 of pesticide-feed materials combinations from Russia.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlorothalonil	Soybean	Soya expeller/extracted	0.01[2)]	0.2 (dry beans)
		Vinasse (may be derived from soybean)	0.01[2)]	0.2 (dry beans)
glufosinate	Soybean	Soya expeller/extracted	2.0	3.0 (legumes)
		Vinasse (may be derived from soybean)	2.0	3.0 (legumes)
paraquat (dichloride)	Soybean	Soya expeller/extracted	0.02[2)]	0.5 (legumes)
		Vinasse (may be derived from soybean)	0.02[2)]	0.5 (legumes)

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

3.5.3 Argentina

The regulation outlining MRLs in agricultural products in Argentina was derived from the legislation information database (Ministerio_de_Justicia_y_Derechos_Humanos_Argentina, ND), (Ministerio_de_Justicia_y_Derechos_Humanos_Argentina, 2010) consulting an acquaintance from South America.
The MRLs are outlined in the following legal document:
Servicio Nacional de Sanidad y Calidad Agroalimentaria
PRODUCTOS AGROPECUARIOS
Resolución 934/2010
Establécense los requisitos que deben cumplir los productos y subproductos agropecuarios para consumo interno.

English translation (Google Translate):
National Service for Agrifood Health and Quality
AGRICULTURAL PRODUCTS
Resolution 934/2010
Establish the requirements that must be met by agricultural products and by-products for domestic consumption.

If MRLs are not listed in the Annex of this regulation, the standards established by Codex Alimentarius have to be adhered to. If no limits are given by Codex either, a default MRL of 0.01 mg/kg applies. Despite the fact that this standard applies do agricultural products for domestic consumption (locally produced or imported) it is assumed that it also covers agricultural products which are intended for export.
In total 16 out of 59 pesticide-crop combinations (27%) are included on the priority list no 1 because of higher legal limits (see Table 10).

Table 10 *Monitoring priority 1 of pesticide-feed materials combinations from Argentina.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlorothalonil	Soybean	Soybean	0.01[2)]	0.2
		Soya expeller/extracted	0.01[2)]	0.2
		Soya hulls	0.01[2)]	0.2
diquat (dibromide)	Maize	Maize	0.02[2)]	0.1
	Rapeseed/ oilseed rape	Rapeseed	1.5	2
	Sunflower	Sunflower seeds	0.9 for seeds	1.0 for seeds
		Sunflower seed expeller/extracted	0.9 for seeds	1.0 for seeds
haloxyfop	Sunflower	Sunflower seeds	0.4 for seeds	0.5 for seeds
		Sunflower seed expeller/extracted	0.4 for seeds	0.5 for seeds
haloxyfop-P	Sunflower	Sunflower seeds	0.4 for seeds	0.5 for seeds
		Sunflower seed expeller/extracted	0.4 for seeds	0.5 for seeds
paraquat	Soybean	Soybean	0.02[2)]	0.05; 0.1 for soya forage
		Soya expeller/extracted	0.02[2)]	0.05; 0.1 for soya forage
		Soya hulls	0.02[2)]	0.05; 0.1 for soya forage
	Sunflower	Sunflower seeds	0.02[2)] for seeds	0.05 for seeds
	Sunflower	Sunflower seed expeller/extracted	0.02[2)] for seeds	0.05 for seeds

1) Pesticides MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) Established MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified for Argentina.

3.5.4 Brazil

Brazil uses the Codex standards as a general reference, according to the legal document (*MERCOSUR/GMC/RES. N 15/16*) of MERCOSUR, the South American trade bloc between Argentina, Brazil, Paraguay and Uruguay, and the country report of the US FAS. These Codex standards are followed if no national MRLs for plant products are established. Information regarding MRLs in agricultural products in Brazil are outlined in a database of the Brazil Health Surveillance Agency (ANVISA) (AGÊNCIA_NACIONAL_DE_VIGILÂNCIA_SANITÁRIA, ND).
The standard for paraquat dichloride indicated that from 22 September 2020 onward the use of pesticides containing the active ingredient paraquat is forbidden. This decision is based on a toxicological re-evaluation carried out by ANVISA.

In total 12 out of 42 pesticide-crop combinations (29%) are included on the priority list no 1 because of higher legal limits (see Table 11).

With regard to Paraquat, the Brazilian Food Safety Agency has banned this active ingredient from 22.09.2020 onward due to new toxicological re-evaluation (see Step 6).

Table 11 *Monitoring priority 1 of pesticide-feed materials combinations from Brazil.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
amitraz	Citrus fruit	Citrus pulp	0.05[2)]	0.5 (foliar)
captan	Citrus fruit	Citrus pulp	0.03[2)]	15 (foliar)
	Maize	Maize	0.07[2)]	2.0 (sementes)
chlorothalonil	Citrus fruit	Citrus pulp	0.01[2)]	0.5 (foliar)
	Soybean	Soybean	0.01[2)]	0.5 (foliar)
		Soya expeller/extracted	0.01[2)]	0.5 (foliar)
Fluazifop (fluazifop-butyl)	Citrus fruit	Citrus pulp	0.01[2)]	0.05 (post emergency)
Fluazifop-P (fluazifop-P-butyl)	Citrus fruit	Citrus pulp	0.01[2)]	0.05 (post emergency)
folpet	Citrus fruit	Citrus pulp	0.03[2)]	10.0 (foliar)
paraquat (dichloride)	Citrus fruit	Citrus pulp	0.02[2)]	0.05 (post emergency) Banned from 22.09.2020 onwards
	Soybean	Soybean	0.02[2)]	0.1 (post emergency, desiccant) Banned from 22.09.2020 onwards
	Soybean	Soya expeller/extracted	0.02[2)]	0.1 (post emergency, desiccant) Banned from 22.09.2020 onwards

1) Pesticides MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) Established MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified for Brazil.

3.5.5 Ukraine

The official legal act on pesticides limits in Ukraine could not be retrieved by consulting the usual sources. Therefore, the NVWA provided information from the Dutch embassy in Ukraine. The contact person provided the right legislative act from the portal of the Parliament (VERKHOVNA_RADA_OF_UKRAINE, 2020), (Ministry_of_Health_of_Ukraine, 2001).
The legal limits are outlined in the following Decree:
Державні санітарні правила та норми ДСанПіН 8.8.1.2.3.4-000-2001
Допустимі дози, концентрації, кількості та рівні вмісту пестицидів у сільськогосподарській сировині, харчових продуктах, повітрі робочої зони, атмосферному повітрі, воді водоймищ, грунті

English translation (Google Translate):
State sanitary rules and norms ДСанПиН 8.8.1.2.3.4-000-2001 Permissible doses, concentrations, quantities and levels of pesticide content in agricultural raw materials, food products, air working area, atmospheric air, water reservoirs, soil
Since the document is only available in Ukrainian language, the contact person provided the MRLs for the requested pesticide-crop combination which are of interest for this study.

In total 1 out of 33 pesticide-crop combinations (3%) are included on the priority 1 list because of higher legal limits (see Table 12).

Table 12 *Monitoring priority 1 of pesticide-feed materials combinations from Ukraine.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
Ethephon	Maize	Maize	0.05[2)]	0.5 for cereals

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combinations for priority 2 monitoring were identified from Ukraine.

3.5.6 Turkey

The Turkish legislation outlining pesticide MRLs was derived from the electronic legislation information system (Mevzuat_Bilgi_Sistemi, ND), (Mevzuat_Bilgi_Sistemi, 2016). The legal limits are outlined in the following regulation:
TÜRK GIDA KODEKSİ PESTİSİTLERİN MAKSİMUM KALINTI LİMİTLERİ YÖNETMELİĞİ

English translation (Google Translate):
MAXIMUM THICKNESS OF TURKISH FOOD CODES PESTICITES LIMITATIONS REGULATION

The above mentioned legislation outlines in Art. 6 that MRLs for plant products are established in Annex 2 (Turkish limits). In case no MRLs are established for the pesticide and products in this annex, the EU MRL, which is outlined in Annex 3, is adhered to. If no limits are established in this annex either, the LOD outlined in Annex V applies, and finally a default MRL of 0.01 mg/kg in case no LOD is established in Annex V.

In total 4 out of 24 pesticide-crop combinations (17%) are included on the priority 1 list because of higher legal limits (see Table 13).

Table 13 *Monitoring priority 1 of pesticide-feed materials combinations from Turkey.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
Fluazifop (fluazifop-butyl)	Rapeseed/ oilseed rape	Rapeseed	9.0	15
	Sunflower	Sunflower seeds	0.1 for seeds	0.2
Fluazifop-P (fluazifop-P-butyl)	Rapeseed/ oilseed rape	Rapeseed	9.0	15
	Sunflower	Sunflower seeds	0.1	0.2

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

No pesticide-feed material combination for priority 2 monitoring were identified from Turkey.

3.5.7 Uruguay

Uruguay is a member of MERCOSUR, the South American trade bloc between Argentina, Brazil, Paraguay and Uruguay. The MERCOSUR document (*MERCOSUR/GMC/RES. N 15/16*) outlines that Codex standards are followed in case no MRLs for plant products have been established in the own country. Besides that no further information was found. Therefore, the NVWA contacted the Dutch Embassy in Argentina who retrieved information from the Ministry (Ministerio de Ganaderia, Agricultura y Pesca) in Uruguay. The provided document (2018/7/4/8/534) prescribes that Uruguay established MRLs according to the Codex standards. In case no pesticide residue limits have been established by Codex, the ministry takes into account either US or EU MRLs. The legal document 'Resolution No 75/2018' of the General Directorate of Agriculture Services of the Ministry of Livestock, Agriculture and Fisheries outlines that in general MRL from Codex Alimentarius are adhered. In case of absence of Codex limits, the EU standards are adhered to, and if no information are available from the EU, the standards by the US Environmental Protection Agency are established.

3.5.8 Canada

Information on MRLs, regulated under the Pest Control Products Act, were retrieved from an online query application Database (Government_of_Canada, 2017), (Health_Canada, 2012) from the Health Canada Pest Management Regulatory Agency. The Agency also established under DIVISION 15 Adulteration of Food B.15.002 of the Food and Drug Regulations a default MRL of 0.1 mg/kg. This default MRL applies to registered pesticides for which no MRLs have been established. It is not clear, however, whether this

default MRL applies to all crops for which no pesticide limits have been established. The default MRL of 0.1 mg/kg is 10 times higher than the default MRL in the EU. Considering this fact, a pesticide residue in Canada with a default MRL of 0.1 mg/kg is likely to be higher than the strict limits for pesticides in the EU. The practical question is whether the pesticide-crop combinations covered by the default MRL are used for crops produced in practice in Canada or established for non-approved pesticides which may be applied on imported products from other countries. In the EU, default MRLs (of 0.01 mg/kg or higher) have been established for approved (e.g. chlormequat in maize) and non-approved pesticides (e.g. paraquat).

In total, 3 out of 19 pesticide-crop combinations (16%) are included on the priority 1 list because of higher legal limits (see Table 14).

Table 14 *Monitoring priority 1 of pesticide-feed materials combinations from Canada.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
difenzoquat (metilsulfate)	Wheat	Wheat	0.01	0.05
glufosinate	Maize	Maize	0.1	0.2
glyphosate	Maize	Maize	1.0	3

1) Pesticides MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

Some pesticide-crop combination were included on the priority 2 list, because they are covered by the Canadian default MRL of 0.1 mg/kg (see chapter 3 – Step 6 – Canada). However, it is not clear whether these pesticides are actually permitted to be applied on those crops in Canada, or whether the default MRL were established for non-approved pesticide-crop combinations. The Canadian Pesticide Database outlines that these five pesticides have MRLs for specific crops/vegetables but not for the given crop mentioned in column 2 of the table below.

Table 15 *Monitoring priority 2 of pesticide-feed materials combinations from Canada.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
captan	Maize	Maize	0.07[2)]	0.1[3)]
chlorothalonil	Maize	Maize	0.01[2)]	0.1[3)]
chlorothalonil	Soybean	Soybean	0.01[2)]	5 (beans); or 0.1[3)]
difenzoquat (metilsulfate)	Maize	Maize	0.01	0.1[3)]
ethephon	Maize	Maize	0.05[2)]	0.1[3)]
paraquat (dichloride)	Soybean	Soybean	0.02[2)]	0.1[3)]

1) Pesticides MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

3) The established MRL in the third country is a default MRL.

3.5.9 Mexico

The US FAS country report of Mexico outlines that Mexico is planning to establish its own pesticides MRLs. The Mexican Ministry Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) has announced in 2014 a draft regulation which will set MRLs on pesticide residues on imported and locally produced food. No further information were found on whether this regulation has already come into force. Besides that, the NVWA contacted the Dutch Embassy in Mexico to derive further information, but no answer came back. Thus, it is assumed that until now Mexico is following the Codex standards.

No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified from Mexico.

3.5.10 China

Information on pesticide MRLs in China were obtained from the US FAS country report. This report provides an unofficial translation of the '*National food safety standard – Maximum Residue Limits for Pesticides in Food' (GB 2763-2014)*' which regulates 3650 MRLs of 387 pesticides.

In total, 3 out of 17 pesticide-crop combinations (18%) are included on the priority 1 list because of higher legal limits (see Table 16).

Table 16 *Monitoring priority 1 of pesticide-feed materials combinations from China.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlorothalonil	Soybean	Soya expeller/extracted	0.01[2)]	0.2
paraquat (dichloride)	Soybean	Soya expeller/extracted	0.02[2)]	0.5
	Sunflower	Sunflower seeds	0.02[2)] for seeds	2.0

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified from China.

3.5.11 Costa Rica

Information regarding pesticide legislation and MRLs was retrieved from the National Authority State Phytosanitary Service (SFE – Servicio Fitosanitario del Estado) subordinate to the Ministry of Agriculture. National MRLs can be consulted from an online database (Servicio_Fitosanitario_del_Estado_Costa_Rica, 2020a), (Servicio_Fitosanitario_del_Estado_Costa_Rica, 2020b). Besides the national database, *Decree No. 35301-MAG-MEIC-S RTCR 424-2008*, a technical regulation pesticide MRLs in plants outlines that Codex Alimentarius will be applied in the first instance. If Codex has not established limits, the standards from the US and EU are followed depending on the higher nominal value which is adopted.

In total, 4 out of 15 pesticide-crop combinations (27%) are included on the priority 1 list because of higher legal limits (see Table 17).

Table 17 *Monitoring priority 1 of pesticide-feed materials combinations from Costa Rica.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
diquat (dibromide)	Citrus fruit	Citrus pulp	0.02	0.05
fenbutatinoxide	Citrus fruit	Citrus pulp	5.0	US: 20 for citrus fruit, 100 for citrus dried pulp
Fluazifop (fluazifop-butyl)	Citrus fruit	Citrus pulp	0.01[2)]	US: 0.03 for citrus fruit, 0.40 for citrus dried pulp
Fluazifop-P (fluazifop-P-butyl)	Citrus fruit	Citrus pulp	0.01[2)]	US: 0.03 for citrus fruit, 0.40 for citrus dried pulp

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified from Costa Rica.

3.5.12 India

Information on pesticide legislation and MRL regulations in India were obtained from the Food Safety and Standards Authority in India (FSSAI) (Food_Safety_and_Standards_Authority_of_India, 2020a), (Food_Safety_and_Standards_Authority_of_India, 2020b) subordinate to the Ministry of Health & Family Welfare, Government of India. No pesticide-feed materials combinations for priority 1 monitoring were identified for India.
Some pesticide-crop combination were included on the priority 2 list (see Table 18), since the established pesticide MRLs refer not to these specific crops, but to vegetables in general. This would imply that the pesticide paraquat may be applied on all vegetables in India.

Table 18 *Monitoring priority 2 of pesticide-feed materials combinations from India.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
paraquat (dichloride)	Soybean	Soya expeller/extracted	0.02[2)]	0.05 (vegetable)
	Sugar cane	Sugar cane molasses	0.02[2)]	0.05 (vegetable)

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

3.5.13 Paraguay

According to the legal document (*MERCOSUR/GMC/RES. N 15/16*) of MERCOSUR, the South American trade bloc between Argentina, Brazil, Paraguay and Uruguay, Paraguay uses the Codex standards as general reference. No further information was found. Besides that, the NVWA contacted the Dutch Embassy in Paraguay to derive further information, but no answer came back. Thus, Codex standards are assumed to be followed.

In total, 2 out of 10 pesticide-crop combinations (20%) were included on the priority 1 list because of higher legal limits (see Table 19).

Table 19 *Monitoring priority 1 of pesticide-feed materials combinations from Paraguay.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
haloxyfop	Soybean	Soybean	0.5	2.0[2)]
haloxyfop-P	Soybean	Soybean	0.5	2.0[2)]

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) No/ not enough information was found on pesticide regulation and MRLs for the respective country. Therefore, it was assumed that Codex limits are applied in this country.

In case of paraquat, Codex has established an MRL not for the soybean as such, but for soya bean fodder. It is characterised in the Codex standards as legume animal feed in 'Primary Animal Feed Commodities'. It is not clear whether this product is comparable with soybean and thus the MRLs may also not be comparable. However, the established limit by Codex is higher than the EU. For this reason paraquat in soybean is identified as priority 2 (see Table 20).

Table 20 *Monitoring priority 2 of pesticide-feed materials combinations from Paraguay.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Codex Alimentarius MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
paraquat (dichloride)	Soybean	Soybean	0.02[2)]	0.5 for soy bean fodder - dry weight	0.5[3)]

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

3) No/ not enough information were found on pesticide regulation and MRLs for the respective country. Therefore, it was assumed that Codex limits are applied in this country.

3.5.14 Australia

Information on the pesticide regulation in Australia was retrieved from the Food Standards Australia New Zealand (FSANZ) (Food_Standards_Australia_New_Zealand, 2019), (Australian_Government, 2003a), (Australian_Government, 2003b), a statutory authority in the Australian Government Health portfolio. The authority has published its standards in the Food Standards Code. '*Standard 1.4.2 Agvet chemicals*' outlines the legislative act for pesticides (agricultural chemical products) and the respective MRLs are prescribed in '*Schedule 20 Maximum residue limits*'.

In total, 4 out of 9 pesticide-crop combinations (44%) were included on the priority 1 list because of higher legal limits (see Table 21).

Table 21 *Monitoring priority 1 of pesticide-feed materials combinations from Australia.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
captan	Rapeseed/ oilseed rape	Rapeseed	0.07[2)]	0.1 (all other foods)
diquat (dibromide)	Rapeseed/ oilseed rape	Rapeseed	1.5	5 (oilseeds)
glufosinate	Rapeseed/ oilseed rape	Rapeseed	1.5	5
glyphosate	Rapeseed/ oilseed rape	Rapeseed	10.0	20

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified for Australia.

3.5.15 Serbia

Legislation on pesticides in Serbia was retrieved from the FAOLEX Database (FAO, 2020), (FAO, 2014): '*Regulation on maximum residue levels of pesticides in food and feed and for feed and food which are subject to the analysis of the maximum permitted amount of residues of plant protection products'*. The document is solely available in Serbian. Information was extracted from this legal source using Google translations. Additionally, NVWA has contacted the Dutch embassy in Serbia to obtain information on the respective pesticide-crop combinations. No answer came back. Thus, the Serbian legal document was used and translated with Google Translate.

In total, 2 out of 9 pesticide-crop combinations (22%) were included on the priority 1 list because of higher legal limits (see Table 22).

Table 22 *Monitoring priority 1 of pesticide-feed materials combinations from Serbia.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
diquat (dibromide)	Maize	Maize	0.02[2)]	1.0
glufosinate	Maize	Maize	0.1	0.5

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified for Serbia.

3.5.16 Indonesia

MRLs in plant products in Indonesia are outlined in the legislative act '*Nomor 55/Permentan/KR.040/11/2016*' published on the electronic legislation website from the Ministry of Agriculture (Agricultural_Quarantine_Agency, 2011). This regulation outlines MRLs for fruits, vegetables, grains, nuts and pulses, but not for oilseeds. Indonesia is the main exporter of palmkernel expeller/extracted but pesticide MRLs are not established for palm oil. In comparison, neighbouring countries such as Malaysia, Thailand or Japan have established own MRLs. An Indonesian review article indicates that pesticide residues in palm oil were not detected and generally categorized as low compared to other vegetable oils (soybean oil, rapeseed oil and sunflower oil). This was explained by the fact that palm fruits are grown relatively high above the ground and pesticides in palm fruits generally not applied (Hasibuan, 2016).

No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified Indonesia.

3.5.17 Algeria

The US FAS country report outlines that standards in Algeria are consistent with Codex Alimentarius. No more additional information was found. No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified for Algeria.

3.5.18 Guatemala

The US FAS country report indicates that Guatemala did not establish own MRLs for pesticide residues in food products, but applies the MRLs adopted by Codex Alimentarius.
No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified for Guatemala.

3.5.19 Nicaragua

The US FAS country report indicates that Nicaragua did not establish own MRLs for pesticide residues in food products, but applies the MRLs adopted by Codex Alimentarius.

3.5.20 Pakistan

Information derived from the US FAS country report indicated that Pakistan generally complies with pesticides MRLs adopted by Codex Alimentarius. While these limits are enforced by customs officials for imported foods, the country does not have an enforcement system to control pesticides limits in domestically produced foods.

No pesticide-feed material combinations for priority 1 monitoring were identified for Pakistan. However some feed materials from Pakistan are included on the priority 2 (see Table 23) list due to the fact that Pakistan has no enforcement capacities to enforce the Codex standards on the domestic market. Thus sugar cane (and other products) originating from Pakistan may be relevant to monitor for pesticides in general. For the three potential pesticides to be applied on sugar cane, Codex has no

MRLs established. Adherence to Codex standards would mean that these three pesticides are not applied on sugar cane. However, this cannot be excluded (as illegal use of any pesticide in any country in general) as well as the use of other pesticides which are outlined for sugar cane by Codex.

Table 23 *Monitoring priority 2 of pesticide-feed materials combinations from Pakistan.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Codex Alimentarius MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlormequat (chloride)	Sugar cane	Sugar cane molasses	0.01[2)]	-	[3)] No national enforcement capacity
diquat (dibromide)	Sugar cane	Sugar cane molasses	0.01[2)]	-	[3)] No national enforcement capacity
paraquat (dichloride)	Sugar cane	Sugar cane molasses	0.02[2)]	-	[3)] No national enforcement capacity
Others...					

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

3) Retrieved information indicated that the third country follows the maximum limits established by Codex Alimentarius.

3.5.21 Thailand

Standards on pesticide MRLs are published by the National Bureau of Agricultural Commodity and Food Standards (National_Bureau_of_Agricultural_Commodity_and_Food_Standards, ND), (National_Bureau_of_Agricultural_Commodity_and_Food_Standards, 2016). The following standard outlines MRLs:
'THAI AGRICULTURAL STANDARD TAS 9002-2016 - PESTICIDE RESIDUES: MAXIMUM RESIDUE LIMITS'

The document outlines MRLs for several pesticides in crops. A default MRL of 0.01 mg/kg applies for pesticides not having a specific MRL established. However, for certain pesticides, a more specific MRL was set deviating from the default MRL (e.g. chlormequat: 0.1 mg/kg).

In total, 1 out of 3 pesticide-crop combinations (33%) were included on the priority 1 list because of higher legal limits (see Table 24). Chlormequat is permitted in food in general and regulated with a default MRL of 0.1 mg/kg.

Table 24 *Monitoring priority 1 of pesticide-feed materials combinations from Thailand.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
chlormequat (chloride)	Sugar cane	Sugar cane molasses	0.01[2)]	0.1[3)]

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

3) The established MRL in the third country is a default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified.

3.5.22 Malaysia

Information on pesticide MRLs were derived from the Food Safety and Quality Division of the Ministry of Health Malaysia (Ministry_Of_Health_Malaysia, 2020), (Ministry_Of_Health_Malaysia, 1985). MRLs for pesticides are outlined in the following regulation and Schedule (updated January 2018).
'*P.U.(A). 437/85 - Food Regulation 1985' - Part VII Regulation 41*
'Schedule in Food Act 1983' – Sixteenth Schedule (Regulation 41) Pesticide Residue
If maximum limits are not prescribed in the Schedule, the limits established by Codex Alimentarius apply. When pesticides are not specified for food in the Codex standards either, a default MRL of 0.01 mg/kg applies.

In total, 2 out of 3 pesticide-crop combinations (66%) were included on the priority 1 list because of higher legal limits (see Table 25).

Table 25 *Monitoring priority 1 of pesticide-feed materials combinations from Malaysia.*

SRM Pesticide	Crop with feed relevance	Feed material derived from that crop	EU MRL (mg/kg)[1)]	Non-EU MRL (mg/kg)[1)]
glufosinate	Oil palm	Palmkernel expeller/extracted	0.03[2)]	0.5
paraquat (dichloride)	Oil palm	Palmkernel expeller/extracted	0.02[2)]	0.1

1) Pesticide MRLs established in the EU, in Codex and non-EU countries refer by default to the crop and not the feed material, except where otherwise stated. Codex Alimentarius and some countries (e.g. USA) have MRLs established for certain feed materials.

2) MRL is established at the limit of detection, which considers the available analytical methods. In the EU it is also the Default MRL.

No pesticide-feed material combination for priority 2 monitoring were identified for Malaysia.

3.5.23 Mauritius

No country report of from US FAS was found. Legislation on pesticides in Mauritius were retrieved from the FAOLEX Database (FAO, 2016), (FAO, 2018).
'Use of Pesticides Act 2018' (No. 8 of 2018) – Government Gazette of Mauritius No. 64 of 19 July 2018
No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified for Mauritius.

3.5.24 Kazakhstan

The US FAS country report indicated that pesticides tolerances in Kazakhstan are based on the technical regulations from the Eurasian Economic Union (see also Russia) which are published by the US FAS in the non-official translation document 'Eurasia Economic Union – New Pesticide MRLs'.
No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified for Kazakhstan.

3.5.25 South Africa

Legislation on pesticide MRLs in South Africa were provided by the Dutch Embassy in South Africa and were derived from the Health Department of the South African Government (Department_Health_Republic_of_South_Africa, 2020). The applicable regulations are:
'*GNR.246 of 11 February 1994: Regulations governing the maximum limits for pesticide residues that may be present in foodstuffs*' (as last amended by R.46 on 19 January 2012)
No. 334 of 07 April 2017: Foodstuffs, Cosmetics and Disinfectants Act, 1972: Regulations governing the maximum limits for pesticide residues that may be present in foodstuffs: Draft amendment

No pesticide-feed materials combinations for priority 1 and 2 monitoring were identified for South Africa.

3.6 Overview of priority 1 list for monitoring

The 457 feed material-SRM pesticide-country of origin combinations are composed of 24 pesticides in combination with 17 feed materials and 25 countries. From the results described in paragraph 3.5 it can be concluded that 83 of this 457 combination are marked as "priority 1". These are presented in Table 26.

Table 26 *"Feed material-country of origin-SRM pesticide" combinations for which the established MRL in the "country of origin" is higher than the legal limit in the EU (= priority 1 list).*

Feed material	Country of origin	SRM Pesticide	Feed material	Country of origin	SRM Pesticide
Citrus pulp	Brasil	amitraz	Soybean	Argentina	chlorothalonil
		captan			paraquat (dichloride)
		chlorothalonil		Brasil	chlorothalonil
		fluazifop (fluazifop-butyl)			paraquat (dichloride)
		fluazifop-P (fluazifop-P-butyl)		Paraguay	haloxyfop
		folpet			haloxyfop-P
		paraquat (dichloride)		USA	chlorothalonil
	Costa Rica	diquat (dibromide)			paraquat (dichloride)
		fenbutatinoxide	Sugar cane molasses	Thailand	chlormequat (chloride)
		fluazifop (fluazifop-butyl)		USA	diquat (dibromide)
		fluazifop-P (fluazifop-P-butyl)			paraquat (dichloride)
	USA	diquat (dibromide)	Sunflower seeds	Argentina	diquat (dibromide)
		fenbutatinoxide			haloxyfop
		fluazifop (fluazifop-butyl)			haloxyfop-P
		fluazifop-P (fluazifop-P-butyl)			paraquat (dichloride)
		paraquat (dichloride)		China	paraquat (dichloride)
Maize	Argentina	diquat (dibromide)		Russia	diquat (dibromide)
	Brasil	captan			glufosinate
	Canada	glufosinate			paraquat (dichloride)
		glyphosate		Turkey	Fluazifop (fluazifop-butyl)
	Serbia	diquat (dibromide)			Fluazifop-P (fluazifop-P-butyl)
		glufosinate	Sunflower seed expeller/ extracted	Argentina	diquat (dibromide)
	Ukraine	ethephon			haloxyfop
	USA	glufosinate			haloxyfop-P
		glyphosate			paraquat (dichloride)
Palmkernel expeller/ extracted	Malaysia	glufosinate	Vinasse (from maize)	Russia	chlorothalonil
		paraquat (dichloride)			ethephon
Rapeseed	Argentina	diquat (dibromide)		USA	glufosinate
	Australia	captan			glyphosate
		diquat (dibromide)	Vinasse (from soybean)	USA	chlorothalonil
		glufosinate		USA	paraquat (dichloride)
		glyphosate	Vinasse (from sugar beet)	Russia	chlorothalonil
	Russia	glufosinate			ethephon
	Turkey	fluazifop (fluazifop-butyl)		USA	diquat (dibromide)
		fluazifop-P (fluazifop-P-butyl)			paraquat (dichloride)
Soya expeller/ extracted	Argentina	chlorothalonil			diquat (dibromide)
		paraquat (dichloride)			paraquat (dichloride)
	Brasil	chlorothalonil	Wheat	Canada	difenzoquat (metilsulfate)
		paraquat (dichloride)			
	China	chlorothalonil			
		paraquat (dichloride)			
	USA	chlorothalonil			
		paraquat (dichloride)			
Soya hulls	Argentina	chlorothalonil			
		paraquat (dichloride)			

3.7 Overview of Priority 2 list for monitoring

The 457 "feed material-SRM pesticide-country of origin" combinations are composed of 24 pesticides in combination with 17 feed materials and 25 countries. From the results described in paragraph 3.5 it can be concluded that 21 of this 457 combinations are marked as "priority 2". These are presented in Table 27.

Table 27 *"Feed material-country of origin-SRM pesticide" combinations for which it is not clear if the established MRL in the "country of origin" is higher than the legal limit in the EU (= priority 2 list).*

Feed material	Country of origin	SRM Pesticide	Details
Maize	Canada	captan	It is not clear whether these pesticides are permitted to be applied on maize in Canada. The Canadian default MRL is higher than the EU MRL.
		chlorothalonil	
		difenzoquat (metilsulfate)	
		ethephon	
Soya expeller / extracted	India	paraquat (dichloride)	It is unclear if soybeans belong to the group of vegetables. The MRL in India for paraquat in vegetable is higher than the EU MRL.
	Russia	chlorothalonil	It is unclear if soybeans belong to the group of beans or legumes. The Russian MRL for chlorothalonil in dry beans and glufosinate/paraquat in legumes are higher than the EU MRL.
		glufosinate	
		paraquat (dichloride)	
	USA	diquat (dibromide)	The MRL in the USA is applicable for soy bean hulls and higher than the EU MRL.
Soybean	Canada	chlorothalonil	It is not clear whether these pesticides are permitted to be applied on soybean in Canada. The Canadian default MRL is higher than the EU MRL.
		paraquat (dichloride)	
	Paraguay	paraquat (dichloride)	It is assumed that Paraguay follows Codex standards. In case of paraquat, Codex has established an MRL not for the soybean as such, but for soy bean fodder. It is not clear whether this product is comparable with soybean. The Codex MRL for soy beans fodder is higher than the EU MRL for soy beans.
	USA	diquat (dibromide)	The MRL in the USA is applicable for soy bean hulls and higher than the EU MRL.
Sugar cane molasses	India	paraquat (dichloride)	It is unclear if soybeans belong to the group of vegetables. The MRL in India for paraquat in vegetable is higher than the EU MRL.
	Pakistan	chlormequat (chloride)	Pakistan follows the Codex standards for pesticides application on crops, but has no capacity to enforce the standards on the domestic market. For these pesticide-crop combinations no Codex MRL's were established. Due to this and the lack of enforcement the situation is unclear.
		diquat (dibromide)	
		paraquat (dichloride)	
Vinasse (from soybean)	Russia	chlorothalonil	It is unclear if soybeans belong to the group of beans or legumes. The Russian MRL for chlorothalonil in dry beans and glufosinate/paraquat in legumes are higher than the EU MRL.
		glufosinate	
		paraquat (dichloride)	
	USA	diquat (dibromide)	The MRL in the USA is applicable for soy bean hulls and higher than the EU MRL.

4 Discussion

This chapter provides some general remarks and comments which have to be considered for the interpretation of the results. In addition, it addresses assumptions and compromises made in this study in order to deal with uncertainties as well as to be able to work with the available data.

Pesticide Manual
The Pesticide Manual did not always indicate on which specific crops certain pesticides are applied, but used general terms such as 'other crops', 'wide range of crops'. Thus, certain pesticides may also be applied on crops which were not specifically mentioned by name in the Pesticide Manual but are yet relevant for this study. Therefore, it cannot be excluded that certain relevant pesticide-crop combinations were disregarded in this study. However, most often the specific fruit and vegetable types were mentioned in the Pesticide Manual (e.g. citrus fruit, oilseed rape, soybeans, sunflowers, maize, rice, sugar beet, etc.). The pesticide application on 'cereal stubble' was neglected, because the pesticides are applied after harvest to kill the stubble. Therefore is seems unlikely that feed materials contain residues of these pesticides.

Feed materials from third countries: imports versus usage
The Risk feed model outlines the quantities of imported commodities into the Netherlands. These numbers are based on EUROSTAT data and do not distinguish whether they are used for animal feed or human consumption. For some commodities the link to animal feed is more clear (e.g. citrus pulp, rape seed and soybean expeller, vinasse, molasses) than others (e.g. wheat, maize). Moreover, import into the Netherlands does not automatically mean that these commodities are also used in the Netherlands. The harbour in Rotterdam is the biggest harbour in Europe and therefore many consignments which arrive there are also further distributed to other EU countries. Thus, a high import quantity of a commodity is not necessarily linked to a high usage in the Netherlands. Nevertheless, the Netherlands also has the duty of monitoring commodities on behalf of the EU if the harbour of Rotterdam is the first Border Inspection Post of the EU. Therefore, controlling feed materials upon arrival in Rotterdam (EU) also benefits other Member States of the EU.
According to SecureFeed information, other types of feed materials, i.e. liquid or moist-rich co-products (e.g. potato peelings, wheat starch, distillers grain) and fodder crops and roughages may also be used in large volumes in animal diets. Because of their nature (e.g. low dry matter content, relative low nutritional value) and related high costs of transportation, these products are likely to be produced in the Netherlands or neighbouring-countries and therefore produced under EU legislation. Therefore, these feed materials were not included in this study.

Country of Origin
With regard to the country of origin, the true country of origin of a feed material may not always be the same as the indicated country of origin derived from EUROSTAT. For unprocessed feed materials (e.g. wheat, maize) it can be assumed that they are cultivated and harvested in the same country as they are imported from. Nonetheless, these commodities may be imported via another EU country. Moreover, agricultural commodities may be harvested in one country and processed into a feed material (e.g. soybean expeller, molasses, vinasse) in another (neighbouring) country from which it is exported to the EU. Thus, the country of origin of the feed materials, as indicated in the EUROSTAT data, is not necessarily the same as the country where the crop was cultivated, and the adopted use of pesticides and MRLs in the present study may not be correct. Therefore, it cannot be excluded that relevant pesticide-crop combinations from specific countries were missed in this study.

Processing factors
Processing factors were not included in this study. Pesticide residues may concentrate or dilute in certain parts of the crop during processing. Consequently, pesticide residues may also be concentrated or diluted in feed materials in comparison to the starting material (crop) and concentrations may be higher (or lower) than the EU legislator has established in the MRL for the food crop. These

concentration or dilution processes would have to be considered when MRLs of the crops are compared with feed materials. Processing factors for each pesticide-feed material combination would have to be established to describe a more realistic picture of pesticide residues in animal feed. Codex Alimentarius has established some MRLs specifically for animal feed products. However, the actual number of feed products and their respective pesticide MRLs in the Codex Catalogue are limited. Besides Codex Alimentarius, the US legislation also has established some pesticides MRLs for feed materials. For example, this is the case for residues of the pesticides fluazifop, glufosinate and glyphosate in sugar beet. Besides MRLs for sugar beet roots, higher MRLs apply for example for sugar beet dried pulp and sugar beet molasses. In these cases the limit for sugar beet roots is lower than the EU limit and thus not highlighted to be of any priority in this study approach. However, the MRLs for the processed feed materials (pulp, molasses) are higher than the EU limit, which is based merely on the crop (raw agricultural commodity. As a result, exceedances of EU MRLs for these feed materials from the USA may theoretically occur. However, this does not apply solely to the USA, but to processed feed materials imported in the EU from any third country that uses specific MRLs for processed feed materials. Thus, processing factors require more attention to adequately address the probability of MRL exceedance in processed products.

Use of pesticides if legal limits in third countries are missing

If no pesticide MRL from Codex or third country could be retrieved, no further effort has been made to investigate whether the pesticide in the third country is used in the respective commodities/crops. Information on whether specific pesticides in the third countries are actually used (legally or illegally) cannot be retrieved with the available information described in chapter 2.1. Further investigations through literature studies and other sources would need to be conducted, while it remains questionable whether this information on actual use of the respective pesticides in the crop/ feed materials in the specific third countries, can be obtained.

Risk based monitoring approach of theoretical occurrence of MRL exceedances based on legal limits

This study used a risk based approach, considering the most important animal feed materials used in the Netherlands and the legal MRLs. It is, however, not based on actual monitoring results, but solely on the residues that potentially can be expected in feed materials based on legal limits. Thus, it is a theoretical approach outlining from which third countries residue exceedances in feed materials may potentially be of concern and more likely to occur due to higher national MRLs. Whether these feed materials from specific countries actually contain higher residues when imported into the EU, has to be examined via monitoring.

Necessity for randomized monitoring

Many pesticide-crop combinations were not classified to be of priority in this study because of lower or equal MRLs in the third countries or the fact that certain pesticides are not permitted in that country. However, compliance with the national limits in the third countries cannot be assured and therefore, also the combinations assessed as no priority in this study should be monitored on a regular basis. Residue exceedance may be also found in these cases. Furthermore, this study does not consider that pesticides in third countries may be illegally used on crops for which the pesticide is not authorised. Thus, for instance pesticides considered in this study which do not have a MRL in a third country because they are not permitted, may be actually found in a feed material imported from that country due to illegal use in the field or due to cross-contamination during processing or storage. In conclusion, this study only focused on a limited number of pesticides and their residues which can be reasonably expected to be found in feed materials based on what is legally permitted. Illegal use in of pesticides, resulting in exceeding of MRLs (in third countries and EU) is not covered by this study. Use of non-approved pesticides cannot be anticipated in terms of the pesticide used and the crop it is applied on. Thus, also a randomized monitoring of all pesticides which are known to be used and expected to be (illegally) used should be part of the National Plan Animal Feed.

Limitation of this study

This study is a follow–up of the finding of paraquat in soybean products originating from South America and limited to single residue method (SRM) pesticides. SRM pesticides are not monitored frequently because they cannot be included in regular multi-residue methods for pesticides, and

separate analysis has to be conducted for these pesticides. The study does not include an evaluation of pesticides that analytically could be included in the multi-residue method; rather it focuses on pesticides that are currently not included in such an analytical method. The multi-residue method contains about 250 pesticides, while the list of pesticides is considerably larger (>500). Although the selection of pesticides included in the multi-method is based on incidence of MRL exceedance, advice from EU reference laboratories and experts opinions, it would be relevant to determine whether a study similar to this study would result in additional pesticide -crops combinations to be included in the multi-residue methods.

This study was limited to feed materials with a usage-volume above 100,000 tonnes in the Netherlands. The feed materials with a usage-volume below 100,000 tonnes like cotton, potatoes, rye, coconut palms, rice, peanut, linseed, alfalfa, clover, pea, bean, grass seed crops, manioc were not included in this study. It is however likely that an evaluation of these smaller usage-volume feed materials (crops) will result in corresponding lists of priority 1 and priority 2 feed material-pesticide-country combinations.

5 Conclusions and recommendations

Conclusions

- A risk-based approach for MRL exceedance of SRM (single residue method) pesticides in animal feed materials from outside the EU has been developed, based on theoretical occurrence of residues caused by higher MRLs in third countries of origin.
- Eighty-four "feed material - SRM pesticide - country of origin" combinations have been given priority 1 (see Table 26). For these combinations the pesticide may have been used on the crop and the MRL for this pesticide/crop combination in the third country of origin is higher than the EU MRL.
- Twenty-two "feed material - SRM pesticide - country of origin combinations have been given priority 2 (see Table 27). For these combination the pesticide may have been used on the crop and the MRL in the third country shows ambiguities and could be higher than the EU MRL.
- This study is restricted to SRM pesticides and feed materials with a usage-volume above 100,000 tonnes in compound feed in the Netherlands.
- The results give a good indication of what SRM pesticide residues may be expected in bulk feed materials from specific third countries and can be used to strengthen the risk-based monitoring of pesticides in feed materials in the National Plan Animal Feed.

Recommendations

- It is recommended to expand the National Plan Animal Feed with a monitoring programme of SRM pesticides in feed materials with priority 1 (and to a lesser extent priority 2) as included in Tables 26 and 27.
- It is recommended to repeat this study for the addressed and potentially new pesticides after three to five years. This study focused on the years 2013 – 2017 for the relevant feed materials and 2013 – 2016 for the relevant import countries outside the EU. However, the use of feed materials, the countries of origin, the permitted and used pesticides and the legal limits are likely to change over time.
- The approach and steps taken in this project allow that it can be extended at any time. It would be useful to apply this approach for:
  - Feed materials with a usage-volume below 100,000 tonnes in compound feed (in the Netherlands).
  - Pesticides that analytically could be included in the multi-residue-method, but which are currently not included.
- In addition to the risk-based approach described in this study, it is recommended to continue randomised monitoring to account for unforeseen and illegal use of pesticides.

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