SCIENTIFIC REPORT OF EFSA

The 2010 European Union Report on Pesticide Residues in Food[1]

European Food Safety Authority[2, 3]

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ABSTRACT

This report presents the results of the control of pesticide residues in food commodities sampled during the calendar year 2010 in the 27 EU Member States and two EFTA countries (Iceland and Norway). The report also comprises the outcome of the consumer risk assessment of pesticide residues. EFSA presents for the first time the results of a pilot cumulative risk assessment (CRA) to multiple chemical residues. Finally, the report provides some recommendations aimed at the improvement of the future monitoring programmes and the enforcement of the European pesticide residue legislation. In total, more than 77,000 samples of approximately 500 different types of food (raw or processed) were analysed for pesticide residues by national competent authorities. Considering the results concerning both the national and the EU-coordinated programmes, the total number of analytical determinations reported among all the countries amounted to more than 14 million. The results of the EU-coordinated programme for 2010 showed that 1.6% of total samples analysed exceeded the European legal limits (MRLs). EFSA concluded that the long-term exposure of consumers did not raise health concerns. In assessing the short-term exposure, the pesticide monitoring results revealed that a risk could not be excluded for 79 samples concerning 30 different pesticides if the pertinent food was consumed in high amounts. The results of the CRA are considered indicative as the work on establishing which groups of pesticides are expected to share the same toxicological effects is not yet complete and the final methodological approach needs to be further elaborated. The outcome of the pilot CRA demonstrated that the exposure calculations are affected by significant uncertainties, mainly related to the analytical results reported as “non-detected”. The methodology used in this pilot exercise will be further revised to reduce the uncertainties of the exposure assessment.

KEY WORDS

Pesticide residues, food control, monitoring, Maximum Residue Levels, consumer risk assessment, Regulation (EC) No 396/2005.

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SUMMARY

This report presents the results of the control of pesticide residues in food commodities sampled during the calendar year 2010 in the 27 EU Member States and two EFTA countries (Iceland and Norway) in order to ensure compliance of food with the European standards with regard to the permissible maximum legal limits for pesticide residues. In addition, the report presents the outcome of the consumer risk assessment of pesticide residues.

In each European reporting country, two control programmes are in place: a national control/monitoring programme (designed individually by each country) and a European coordinated multiannual control programme, which gives clear guidance on which specific control activities should be performed by the Member States.

FOOD COMPLIANCE WITH MAXIMUM RESIDUE LEVES (MRLs)

The food commodities to be analysed in the framework of the 2010 **EU-coordinated control programme** were apples, head cabbage, leek, lettuce, milk, peaches, pears, rye or oats, strawberries, swine meat and tomatoes. This programme defined 157 pesticides to be analysed in food of plant origin (38 of them to be analysed on a voluntary basis) and 34 pesticides in food of animal origin (six of them to be analysed on a voluntary basis), for a total of 178 distinct pesticides. A total number of 12,168 samples were analysed in 2010.

The analysis of the results of the 2010 EU-coordinated programme shows that 197 (1.6%) of the 12,168 samples exceeded the MRL, while 5,802 (47.7%) of the samples had measurable residues above the reporting level but below or at the MRL. 6,169 of the samples (50.7%) were free from measurable pesticide residues.

According to the results of the last four EU-coordinated programmes (2007 to 2010), the percentage of samples exceeding the MRLs was rather stable, with only small variations; the % of samples exceeding the legal limits in this reference period ranged from 1.2% to 2.3%.

In 2010, the MRL exceedance rates among the reporting countries ranged from 0.0% to 4.9% of the samples analysed. The highest percentage of samples exceeding the MRL was identified for oats (5.3%), followed by lettuce (3.4%), strawberries (2.8%), peaches (1.8%), apples (1.3%), pears (1.3%), tomatoes (1.2%), leek (1.0%), head cabbage (0.9%) and rye (0.2%). MRL exceedances were not reported for milk and swine meat samples. Peaches had the highest percentage of samples with measurable pesticide residues above the LOQ (73%), followed by 68% of the apple samples and 68% of the strawberries. Comparing the results of the 2007 and 2010 EU-coordinated control programmes (where the same commodities of plant origin – except pears – were tested), it was noted that the only commodity for which the percentage of samples without detectable residues increased was strawberries (from 31.1% in 2007 to 32.1% in 2010); the highest decrease in the percentage of detectable residues was observed for oats (79.7% in 2007 to 45.5% in 2010). The percentage of samples exceeding the MRLs has increased from 2007 to 2010 for the following crops: leek, lettuce, oats, and tomatoes.

The total number of samples taken in the context of the **2010 national programmes** was 77,075. Compared with the previous year, this is an increase of 13.4%. In 2010, the majority of the samples taken were classified as surveillance samples (72,813 samples, 94.5% of the total number of samples). The total number of enforcement samples taken by all reporting countries was 4,262 (5.5% of the total number of samples). The number of pesticides analysed for in 2010 was 982 (excluding metabolites). In 2010, 529 different food commodities (including processed and unprocessed food samples) were surveyed. The majority of total samples taken in 2010 were produced in one of the reporting countries (73%), while 23% of the samples originated from third countries.

In total, residues of 328 distinct pesticides were found in measurable quantities in vegetables, 301 in fruit and nuts, while in cereals residues of 88 different pesticides were observed (surveillance samples only).

97.2% of the analysed surveillance samples were below or at the legal MRLs. In 2.8% of the samples, the legal limits were exceeded for one or more pesticides. MRLs were more often exceeded for samples from third countries (7.9% of the surveillance samples) than for samples from the EU and EFTA countries (1.5% of the surveillance samples). In terms of commodity groups, most of the MRL exceedances (11.1%) were found in unprocessed surveillance samples of legume vegetables (e.g. beans with pods), spices (8.5%) and nuts (8.3%). High MRL exceedance rates were also observed in table and wine grapes, and leafy vegetables (e.g. lettuce) and fresh herbs.

With regard to multiple residues in the same sample, residues of two or more pesticides were found in 19,382 samples, corresponding to 26.6% of the surveillance samples analysed. Important commodities for human consumption with high frequencies of multiple residues were liver (95.7% of 23 liver samples), citrus fruits (62.8% of 4,363 citrus fruit samples) and strawberries (60.5% of 2,479 strawberries samples).

The majority of food of **animal origin** was free of detectable residues (87.3% of samples were reported below the quantification limits). In total, 43 different pesticides were found in animal products; the most frequently found pesticides were DDT and HCH, which were detected in 13.4% and 11.6% of the samples analysed for these pesticides, respectively. These substances are considered as persistent organic pollutants which have a tendency to bio accumulate in fat matrices. In the EU the use of these pesticides is banned.

In 2010, a total of 1,828 surveillance samples of **baby food** were reported by 28 countries. Residues above the reporting level were found in 154 samples (8.4%), while the MRL was exceeded in 36 samples (2.0%).

3,571 samples of **organic origin** were taken in 2010 by a total of 28 countries, which corresponds to 4.9% of all surveillance samples taken overall in the reporting countries. For fruit and nuts, a lower rate of MRL exceedances (0.9%) was found in comparison to conventionally grown fruit and nuts (2.9%). For vegetables, the exceedance rates of the surveillance samples were 1.0% and 3.8% respectively for organic and conventionally grown products. Overall, the MRL exceedance rate for organic food was 0.8%. In total, 131 different pesticides were found in organic products in measurable concentrations; of those, 26 pesticides were found in at least five samples. It is noted that 25 out of these 26 substances are not allowed in organic farming.

DIETRAY EXPOSURE ASSESSMENT

The results of the EU-coordinated monitoring programme were used also to assess the **consumer dietary exposure** to pesticide residues.

The **acute (short-term) consumer exposure** assessment was performed for the 134 pesticides covered by the EU-coordinated monitoring programme that were considered relevant for acute risk assessment. The assessment focussed on the 12 target food commodities of the 2010 monitoring programme. For 20 of these pesticides no residues were detected in quantifiable concentrations in any of the samples taken, i.e.: aldrin and dieldrin, benfuracarb, bromuconazole, cadusafos, carbosulfan, chlordane, chlorbenzilate, dinocap, fipronil, fosthiazate, metconazole, methoxychlor, parathion, phenthoate, phoxim, prothioconazole, pyrazophos, resmethrin, tecnazene and triticonazole. Thus, for these substances the dietary exposure resulting from the food commodities covered by the EU-coordinated monitoring programme was negligible.

Considering the remaining pesticides covered by the EU-coordinated programme, a potential acute risk could not be excluded for 79 samples (out of the 18,243 samples considered) concerning 30 different pesticides. However, for two pesticides included in the EU-coordinated programme the residue definition contains two or more compounds with different toxicological properties. Thus, for these substances two scenarios were calculated, an optimistic scenario, assuming the residue concentrations measured refer to the less toxic substance and a pessimistic scenario, which is considered as the less likely, using the ARfD for the more toxic substance. Under the pessimistic scenario, the number of samples which exceeded the respective toxicological reference value increased from 79 to 200. The commodities for which no risk was identified were milk, oats, rye and swine meat. The commodities with the most frequent exceedance of the ARfD were apples, lettuce and tomatoes (23, 22 and 21 samples, respectively) in the optimistic scenario; also in the pessimistic scenario these commodities exceeded most frequently the toxicological threshold (45, 87 and 29 samples, respectively). Of the samples posing a potential acute consumer risk none concerned organically produced food.

The **long-term (chronic) exposure assessment** was performed for 171 of the 178 substances covered by the EU-coordinated monitoring programme and for which toxicological reference values were available, and it was based on the residue findings for the 28 most prominent food commodities in the human diet. For none of the pesticides included in the 2010 EU-coordinated control programme the exposure exceeded the toxicologically acceptable limits. Based on the current scientific knowledge, it is therefore concluded that the food commodities covered by the EU monitoring programme did not pose a long-term consumer health risk.

For the first time in the context of preparing this report, EFSA performed an indicative **cumulative risk assessment** taking into account the results of the 2010 monitoring programme with the purpose of exploring possible deficiencies in the monitoring data (e.g. if the level of detail of the data reported was sufficient) and other limitations, which may impede the practical implementation of the cumulative risk assessment methodologies currently under development. Since the work on the establishment of common assessment groups (i.e. pesticides which are expected to share the same toxicological effects) and the assessment methodology is not yet completed the calculations are based on simplistic assumptions which are likely to overestimate the exposure significantly. Noting that the purpose of the exercise is to test the suitability of the monitoring data for this type of assessment, the results of the exposure assessments should be regarded as indicative only.

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LEGAL BASIS

According to the EU legislation in place in 2010, EU Member States and two EFTA countries (Iceland and Norway) had to carry out national control programmes on pesticide residues in food commodities and to report the results to the European Commission and EFSA.

General legal provisions for food inspections and monitoring were established by Regulation (EC) No 882/2004[4] on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare.

The legal basis for the preparation of this Annual Report on the pesticide residues is laid down in Regulation (EC) No 396/2005[5] on Maximum Residues Levels (MRLs) for pesticide residues. This regulation requires Member States to establish national control programmes, to carry out regular official controls on pesticide residues in food commodities in order to check compliance with the MRLs for pesticide residues and to assess the consumer's exposure. According to Article 31 of Regulation (EC) No 396/2005 Member States have to submit the results of official controls and other relevant information to the European Commission, to EFSA and to other Member States. On the basis of these results an Annual Report on pesticide residues shall be prepared each year. With Article 32 of this regulation the responsibility for preparing the Annual Report on pesticide residues is assigned to EFSA. The MRL regulation also contains general provisions regarding the content of the Annual Report.

In addition to the general provisions on national monitoring programmes as defined in Article 30 of the pesticide MRL Regulation, the Commission has set up a specific EU-coordinated monitoring programme. Starting from the calendar year 2009, the participation of the EU Member States in the EU-coordinated control programme has become mandatory. The details of the coordinated multiannual Community control programme for 2010 have been established in Commission Regulation (EC) No 901/2009[6].

According to Decision of the EEA Joint Committee No 127/2009[7] the EFTA countries Iceland and Norway were requested to participate in the EU-coordinated control programme. Thus, the provision of Regulation (EC) No 901/2009 is applicable also in those EFTA countries.

The results of the analysis of food samples taken in 2010 under the national and coordinated Community control programmes had to be submitted to the European Commission and to EFSA by the end of August 2011. All 27 EU Member States and two EFTA States submitted validated results of the 2010 monitoring programmes to EFSA between 5th July and 2nd December 2011.

[4] Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules. OJ L 165, 30.4.2004, p. 1-141.

[5] Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC. OJ L 70, 16.3.2005, p 1-16.

[6] Commission Regulation (EC) No 901/2009 of 28 September 2009 concerning a coordinated multiannual Community control programme for 2010, 2011 and 2012 to ensure compliance with maximum levels of and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin (Text with EEA relevance). OJ L 256, 29.9.2009, p. 14-22.

[7] Decision of the EEA Joint Committee No 127/2009 of 4 December 2009 amending Annex II (Technical regulations, standards, testing and certification) to the EEA Agreement. Official Journal L 62, 11.3.2010, p. 14–15.

TERMS OF REFERENCE

In accordance with Article 32 of Regulation (EC) No 396/2005, EFSA shall submit the Annual Report on pesticide residues concerning the control activities carried out in 2010 to the Commission.

The Annual Report shall at least include the following information:

- an analysis of the results of the controls on pesticide residues provided by EU Member States and two EFTA States;
- a statement of the possible reasons why the MRLs were exceeded, together with any appropriate observations regarding risk management options;
- an analysis of chronic and acute risks to the health of consumers from pesticide residues;
- an assessment of consumer exposure to pesticide residues based on the information provided under the first bullet point and any other relevant information available, including reports submitted under Directive 96/23/EC[8].

In addition, the report may include an opinion on the pesticides that should be included in future programmes.

[8] Council Directive 96/23/EC of 29 April 1996 on measures to monitor certain substances and residues thereof in live animals and animal products and repealing Directives 85/358/EEC and 86/469/EEC and Decisions 89/187/EEC and 91/664/EEC. OJ L 125, 23.5.1996, p. 10–32.

ASSESSMENT

1. Introduction

The report presents the results of the control programmes on pesticide residues in food commodities sampled during the calendar year 2010 in the 27 EU Member States and the two EFTA countries (Norway and Iceland).

The objective of this report is to give an overview of the official control activities performed by EU Member States and EFTA countries (in the following referred to as EU or reporting countries) in order to ensure compliance of food with the standards defined by Regulation (EC) No 396/2005, to summarise the results provided by the reporting countries, to identify critical areas of concern regarding sample compliance with Maximum Residue Levels (MRLs), to assess the actual consumer exposure to pesticide residues and to perform an analysis of the chronic and acute risks to consumer health. Furthermore, this report provides some recommendations for future monitoring plans and activities related to the enforcement of the pesticide legislation.

2010 was the second year in which the fully harmonised pesticide MRL legislation was in place in Europe. Regulation (EC) No 396/2005 lays down MRLs for all active substances used in plant protection products that have the potential to enter the food chain. The same legal limits are applicable in the EFTA countries; however, these limits normally enter into force later than in the EU Member States.

In 2009 a new format for submitting the results of monitoring activities, was implemented (EFSA, 2010). In contrast to previous years, Member States now provide all relevant details related to the samples analysed, whereas in previous years aggregated results were submitted. In total, 42 fields are defined to characterise an analysed sample and its analytical results, 22 of the fields are mandatory (EFSA 2012a). The detailed information available to EFSA allows the performance of a more detailed analysis of the results, including a more accurate assessment of the consumer exposure.

Due to the changed legal situation and the introduction of the new reporting format, the results of monitoring reports 2009 and 2010 are not directly comparable with the results reported in previous reports. It is also important to highlight that the comparability of results reported by individual reporting countries is also limited due to differences in the scope of the national control programmes, proficiencies of analytical laboratories providing results, the data validation and recoding[9].

Chapter 2 of the report describes the design of the monitoring programmes in place in Europe. In particular, the **EU-coordinated multiannual control programme** and the **national control *programmes*** are explained.

The results of the **EU-coordinated multiannual control programme,** as established in Commission Regulation (EC) No 901/2009, are reported in **chapter 3** of this report.

Key figures and results of the **national control programmes** (focussing mainly on the surveillance samples***)*** are summarised in **chapter 4**.

In the last section of the report (**chapter 5**), EFSA assessed the **dietary exposure** of European consumers, mainly based on the results of the EU-coordinated multiannual Community control programme.

[9] More detailed information on the results of control activities in the individual reporting countries is available from the respective national authorities. The list of web addresses where the results of monitoring plans have been published is reported in Appendix I. It should be noted that upon submission of the data, EFSA validated the data and recoded the names of the food and the pesticide names reported by the participating countries to make them comparable. In case of data inconsistencies, the reporting countries were asked for corrections. Therefore, small differences in the data published separately by the national authorities or in the "national summary reports" of Appendix II respectively and the data reported in the present report may occur.

Readers not familiar with terms and concepts frequently used in the present report (e.g. MRL and sampling strategy) are invited to read the **Glossary** at the end of the report.

2. Design and background of the control programmes

To fulfil the requirements of Regulation (EC) No 882/2004 and Regulation (EC) No 396/2005, EU Member States perform official controls to ensure the compliance of feed and food samples with regard to the pesticide MRL legislation.

Typically, in each European reporting country, two control programmes are in place: a national control/monitoring programme (designed individually by each country) and a European coordinated multiannual control programme, which gives clear guidance on which specific control activities should be performed by the Member States[10].

2.1. EU-coordinated programme (EUCP)

The **EU-coordinated programme** aims to provide statistically representative data regarding pesticide residues in food available to European consumers. The lots sampled should be chosen without any particular suspicion towards a specific producer and/or consignment. Thus, the results obtained in the coordinated programme are considered as an indicator for the MRL compliance rate in food of plant and animal origin placed on the European common market and they allow an estimation of the actual consumer exposure.

The establishment of a coordinated community programme was initiated in 1996. Since then, the number of participating reporting countries has increased; in 1996, 15 EU Member States and one EFTA State (Norway) reported their control results, whereas in 2010 the number of participating countries was 29: 27 EU Member States and two EFTA countries (Norway and Iceland) who have signed the Agreement on the European Economic Area (EEA agreement). Over time, the programme was also extended with regard to the number of samples, the food commodities and the pesticides to be analysed each monitoring year.

The coordinated control programme for 2010 is laid down in Commission Regulation (EC) No 901/2009.

2.1.1. Food commodities analysed

The major components of the European diet (food of plant origin) are represented by approx. 30 food products. Monitoring the pesticide residues in these commodities should provide a representative basis for the estimation of the exposure to pesticide residues in food of European consumers. In view of the resources available at national level, participating countries focus on the sampling and analysis of approx. ten products each year, which are tested in a three-year cycle, in total covering the major food items. Food commodities[11] to be analysed in 2010, 2011 and 2012 in the framework of the EU-coordinated programme are listed in Table 2-1. For the second time food of animal origin (milk, swine meat) was included into the coordinated control programme in 2010.

[10] See "Control programmes" and "Sampling strategy" in the Glossary.
[11] See "Food commodities" in the Glossary.

Table 2-1: EUCP – Food commodities to be monitored in the calendar years 2010, 2011 and 2012.

2010	2011	2012
Apples	Beans without pods [(a)]	Aubergines
Head cabbage	Carrots	Bananas
Leek	Cucumbers	Butter
Lettuce	Poultry meat	Cauliflower
Milk	Liver [(d)]	Eggs
Peaches [(c)]	Oranges or Mandarins	Orange juice [(b)]
Pears [(e)]	Pears	Peas without pods [(a)]
Rye or oats	Rice	Peppers (sweet)
Strawberries	Potatoes	Table grapes
Swine meat	Spinach [(a)]	Wheat
Tomatoes		

(a): Fresh or frozen
(b): For orange juice, reporting countries were requested to specify the source (concentrate or fresh fruits)
(c): Peaches including nectarines and similar hybrids
(d): Bovine and other ruminants, swine and poultry
(e): In 2010 pears had to be analysed for amitraz only

Figure 2-1 shows the contribution of food commodities included in the EU-coordinated residue control programme for 2010, 2011 and 2012 to the total food consumption[12]. The food consumption data were retrieved from national food consumption surveys either for the whole population, adults, children or selected consumer groups (e.g. vegetarians) or other sources of information suitable to conclude on the food habits of the European population such as food balance sheets (e.g. WHO diets). The data regarding the national food consumption were submitted to EFSA in the framework of the development of the EFSA PRIMo (Pesticide Residue Intake Model) and details on the diet in each Member State can be found in the EFSA report on temporary MRLs (EFSA, 2007). It should be noted that not all participating countries had submitted food consumption data to EFSA at that time and therefore some countries are not represented in the graph.

[12] The total food consumption for the different diets is expressed as unprocessed food and contains only food of plant origin with the exemption of sugar beet. Food of animal origin was not included in the calculation of the total consumption, because the level of details reported are not comparable.

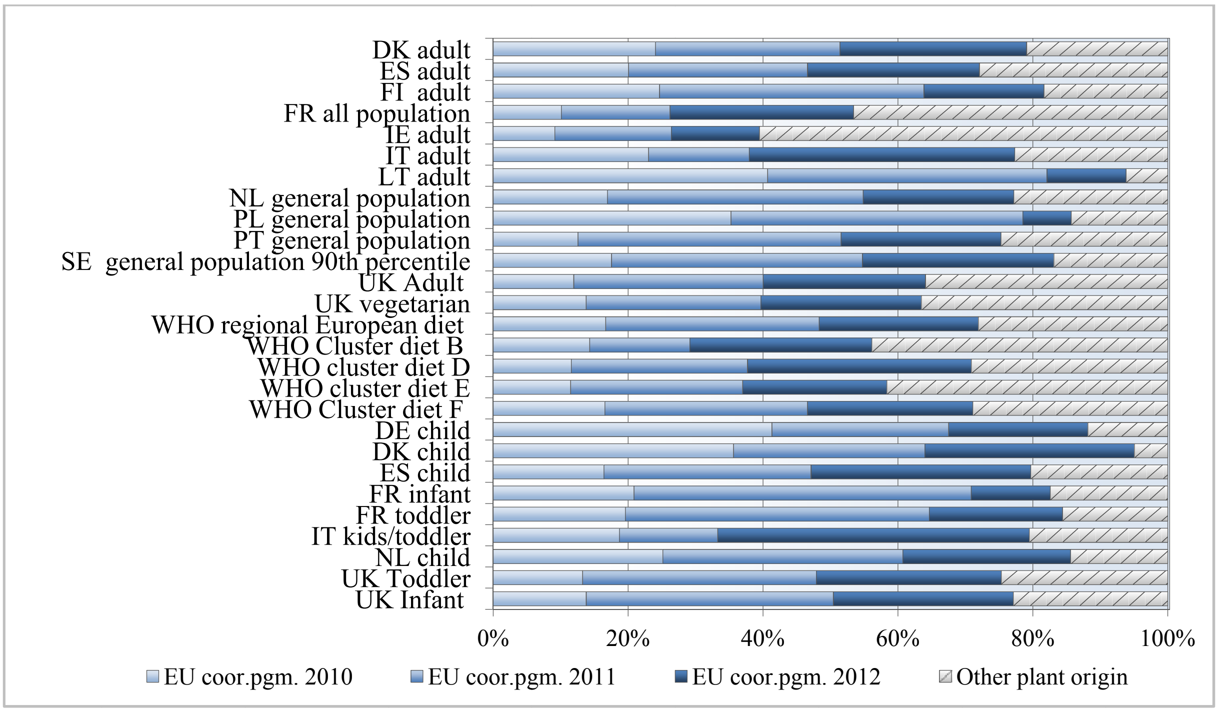


Figure 2-1: EUCP – Contribution of the commodities covered by the EU-coordinated control programmes to the total food intake (excluding orange juice, animal products and sugar beets).

Figure 2-2 shows the individual contributions of the food items included in the 2010 programme for the above mentioned European diets.

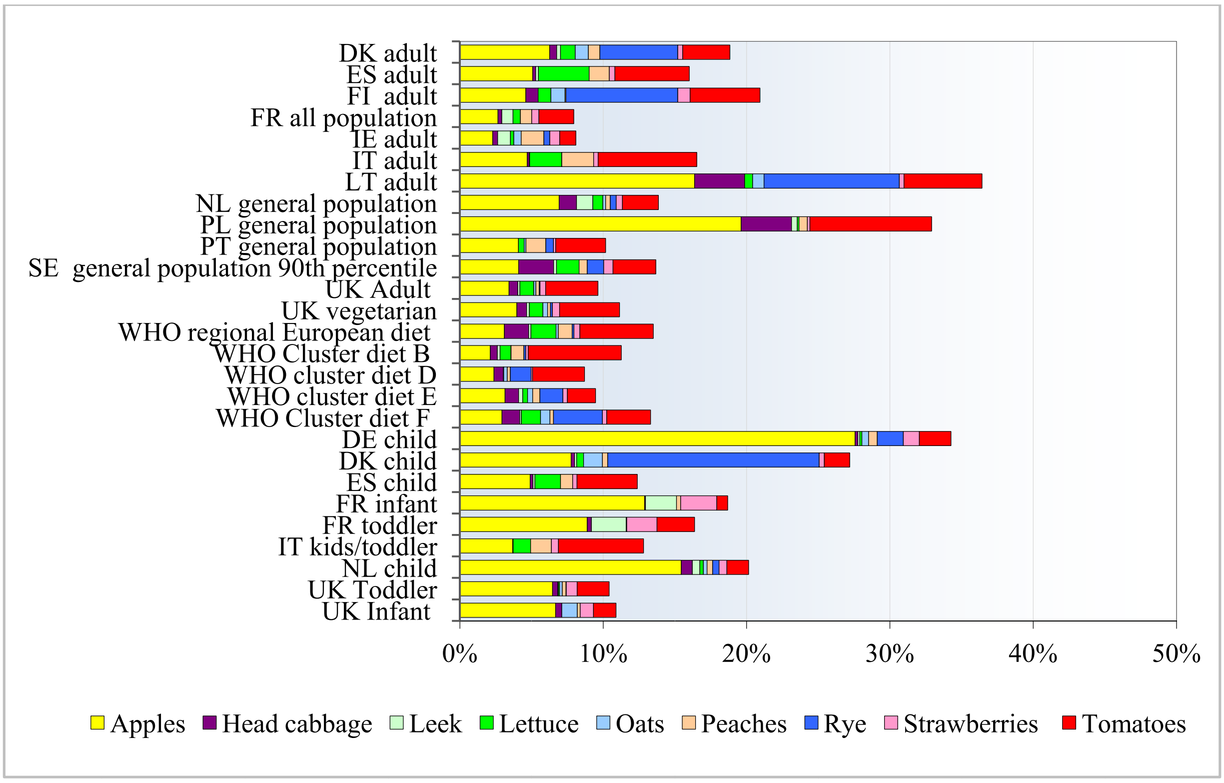


Figure 2-2: EUCP – Contribution of the commodities covered by the EU-coordinated control programme 2010 to the total food intake (excluding orange juice, products of animal origin and sugar beets).

From this analysis it can be seen that the crops (apples, head cabbage, leek, lettuce, milk, peaches, pears, rye, oats, strawberries, swine meat, tomatoes) selected for the 2010 control programme represented 8% to 36% of the total dietary daily intake of products of plant origin, whereas the total contribution of the crops to be monitored in the three years cycle ranges from 39% to 95%. These data demonstrate that the food items selected are representative of the total food consumption of European consumers and can therefore be used for the assessment of dietary exposure to pesticide residues via food.

Figure 2-3 and Figure 2-4 show the total number of samples taken and the total number of determinations carried out for each food commodity in the framework of the 2010 EU-coordinated programme, respectively.

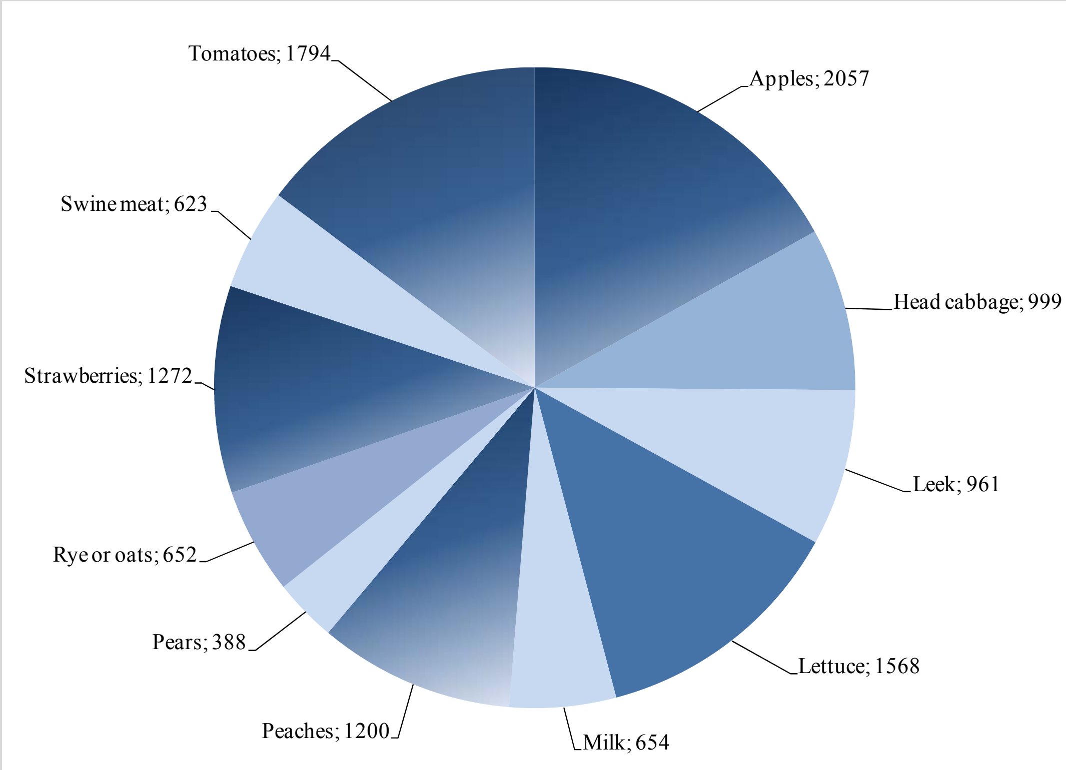


Figure 2-3: Number of samples taken (total of 12,168) for each food commodity included in the 2010 EUCP.

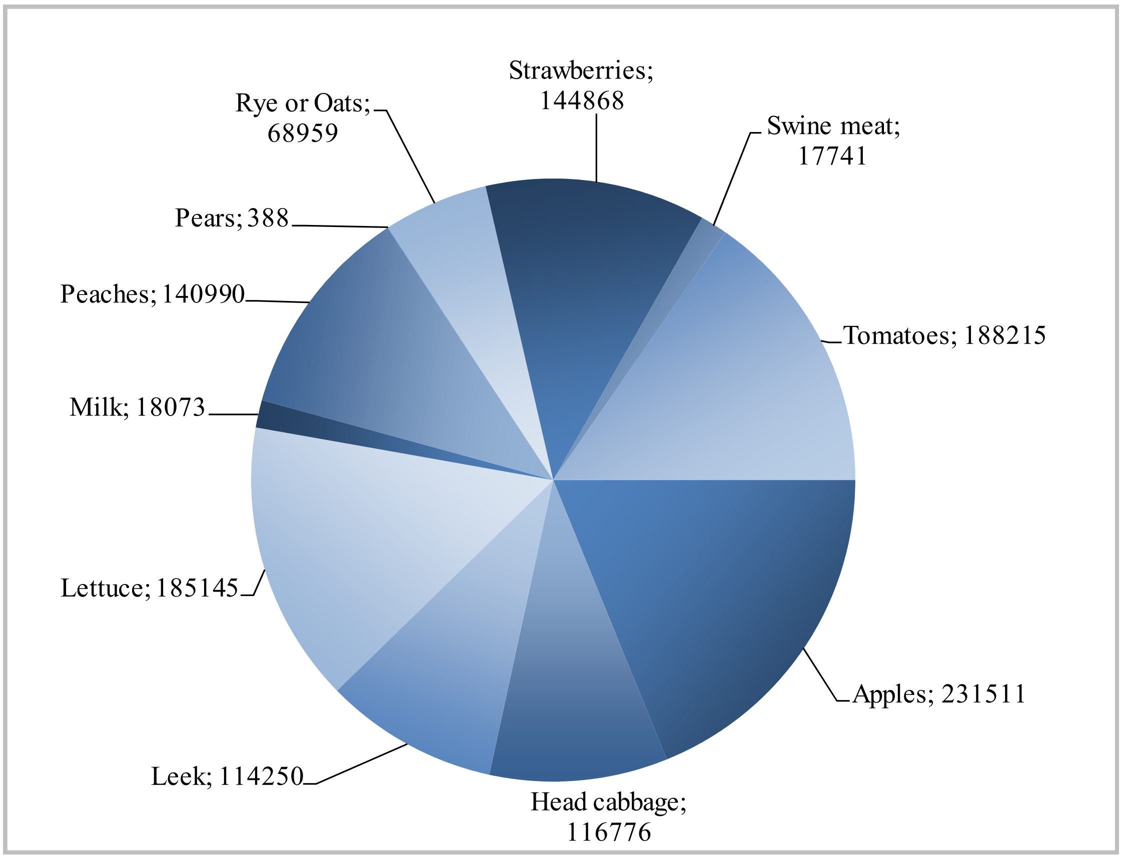


Figure 2-4: Number of single analytical determinations carried out (total of 1,226,916) for each food commodity included in the 2010 EUCP.

2.1.2. Pesticides analysed

Table 2-2 lists the pesticides and their relevant metabolites[13] which - according to the 2010 EU-coordinated programme - had to be analysed in food of plant origin (157 pesticides, 38 of them analysed on a voluntary basis) and in food of animal origin (in total 34 pesticides, six of them analysed on a voluntary basis), in total 178 different pesticides. Since the start of the coordinated control programme in 1996, where only nine pesticides were included in the programme (Figure 2-5), the pesticide list has been extended substantially. Between 1996 and 2008, the EU monitoring programmes were established in Commission Recommendations and were therefore not legally binding. Consequently, the analysis of the pesticides listed in these years was considered as voluntary. Starting from the monitoring year 2009, the Member States participation in the EU-coordinated programme became compulsory. For certain pesticides, however the analysis had to be carried out on a voluntary basis.

It should be noted that for all pesticides analysed in 2010 fully harmonised EU MRLs were in place on 1 January 2010. For two pesticides (cadusafos and dichlofluanid) the default MRL of 0.01 mg/kg, as laid down in Article 18(1) (b) of Regulation (EC) No 396/2005, was applicable[14].

[13] See “Residue definition” in the Glossary.

[14] The EFTA countries (Iceland and Norway) also have the legal limits applicable in the European Union implemented in their national legislation. Compared to the Member States, however, the date of entry into force of the EU MRLs is delayed.

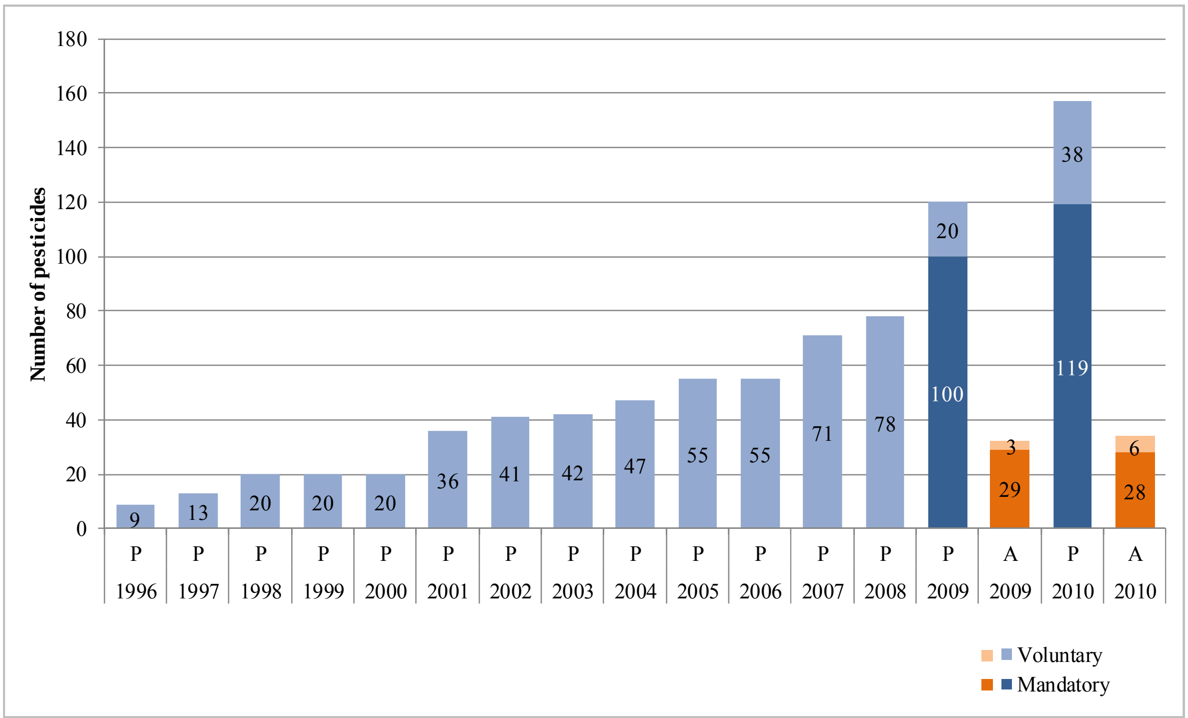


Figure 2-5: EUCP – Number of pesticides (residue definitions) included in the coordinated control programmes 1996-2010 (P = pesticides to be analysed in products of Plant origin, A = pesticides to analysed in products of Animal origin).

Table 2-2: EUCP – List of pesticides included in the 2010 EU-coordinated programme.

Pesticide	Residue definition according to Regulation (EC) No 396/2005 on EU MRLs[(a)]	Type of food[(b)]	Voluntary analysis in 2010[(c)]
2,4-D	Sum of 2,4-D and its esters expressed as 2,4-D	P	X
Abamectin	Sum of avermectin B1a, avermectin B1b and delta-8,9 isomer of avermectin B1a	P	
Acephate		P	
Acetamiprid		P	
Acrinathrin		P	X
Aldicarb	Sum of aldicarb, its sulfoxide and its sulfone, expressed as aldicarb	P	
Amitraz	Amitraz including the metabolites containing the 2,4-dimethylaniline moiety expressed as amitraz	P	Mandatory only in pears
Amitrole		P	X
Azinphos-ethyl		A	X
Azinphos-methyl		P	
Azoxystrobin		P	
Benfuracarb		P	X
Bifenthrin		P, A	
Bitertanol		P	
Boscalid		P	
Bromide ion		P	Mandatory in lettuce and tomatoes

Pesticide	Residue definition according to Regulation (EC) No 396/2005 on EU MRLs[(a)]	Type of food[(b)]	Voluntary analysis in 2010[(c)]
Bromopropylate		P	
Bromuconazole	Sum of diasteroisomers	P	X
Bupirimate		P	
Buprofezin		P	
Cadusafos		P	X
Camphechlor	Sum of parlar No 26, 50 and 62 [(d)]	A	X
Captan [(e)]		P	
Carbaryl		P	
Carbendazim and Benomyl	Sum of benomyl and carbendazim expressed as carbendazim	P	
Carbofuran	Sum of carbofuran and 3-hydroxycarbofuran expressed as carbofuran	P	
Carbosulfan		P	X
Chlordane	Sum of cis- and trans-isomers and oxychlordane expressed as chlordane	A	
Chlorfenapyr		P	
Chlorfenvinphos		P	
Chlormequat		P	Mandatory in rye and oats
Chlorobenzilate		A	X
Chlorothalonil		P	
Chlorpropham [(f)]	Chlorpropham and 3-chloroaniline expressed as chlorpropham	P	
Chlorpyrifos		P, A	
Chlorpyrifos-methyl		P, A	
Clofentezin [(g)]	Sum of all compounds containing the 2-chlorbenzoyl-moiety expressed as clofentezin [(g)]	P	
Clothianidin		P	
Cyfluthrin	Cyfluthrin incl. other mixtures of constituent isomers (sum of isomers)	P, A	
Cypermethrin	Cypermethrin incl. other mixtures of constituent isomers (sum of isomers)	P, A	
Cyproconazole		P	X
Cyprodinil		P	
DDT	Sum of p,p′-DDT, o,p′-DDT, p-p′-DDE and p,p′-DDD (TDE) expressed as DDT	A	
Deltamethrin	Cis-deltamethrin	P, A	
Diazinon		P, A	
Dichlofluanid		P	
Dichlorvos		P	
Dicloran		P	
Dicofol	Sum of p,p′ and o,p′ isomers	P	
Dieldrin	aldrin and dieldrin combined expressed as dieldrin	A	

Pesticide	Residue definition according to Regulation (EC) No 396/2005 on EU MRLs(a)	Type of food(b)	Voluntary analysis in 2010(c)
Difenoconazole		P	
Dimethoate	Sum of dimethoate and omethoate expressed as dimethoate (i)	P	
Dimethomorph		P	
Dinocap	Sum of dinocap isomers and their corresponding phenols expressed as dinocap	P	X
Diphenylamine		P	
Dithiocarbamates	Dithiocarbamates expressed as CS2, including maneb, mancozeb, metiram, propineb, thiram and ziram	P	
Endosulfan	Sum of alpha- and beta-isomers and endosulfan-sulphate expressed as endosulfan	P, A	
Endrin		A	
Epoxiconazole		P	
Ethephon		P	X
Ethion		P	
Etofenprox		P	X
Ethoprophos		P	X
Fenamiphos	Sum of fenamiphos and its sulfoxide and sulfone expressed as fenamiphos	P	X
Fenarimol		P	
Fenazaquin		P	
Fenbuconazole		P	X
Fenbutatin oxide		P	X
Fenhexamid		P	
Fenitrothion		P	
Fenoxycarb		P	
Fenpropathrin		P	X
Fenpropimorph		P	
Fenthion	Sum of fenthion and its oxygen analogue, their sulfoxides and sulfone expressed as parent	P, A	
Fenvalerate and Esfenvalerate	Sum of RS/SR and RR/SS isomers	P, A	
Fipronil	Sum of fipronil and sulfone metabolite (MB46136) expressed as fipronil	P	
Fluazifop	Fluazifop-P-butyl (fluazifop acid (free and conjugate))	P	X
Fludioxonil		P	
Flufenoxuron		P	
Fluquinconazole		P	X
Flusilazole		P	
Flutriafol		P	X
Folpet (e)		P	
Formetanate	Sum of formetanate and its salts expressed as formetanate (hydrochloride)	P	

Pesticide	Residue definition according to Regulation (EC) No 396/2005 on EU MRLs[(a)]	Type of food[(b)]	Voluntary analysis in 2010[(c)]
Fosthiazate		P	X
Glyphosate		P	Mandatory in rye and oats
Haloxyfop including Haloxyfop-R	Haloxyfop-R methyl ester, haloxyfop-R and conjugates of haloxyfop-R expressed as haloxyfop-R	P	X
Heptachlor	Sum of heptachlor and heptachlor epoxide expressed as heptachlor	A	
Hexachlorbenzene		A	
Hexachlorocyclohexane (HCH), Alpha-isomer		A	
Hexachlorocyclohexane (HCH), Beta-isomer		A	
Hexaconazole		P	
Hexythiazox		P	
Imazalil		P	
Imidacloprid		P	
Indoxacarb	Indoxacarb as sum of the isomers S and R	P	
Iprodione		P	
Iprovalicarb		P	
Kresoxim-methyl		P	
Lambda-Cyhalothrin	Lambda-cyhalothrin, incl. other mixtures of constituent isomers (sum of isomers)	P	
Lindane	Gamma-isomer of hexachlorocyclohexane (HCH)	A	
Linuron		P	
Lufenuron		P	
Malathion	Sum of malathion and malaoxon expressed as malathion	P	
Mepanipyrim	Mepanipyrim and its metabolite (2-anilino-4-(2-hydroxypropyl)-6-methylpyrimidine) expressed as mepanipyrim	P	
Mepiquat		P	Mandatory in rye and oats
Metalaxyl and Metalaxyl-M	Metalaxyl incl. mixtures of constituent isomers incl. Metalaxyl-M (sum of isomers)	P	
Metconazole		P	X
Methamidophos		P	
Methidathion		P, A	
Methiocarb	Sum of methiocarb and methiocarb sulfoxide and sulfone, expressed as methiocarb	P	
Methomyl and Thiodicarb	Sum of methomyl and thiodicarb expressed as methomyl	P	
Methoxychlor [(j)]		A	
Methoxyfenozide		P	
Monocrotophos		P	

Pesticide	Residue definition according to Regulation (EC) No 396/2005 on EU MRLs[(a)]	Type of food[(b)]	Voluntary analysis in 2010[(c)]
Myclobutanil		P	
Oxadixyl		P	
Oxamyl		P	
Oxydemeton-methyl	Sum of oxydemeton-methyl and demeton-S-methylsulfone expressed as oxydemeton-methyl	P	
Paclobutrazole		P	X
Parathion		P, A	
Parathion-methyl	Sum of parathion-methyl and paraoxon-methyl expressed as parathion-methyl	P, A	
Pencycuron		P	
Penconazole		P	
Pendimethalin		P	
Permethrin	Sum of isomers	A	
Phentoate		P	X
Phosalone		P	
Phosmet	Phosmet and phosmet oxon expressed as phosmet	P	
Phoxim		P	X
Pirimicarb	Sum of pirimicarb and desmethylpirimicarb expressed as pirimicarb	P	
Pirimiphos-methyl		P, A	
Prochloraz	Sum of prochloraz and its metabolites containing the 2,4,6-trichlorophenol moiety expressed as prochloraz	P	
Procymidone		P	
Profenofos		P, A	
Propamocarb	Sum of propamocarb and its salt expressed as propamocarb	P	X
Propargite		P	
Propiconazole		P	
Propyzamide		P	
Prothioconazole	Prothioconazole (prothioconazole-desthio)	P	X
Pyraclostrobin		P	
Pyrazophos		A	
Pyrethrins		P	X
Pyridaben		P	
Pyrimethanil		P	
Pyriproxyfen		P	
Quinoxyfen		P	
Quintozene	Sum of quintozene and pentachloro-aniline expressed as quintozene	A	X
Resmethrin	Resmethrin including other mixtures of constituent isomers (sum of isomers)	A	X
Spinosad	Sum of spinosyn A and spinosyn D, expressed as spinosad	P	
Spiroxamine		P	

Pesticide	Residue definition according to Regulation (EC) No 396/2005 on EU MRLs(a)	Type of food(b)	Voluntary analysis in 2010(c)
Taufluvalinate		P	
Tebuconazole		P	
Tebufenozide		P	
Tebufenpyrad		P	
Tecnazene		A	X
Teflubenzuron		P	
Tefluthrin		P	X
Tetraconazole		P	
Tetradifon		P	
Thiabendazole		P	
Thiacloprid		P	
Thiamethoxam	Sum of thiamethoxam and clothianidin expressed as thiamethoxam	P	
Thiophanate-methyl		P	
Tolclofos-methyl		P	
Tolylfluanid	Sum of tolylfluanid and dimethylaminosulfotoluidide expressed as tolylfluanid	P	
Triadimefon and Triadimenol	Sum of triadimefon and triadimenol	P	
Triazophos		P, A	
Trichlorfon		P	X
Trifloxystrobin		P	
Triflumuron		P	X
Trifluralin		P	
Triticonazole		P	X
Vinclozolin	Sum of vinclozolin and all metabolites cont. the 3,5-dichloraniniline moiety, expressed as vinclozolin	P	
Zoxamide		P	X

(a): Unless specifically indicated in the table, the residue definition comprises the parent compound only.

(b): P = plant products, A = animal products

(c): X = To be analysed on a voluntarily basis

(d): Sum of the three indicator compounds parlar No 26, 50 and 62, where:

Parlar No 26 = 2-endo,3-exo,5-endo,6-exo,8,8,10,10-octachlorobornane

Parlar No 50 = 2-endo,3-exo,5-endo,6-exo,8,8,9,10,10-nonachlorobornane

Parlar No 62 = 2,2,5,5,8,9,9,10,10,-nonachlorobornane

(e): For some commodities covered by the EU-coordinated monitoring programme the residue definition is sum of captan and folpet (i.e. apples, strawberries and tomatoes).

(f): Chlorpropham: residue definition for plant products with exemption of potatoes (chlorpropham only).

(g): Clofentezine: residue definition only for cereals; otherwise, parent compound only.

(h): According to Regulation (EC) No 901/2009 the results for dimethoate and omethoate had to be reported as a sum, but also separately.

(i): Since 4,4´-Methoxychlor listed in Regulation (EC) No 901/2009 is not a pesticide, it is assumed that the control Regulation refers to the active substance methoxychlor.

2.1.3. Number of samples

The control programme in Regulation (EC) No 901/2009 defines the minimum number of samples to be analysed by each reporting country in the framework of the 2010 EU-coordinated programme, varying from 12 to 93 samples per product, depending on the population of the Member State (see Table 2-3). The minimum total number of samples per commodity required to obtain representative results at EU level was calculated to be 642 samples[15,16]; a representative proportion of this figure was then assigned to the Member States taking into account the population per reporting country.

A total number of 12,168 samples of 12 different commodities ("rye and oats" are counted separately) were analysed in the framework of the 2010 EU-coordinated pesticide control programme (Figure 2-6) and 1,226,916 number of determinations were performed (Figure 2-7).

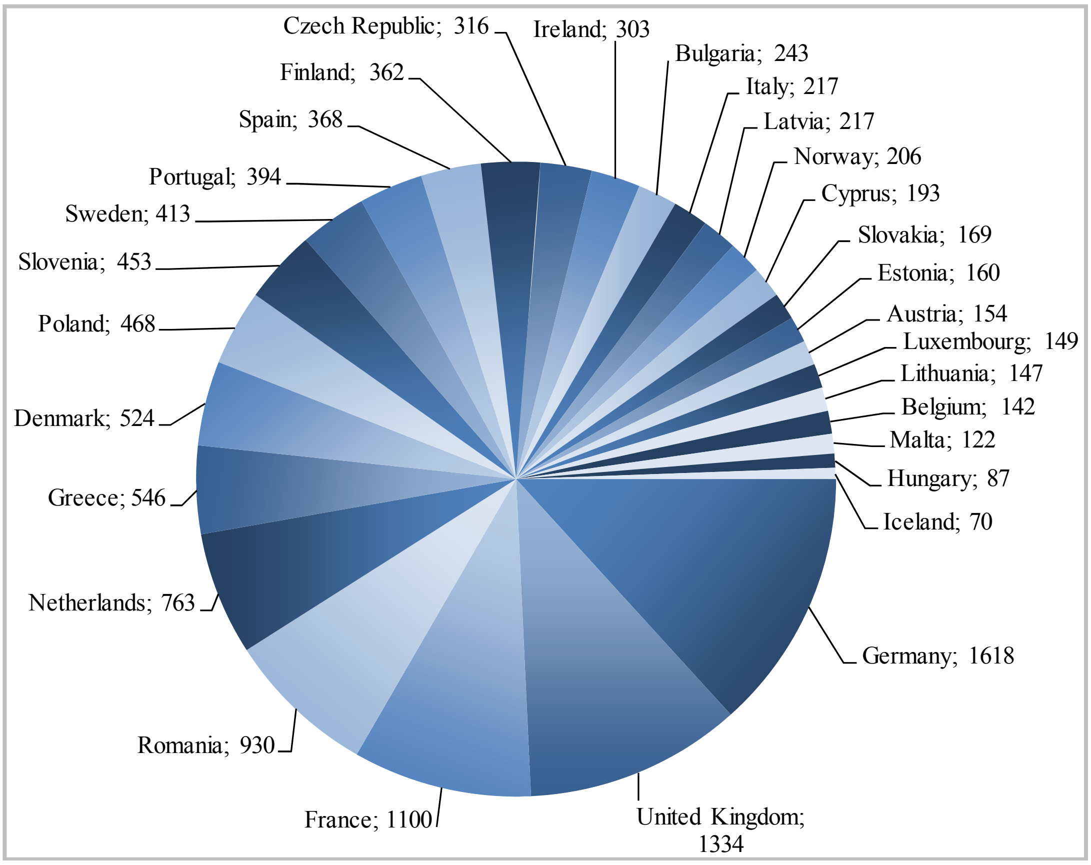


Figure 2-6: EUCP – Number of surveillance samples (total of 12,168) taken in the coordinated programme 2010, specified by reporting country.

[15] According to Article 3 of Regulation (EC) No 901/2009, the total number of samples to be analysed was derived on the basis of a binomial probability distribution, which estimated that the examination of 642 samples allows the detection of a sample containing pesticide residues above the limit of determination, with a certainty of more than 99%, provided that no less than 1% of products of plant origin contain residues above that limit. The collection of these samples should be apportioned between Member States on the basis of population and consumer numbers, with a minimum of 12 samples per product and per year.

[16] It should be noted that the calculation of the number of samples necessary to obtain statistically representative results was based on the number of reporting countries of some years ago. Since the number of reporting countries has increased in the meantime, a recalculation of the total number of necessary samples and the sample distribution should be considered. Therefore, in the previous Annual Report EFSA recommended the re-evaluation of the statistical basis for the number of samples taken by the reporting countries and the development of an updated sampling plan regarding the number of samples per commodity and the assignment of a minimum sample number for each reporting country. EFSA and the European Commission have taken the initiative to reassess the programme design by evaluating the representativeness of e.g. the number of samples collected under the EU-coordinated programme to enable the derivation of more accurate conclusions on the overall MRL compliance rate and on the consumer's exposure assessment. The outcome of this initiative is expected in 2013.

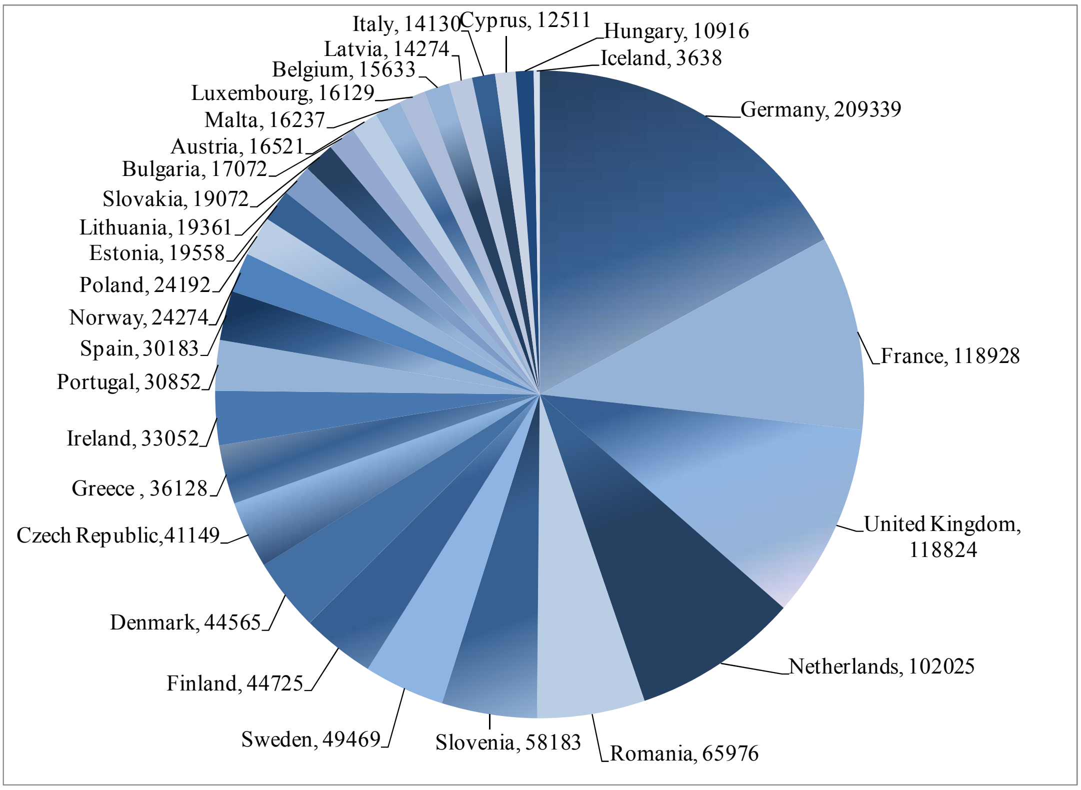


Figure 2-7: EUCP – Number of surveillance determinations (total of 1,226,916) performed in the EU-coordinated programme 2010, specified by reporting country.

Table 2-3 gives an overview of the actual number of samples taken by each reporting country for each commodity.

It is noted that some reporting countries did not fulfil their obligations with regard to the minimum number of samples to be taken for one or several commodities; this is particularly true for apples, head cabbage, leek, milk, pears, rye or oats and swine meat. For pears and swine meat, the minimum number of samples required to obtain representative results at EU level (642 samples) was not reached (see also Table 2-3).

Table 2-3: EUCP – Number of samples taken for each commodity included in the 2010 EU-coordinated programme.

Country	Minimum No. of samples per commodity	Actual number of samples taken											
		Apples	Head cabbage	Leek	Lettuce	Milk	Peaches	Pears**	Rye or oats	Strawberries	Swine meat	Tomatoes	Total
Austria	12/15*	15	15	15	15	17	17	0	13	15	16	16	154
Belgium	12/15*	15	15	15	15	15	15	0	8	14	15	15	142
Bulgaria	12/15*	35	32	37	29	0	36	0	6	31	0	37	243
Cyprus	12/15*	28	0	14	27	5	27	0	0	27	36	29	193
Czech Republic	12/15*	53	39	26	40	0	28	10	51	18	0	51	316
Denmark	12/15*	72	24	22	57	15	53	0	37	60	120	64	524
Estonia	12/15*	17	19	15	13	15	12	0	13	24	15	17	160
Finland	12/15*	102	16	17	47	16	16	6	29	50	16	47	362
France	66	135	64	79	312	0	88	120	83	97	0	122	1100
Germany	93	204	184	191	175	94	188	0	92	199	98	193	1618
Greece	12/15*	90	27	28	78	0	61	26	5	53	15	163	546
Hungary	12/15*	0	10	0	14	0	16	0	15	15	0	17	87
Iceland	12/15*	16	10	7	8	0	9	0	0	5	0	15	70
Ireland	12/15*	89	16	15	38	68	20	0	22	17	0	18	303
Italy	65	56	0	13	17	0	27	1	4	30	2	67	217
Latvia	12/15*	29	30	25	27	8	24	0	9	22	16	27	217
Lithuania	12/15*	20	17	15	14	10	14	0	16	19	8	14	147
Luxembourg	12/15*	20	14	9	18	18	15	9	0	15	15	16	149
Malta	12/15*	15	15	15	15	0	15	0	0	14	15	18	122
Netherlands	17	132	71	56	156	22	70	0	9	97	20	130	763
Norway	12/15*	18	19	22	21	15	22	15	16	19	15	24	206
Poland	45	61	60	50	50	1	50	0	50	49	47	50	468
Portugal	12/15*	63	63	65	41	0	33	0	7	53	0	69	394
Romania	17	296	99	25	74	38	56	0	11	94	0	237	930
Slovakia	12/15*	20	15	15	15	15	14	14	16	13	15	17	169
Slovenia	12/15*	76	30	25	75	1	60	31	20	60	15	60	453

Country	Minimum No. of samples per commodity	Actual number of samples taken											
		Apples	Head cabbage	Leek	Lettuce	Milk	Peaches	Pears**	Rye or oats	Strawberries	Swine meat	Tomatoes	Total
Spain	45	88	5	24	46	16	35	7	9	32	0	106	368
Sweden	12/15*	149	18	25	35	30	31	0	28	34	16	47	413
United Kingdom	66	143	72	96	96	235	148	149	83	96	108	108	1334
Total		**2057**	**999**	**961**	**1568**	**654**	**1200**	**388**	**652**	**1272**	**623**	**1794**	**12168**

* A minimum of 12 samples had to be taken if a single residue method was applied. Otherwise (i.e. multi residue methods), 15 samples was the minimum number of samples to be taken according to the legislation.

** For pears, only amitraz had to be analysed.

2.2. National programmes (NCP)

The official controls carried out at national level within the framework of the **national control programmes** are complementary to the controls performed in the context of the EU-coordinated programme. They are performed to ensure compliance with the provisions established in food legislation regarding pesticide residues. The reporting countries have to define their priorities regarding the design of the national control programmes for pesticide residues in food (see Appendix II).

In designing their national control plans, the reporting countries typically take into account the importance of a commodity in national food habits, the food commodities with high residues/non-compliance rates in previous years, the use pattern of pesticides and the laboratory capacity. Additional details are available in section 2.2 of the 2009 European Report on Pesticide Residue in Food (EFSA, 2011).

More details on the design of the national control programmes are reported in Appendix II of the current report. The number of samples and the analytical scope of the analyses performed by the participating countries are strongly determined by national budgets. Thus, reporting countries have to focus on the specific aspects which are considered most relevant for their national control activities. These results are of value for assessing the MRL compliance at national level; however, due to the variability of the programme designs, the comparison of results from different reporting countries needs to take into account the different objectives and priorities of the national programmes.

2.2.1. Number of samples – national programmes

The total number of samples taken in the context of the national programmes in 2010 was 77,075. Compared to the previous year, an increase of 13.4% was recorded.

In Figure 2-8, the distribution of the total number of samples taken by the reporting countries is displayed. In a second pie chart (Figure 2-9) the number of the single analytical determinations carried out by each reporting country is depicted.

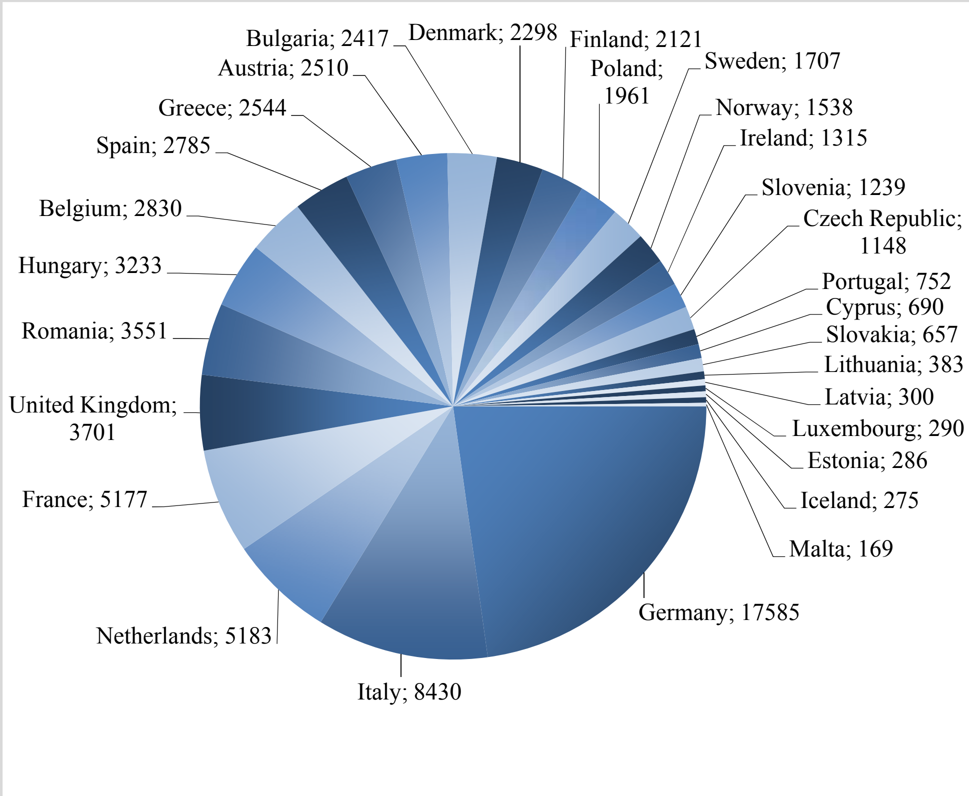


Figure 2-8: EU+NCP – Total number of samples taken (total of 77,075) by each reporting country (surveillance and enforcement) in the framework of the national control programmes.

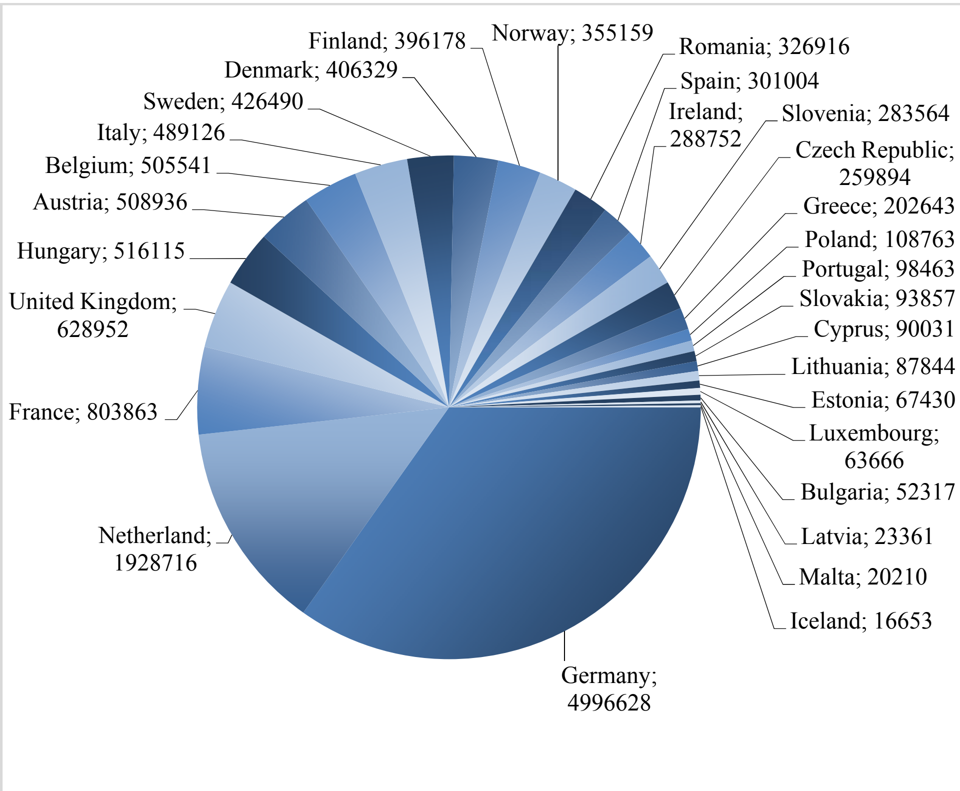


Figure 2-9: EU+NCP – Total number of analytical determinations carried out (total of 14,347,401) in 2010 by each reporting country (surveillance and enforcement) in the framework of the national control programmes.

Depending on the sampling strategy applied, the national programmes are classified as either surveillance or enforcement programmes[17].

In the surveillance programmes, samples are taken without any particular suspicion towards a specific producer and/or consignment. The EU-coordinated control programme is an example of a surveillance programme. However, in most cases the national surveillance programmes are more targeted to achieve the objectives defined in the national control programmes and are therefore already focussed on specific pre-selected food products and countries, but the selection of the consignment/lot is randomised. Follow-up or enforcement sampling is directed at a specific grower/producer or at a specific consignment. In enforcement programmes, the probability of finding samples with positive results or samples exceeding the legal limits is higher than in surveillance programmes.

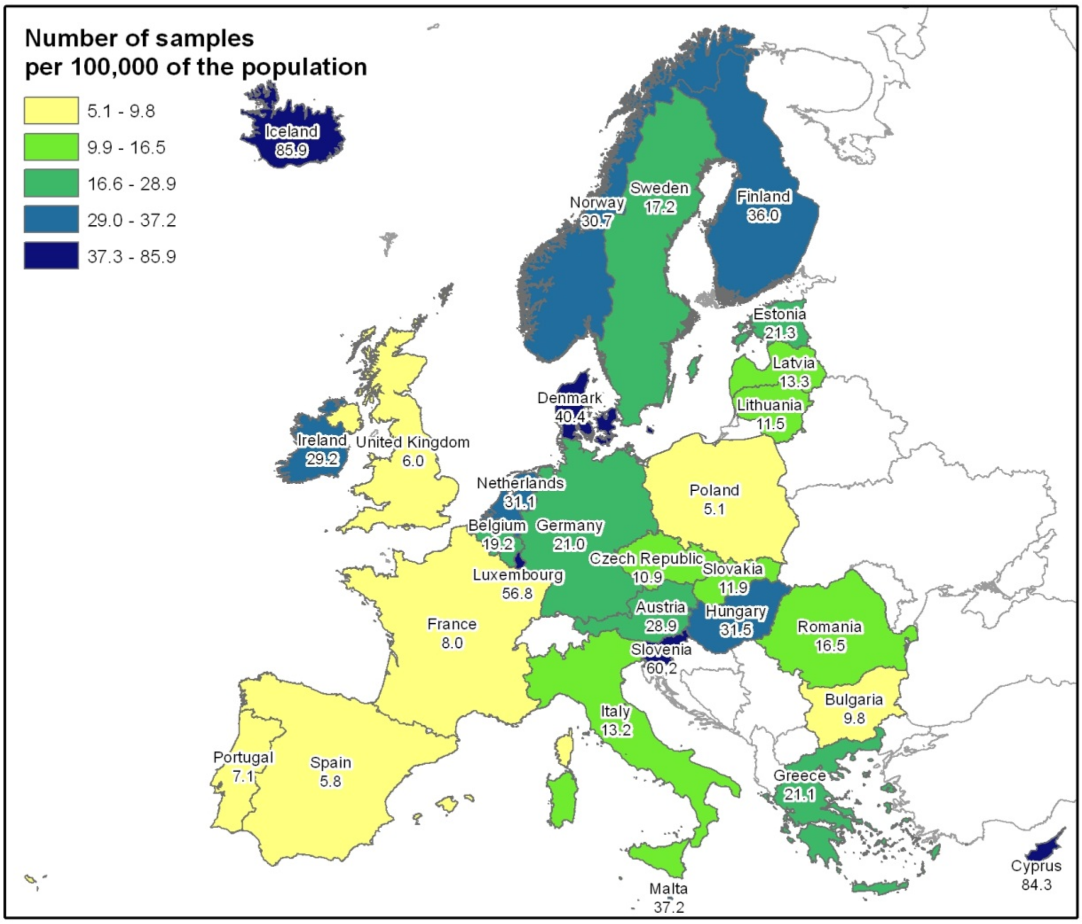
In 2010, the majority of the samples taken were classified as surveillance samples (72,813 samples, 94.5% of the total number of samples). 4,262 (5.5% of the total number of samples) were enforcement samples. Table 2-4 splits them up into the different food product groups.

Table 2-4: EU+NCP – Number of surveillance and enforcement samples in different product groups - 2010.

Product	Surveillance	Enforcement	Total	% of samples
	Number of samples	Number of samples	Number of samples	
Vegetables	29227	2959	32186	41.8
Fruits and nuts	27217	1046	28263	36.7
Animal products	5261	25	5286	6.9
Cereals	4200	81	4281	5.6
Other plant products	2550	102	2652	3.4
Other products	2131	32	2163	2.8
Baby food/Infant formulas	1828	2	1830	2.4
Fish products	399	15	414	0.5
Total	**72813**	**4262**	**77075**	**100.0**

The number of surveillance samples taken by the participating countries, normalised by the national population, is depicted in Map 2-1.

[17] See "Sampling strategy" in the Glossary.



Map 2-1: EU+NCP – Number of surveillance samples taken in 2010 by each reporting country normalised by the national population[18].

The number of surveillance samples taken and normalised per 100,000 national inhabitants varied from 5.1 (Poland) to 85.9 (Iceland) (Figure 2-10). In one single country (Bulgaria) the majority of the samples were classified as enforcement.

[18] Source of population per country 2010: Eurostat http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tps00001 (Download: 30-01-2012 13:54:49)

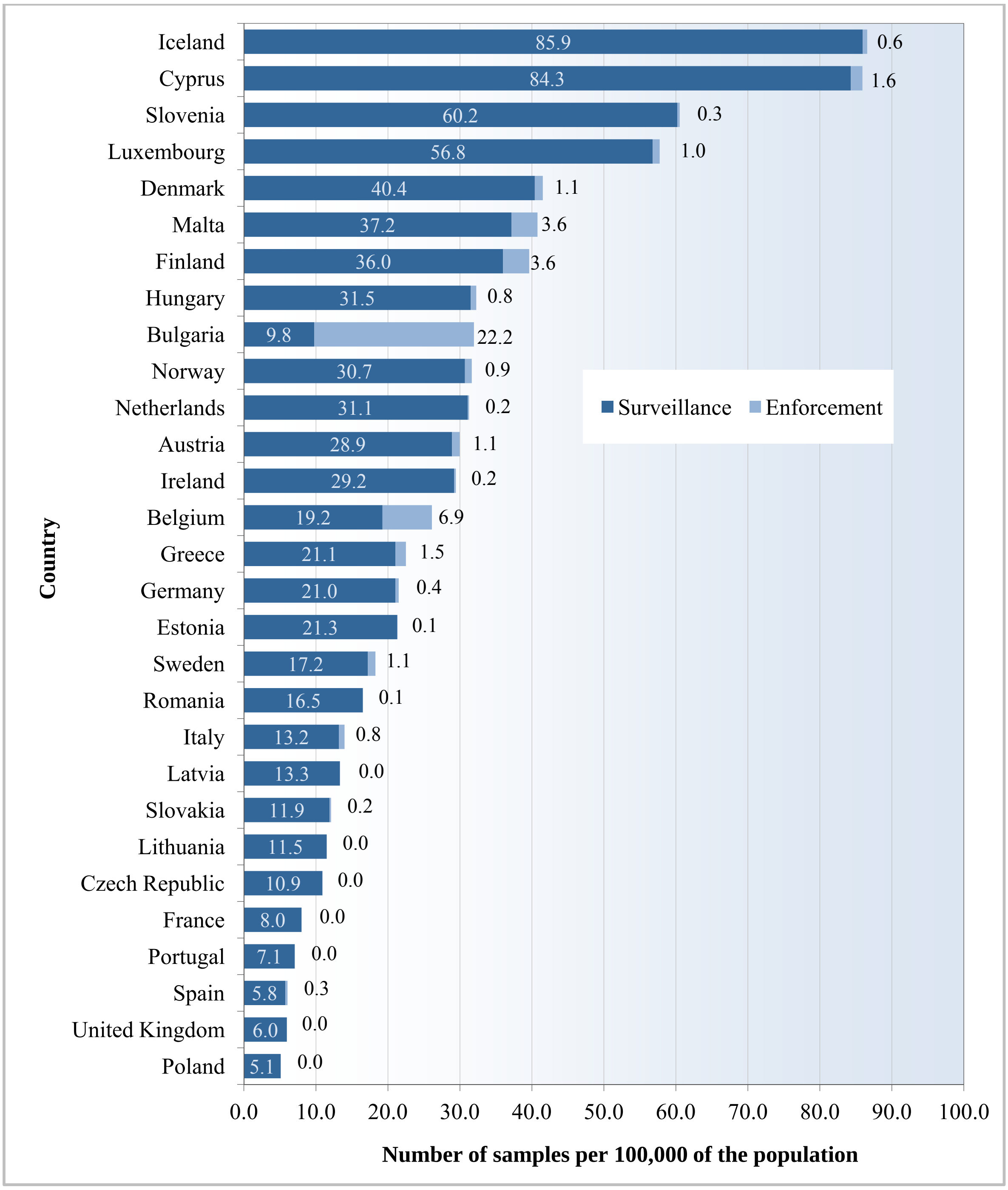


Figure 2-10: EU+NCP – Number of surveillance and enforcement samples by countries normalised by the national population - 2010.

2.2.2. Pesticides analysed – national programmes

In 2010, approximately 500 pesticides were authorised for use as plant protection products in EU Member States[19,20]. However, more than 998 pesticides can potentially be used as plant protection products worldwide and may result in residues in food traded and consumed in Europe. In addition, metabolites resulting from these pesticides may be present in food as well.

[19] Information from the European Commission database available at: http://ec.europa.eu/sanco_pesticides/public/index.cfm

[20] See "Pesticide Residues" in the Glossary.

In 2010, the total number of pesticides sought was 996[21]. Including the metabolites the total number of analytes covered by all reporting countries was 1,096.

Table 2-5 shows the number of pesticides sought in the selected commodity groups by each reporting country. This number varies within a wide range, e.g. in fruits and nuts between 61 and 789 pesticides were sought. It is noted that due to the nature of the national control programmes not all samples were analysed for the full scope of the active substances reported in the table below, but in certain cases (e.g. for enforcement samples) a lower number of analytes was searched in the samples.

Table 2-5: EU+NCP – Number of different residues[22] sought in selected commodity groups by each reporting country in 2010.

Country	Animal products	Baby and infant food	Cereals	Fruits and nuts	Vegetables	Total sought
Austria	133	384	401	397	397	407
Belgium	47	466	286	470	493	497
Bulgaria	-	129	155	155	155	155
Cyprus	103	238	239	241	243	256
Czech Republic	35	258	261	262	261	281
Denmark	115	238	164	235	236	252
Estonia	48	273	259	260	361	367
Finland	39	245	264	279	278	290
France	291	290	328	332	332	336
Germany	573	733	758	789	788	839
Greece	47	227	248	293	278	307
Hungary	1	297	317	319	321	343
Iceland	-	-	-	61	61	61
Ireland	291	290	294	294	294	299
Italy	57	273	318	343	336	362
Latvia	33	140	144	142	142	162
Lithuania	34	239	242	241	240	251
Luxembourg	61	377	341	397	367	422
Malta	37	143	-	155	172	289
Netherlands	50	403	249	411	410	421
Norway	32	254	265	269	257	278
Poland	65	115	129	188	186	201
Portugal	-	231	43	240	239	240
Romania	38	75	135	137	137	180
Slovakia	35	147	217	221	217	245
Slovenia	34	263	256	260	260	285
Spain	255	383	421	491	469	560

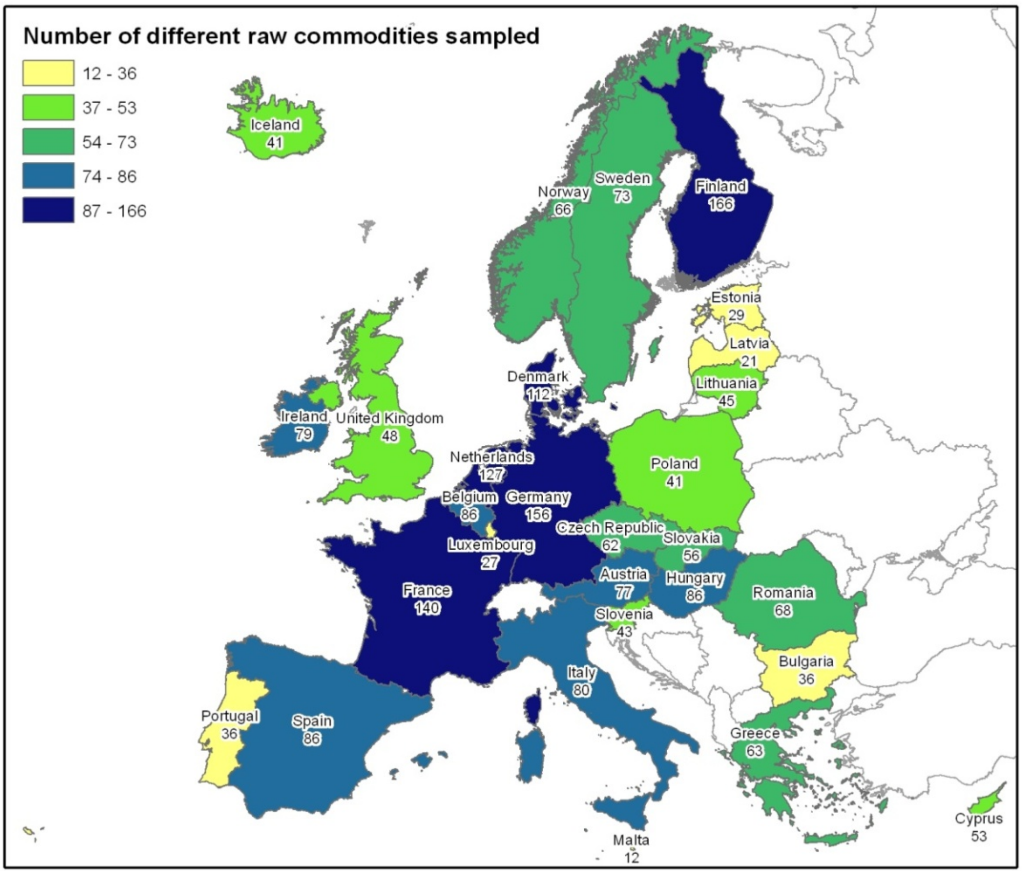
[21] The number of pesticides sought refers to the residue definitions (see "Residue definition" in the Glossary). Metabolites or degradation products included in a residue definition are not counted separately.
[22] The number of different residues reported in Table 2-5 also includes the number of distinct metabolites and degradation products of the pesticides analysed. In Table 2-5 the pesticides sought in the food group "other plant products" (see "Food commodities" in the Glossary) are not reported.

Country	Animal products	Baby and infant food	Cereals	Fruits and nuts	Vegetables	Total sought
Sweden	54	338	221	325	326	371
United Kingdom	37	144	66	349	355	369
Total number of distinct pesticides	**707**	**967**	**926**	**1007**	**1005**	**1075**

2.2.3. Food commodities analysed – national programmes

The EU MRL legislation lists about 400 food commodities[23] for which MRLs have been established. The commodities were classified into 12 main food categories[24]. These products and product groups refer to unprocessed raw commodities of plant or animal origin as placed on the market. The description of the commodities and the parts of the products to which the MRLs apply can be found in Annex I to Regulation (EC) No 396/2005.

In 2010, 529 different food commodities (including processed and unprocessed food commodities) were analysed for pesticide residues among all 29 reporting countries. The number of different raw commodities sampled by each reporting country is shown in Map 2-2. The data shown in the Map reveals that the sampling design with regards the selection of the food commodities greatly varies among the reporting countries.



Map 2-2: EU+NCP Number of different raw commodities sampled by each reporting country (excluding processed and baby food) - 2010.

[23] This figure includes the main crops and related varieties or other crops to which the MRLs apply.
[24] See "Food commodities" in the Glossary.

2.2.4. Baby food monitoring

A general default EU MRL of 0.01 mg/kg is applicable to all pesticides in baby food samples, unless specific MRLs lower than 0.01 mg/kg, are established under the specific EU legislation for baby food (Table 2-6). Table 2-7 lists the pesticides which according to the EU[25] legislation[26,27] shall not be used in agricultural production intended for the production of infant and follow-on formulae, processed cereal-based foods and baby foods for infants and young children. They are considered as not used if their residues do not exceed 0.003 mg/kg. Most of these substances are not approved under Regulation (EC) 1107/2009[28] and therefore cannot be used throughout Europe.

Table 2-6: Substances for which specific MRLs lower than 0.01 mg/kg are established for baby food.

Chemical name of the substance (residue definition)	MRL (mg/kg)
Cadusafos	0.006
Demeton-S-methyl/demeton-S-methyl sulfone/oxydemeton-methyl (individually or combined, expressed as demeton-S-methyl)	0.006
Ethoprophos	0.008
Fipronil (sum of fipronil and fipronil-desulfinyl, expressed as fipronil)	0.004
Propineb/propylenethiourea (sum of propineb and propylenethiourea)	0.006

Table 2-7: Substances which shall not be used in agricultural production intended for the production of infant formulae and follow-on formulae, processed cereal-based foods and baby foods for infants and young children.

Chemical name of the substance (residue definition)
Aldrin and dieldrin, expressed as dieldrin
Disulfoton (sum of disulfoton, disulfoton sulfoxide and disulfoton sulfone expressed as disulfoton)
Endrin
Fensulfothion (sum of fensulfothion, its oxygen analogue and their sulfones, expressed as fensulfothion)
Fentin, expressed as triphenyltin cation
Haloxyfop (sum of haloxyfop, its salts and esters including conjugates, expressed as haloxyfop)
Heptachlor and trans-heptachlor epoxide, expressed as heptachlor
Hexachlorobenzene
Nitrofen
Omethoate
Terbufos (sum of terbufos, its sulfoxide and sulfone, expressed as terbufos)

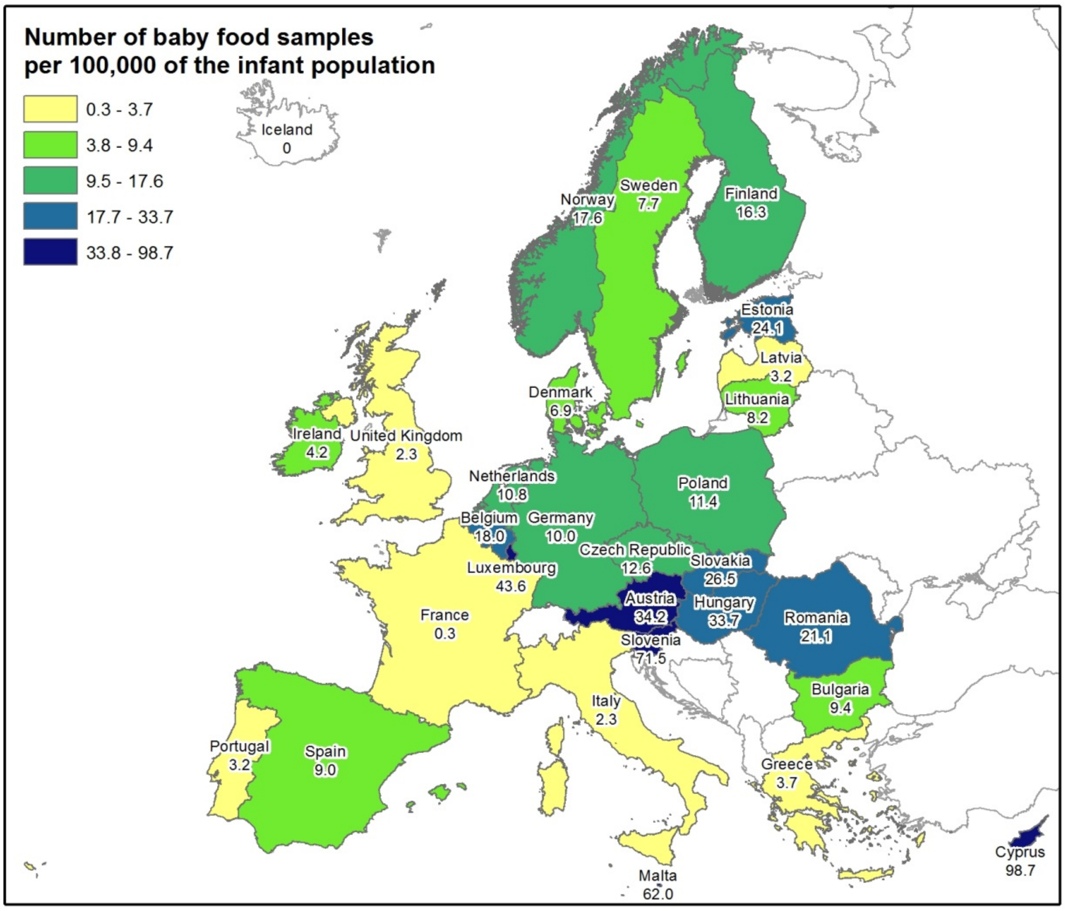
According to Regulation (EC) No 901/2009 on the 2010 EU-coordinated control programme at least ten samples of baby food based mainly on vegetables, fruit or cereal had to be analysed in each Member State. The Regulation, however, did not specify which pesticides had to be included in the analytical scope for the baby food analysis.

In 2010, a total of 1,828 surveillance samples of baby food were reported by 28 countries (Map 2-3).

EFSA notes that for the same pesticides, the residue definitions established in Regulation (EC) No 396/2005 and those regulations specific for baby food differ; this fact results in an additional burden

[25] See "MRL" in the Glossary.
[26] Commission Directive 2006/125/EC of 5 December 2006 on processed cereal-based foods and baby foods for infants and young children. OJ L 339, 6.12.2006, p. 16 - 35.
[27] Commission Directive 2006/141/EC of 22 December 2006 on infant formulae and follow-on formulae and amending Directive 1999/21/EC. OJ L 401. 20.12.2006, p. 1 – 33.
[28] Commission Regulation (EC) No 1107/2007 of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. OJ L 309. 24.11.2009, p. 1 – 50.

on control laboratories and hampers the comparability of monitoring results for different food products. Therefore, in order to avoid enforcement problems, it would be desirable to establish the same residue definition for baby food as for other food items covered by Regulation (EC) No 396/2005.



Map 2-3: EU+NCP – Number of baby food samples (only surveillance) normalised by the national infant population[29] - 2010.

2.2.5. Organic food monitoring

At EU level, no specific MRLs for organic products have been established. Thus, the MRLs set in Regulation (EC) No 396/2005 equally apply to organic food. However, Regulation (EC) No 834/2007[30] and Regulation (EC) No 889/2008[31] on organic production of agricultural products define specific labelling provisions and production methods which entail significant restrictions on the use of pesticides. In cases of immediate threat to the crop only those products listed in Table 2-8 may be used according to the national authorisations.

[29] Source of infant population per country 2010: Eurostat http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en (Download: 02-02-2012 15:50:24).

[30] Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91. OJ L 189, 20.7.2007, p. 1 – 23.

[31] Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. OJ L 250, 18.9.2008, p. 1 – 82.

Table 2-8: Pesticides allowed in organic farming.

Group	Name	Description of use conditions [(a)]
1. Substances of plant or animal origin		
	Azadirachtin extracted from *Azadirachta indica* (Neem tree)	Insecticide
	Beeswax	Pruning agent
	Gelatine	Insecticide
	Hydrolysed proteins	Attractant, only in authorised applications in combination with other appropriate products of this list.
	Lecithin	Fungicide
	Plant oils (e.g. mint oil, pine oil, caraway oil).	Insecticide, acaricide, fungicide and sprout inhibitor.
	Pyrethrins extracted from *Chrysanthemum cinerariaefolium*	Insecticide
	Quassia extracted from *Quassia amara*	Insecticide, repellent
	Rotenone extracted from *Derris* spp. and *Lonchocarpu* spp. and *Terphrosia* spp.	Insecticide
2. Micro-organisms used for biological pest and disease control		
	Micro-organisms (bacteria, viruses and fungi)	
3. Substances produced by micro-organisms		
	Spinosad	Insecticide Only where measures are taken to minimise the risk to key parasitoids and to minimise the risk of development of resistance.
4. Substances to be used in traps and/or dispensers		
	Diammonium phosphate	Attractant, only in traps
	Pheromones	Attractant; sexual behaviour disruptor; only in traps and dispensers
	Pyrethroids (only deltamethrin or lambda-cyhalothrin)	Insecticide; only in traps with specific attractants; only against *Bactrocera oleae* and *Ceratitis capitata* Wied.
5. Preparations to be surface-spread between cultivated plants		
	Ferric phosphate (iron (III) orthophosphate)	Molluscicide
6. Other substances from traditional use in organic farming		
	Copper in the form of copper hydroxide, copper oxychloride, (tribasic) copper sulphate, cuprous oxide, copper octanoate	Fungicide for perennial crops
	Ethylene	Degreening bananas, kiwis and kakis; degreening of citrus fruit only as part of a strategy for the prevention of fruit fly damage in citrus; flower induction of pineapple; sprouting inhibition in potatoes and onions.
	Fatty acid potassium salt (soft soap)	Insecticide
	Potassium aluminium (aluminium sulphate) (Kalinite)	Prevention of ripening of bananas
	Lime sulphur (calcium polysulphide)	Fungicide, insecticide, acaricide
	Paraffin oil	Insecticide, acaricide

Group	Name	Description of use conditions [(a)]
	Mineral oils	Insecticide, fungicide To be used only in fruit trees, vines, olive trees and tropical crops (e.g. bananas).
	Potassium permanganate,	Fungicide, bactericide; only in fruit trees olive trees and vines.
	Quartz sand	Repellent
	Sulphur	Fungicide, acaricide, repellent
7. Other substances		
	Calcium hydroxide	Fungicide Only in fruit trees, including nurseries, to control *Nectria galligena*.
	Potassium bicarbonate	Fungicide

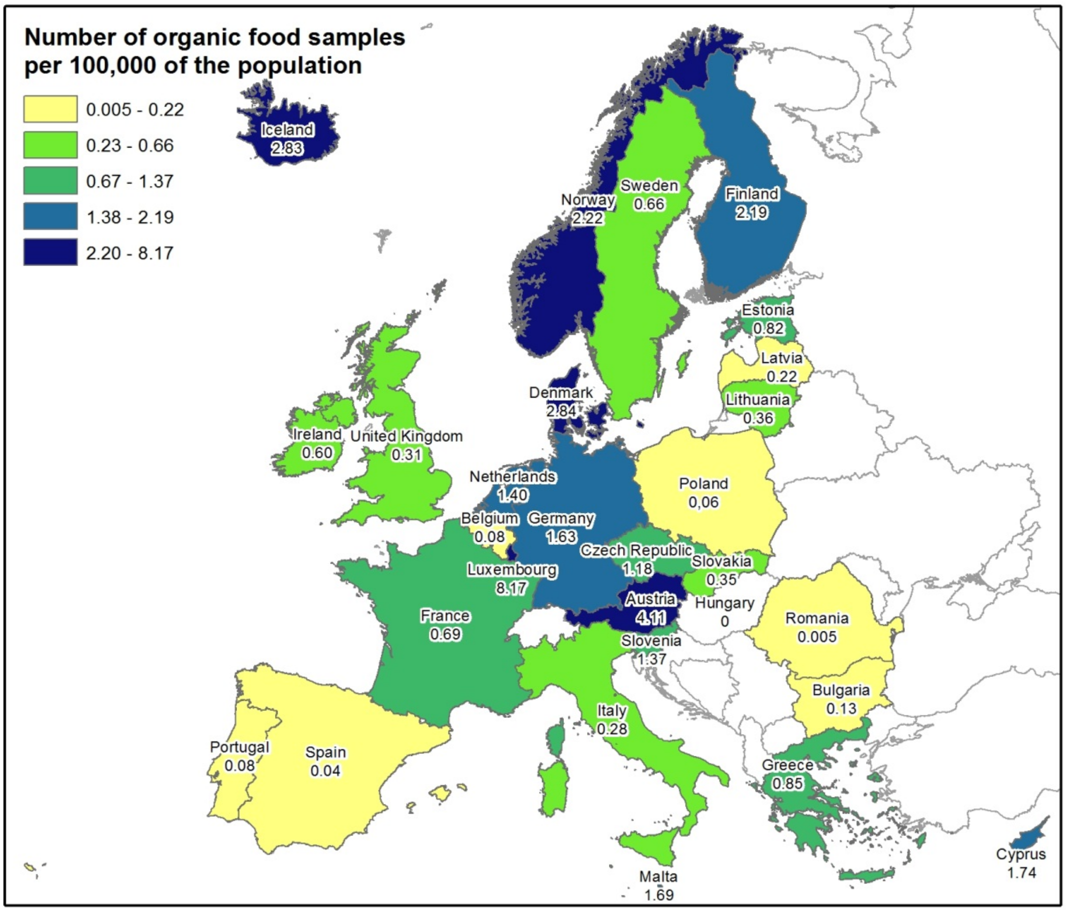
(a) For the detailed description of the uses and restrictions please make reference to Regulation (EC) No 834/2007.

The European Commission requested that at least one sample, where available, is taken from the following commodities: apples, head cabbage, leek, lettuce, milk, peaches, pears, rye or oats, strawberries, swine meat and tomatoes (i.e. the products covered by the EU-coordinated programme). The number of samples of organic farming should represent the market share of organic production in each Member State.

In 2010, a total of 3,571 samples of organic origin were reported by 28 countries (Table 2-9 and Map 2-4), which corresponds to 4.9% of all surveillance samples taken in the reporting countries. It is noted that some countries did not report to EFSA all the results concerning organic samples taken and analysed in the framework of national control results.

Table 2-9: EU+NCP – Number of samples (only surveillance) in organic food in 2010.

Product	Organic samples	Organic samples in % of total samples
Fruits and nuts	987	3.6
Vegetables	1253	4.3
Cereals	554	13.2
Other plant products	242	9.5
Animal products	229	4.4
Fish products	1	0.3
Baby food/Infant Formulas	297	16.3
Other products	8	0.4
Total	**3571**	**4.9**



Map 2-4: EU+NCP – Number of organic food samples (surveillance and enforcement) reported in 2010, normalised by the national population[29].

2.2.6. Processed food monitoring

For processed or composite food, the MRLs established in the MRL legislation for raw commodities are applicable, taking into account changes in the levels and the nature of pesticide residues caused by processing or mixing (processing factors).

Annex VI of Regulation (EC) No 396/2005, which will include processing factors for processed products, has not yet been established but other sources provide summary information on the impact of processing on the nature and magnitude of pesticide residues (e.g. information provided in EFSA conclusions and EFSA reasoned opinions[32] and the German database developed by the Federal Institute for Risk Assessment[33]). These sources can be considered to enforce the legal provisions in processed food.

In 2010, a total of 14,146 samples (surveillance and enforcement) of processed products (without baby food) were taken by 28 countries: all 29 but one country (Iceland). This makes up 18.4% of the total samples. The samples cover a range of approximately 190 different products; 1,650 of the processed samples referred to products derived from grapes (wine or other processed grape products), 601 samples were produced from citrus fruits (e.g. oranges), mainly juices. It is noted that in 2009 the percentage of processed food samples was lower (13.5%).

[32] http://www.efsa.europa.eu/en/publications.htm
[33] The database is available at http://www.bfr.bund.de/cd/579 (BfR compilation of 2009-07-01).

2.2.7. Origin of samples

National programmes cover samples originating from domestic, European Union, EFTA countries and third country production (Figure 2-11). The majority of samples taken were produced in one of the reporting countries (73%). 23% of the samples were taken from imported consignments or lots. In 4% of the samples the origin of the samples was not reported.

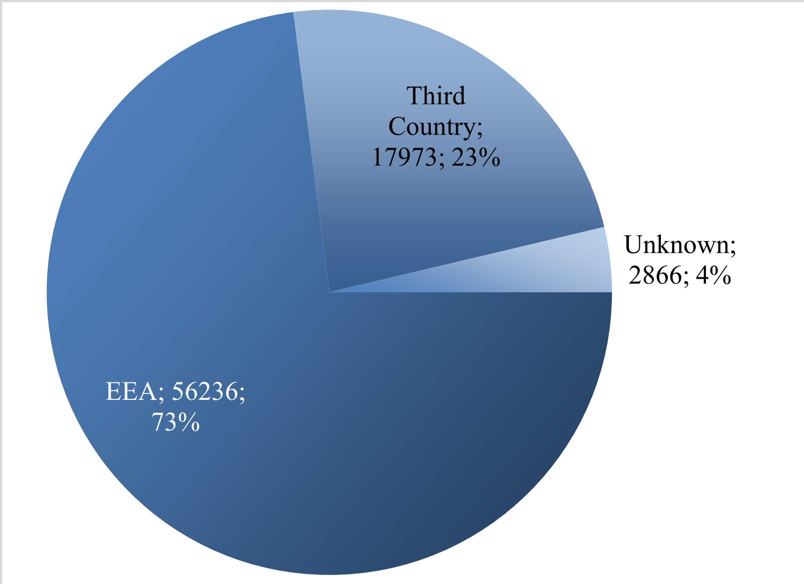


Figure 2-11: EU+NCP – Origin of samples according to the regional origin (surveillance and enforcement).

In Table 2-10, the number of samples according to the country of origin (only EU) is further split up into individual countries. In Table 2-11, the samples originating from third countries are further specified.

Table 2-10: EU+NCP – Number of samples 2010 by origin country (only EEA).

Origin (EEA)	Number of samples		
	Surveillance	Enforcement	Total
Italy	10456	513	10969
Germany	8297	125	8422
Spain	7720	65	7785
France	4473	4	4477
Netherlands	3321	28	3349
Greece	2643	95	2738
Romania	2220	13	2233
United Kingdom	2052	-	2052
Hungary	1963	77	2040
Poland	1896	11	1907
Belgium	1714	20	1734
Austria	1280	29	1309
Portugal	854	1	855
Denmark	838	-	838
Ireland	708	6	714
Bulgaria	628	-	628
Sweden	583	2	585
Cyprus	574	9	583

Origin (EEA)	Number of samples		
	Surveillance	Enforcement	Total
Slovenia	511	7	518
Czech Republic	499	2	501
Norway	498	-	498
Finland	324	-	324
Slovakia	270	1	271
Estonia	210	-	210
Latvia	137	-	137
Lithuania	116	3	119
Malta	115	15	130
Iceland	64	-	64

Table 2-11: EU+NCP – Number of samples 2010 originating from Third Countries (TC)[(a)].

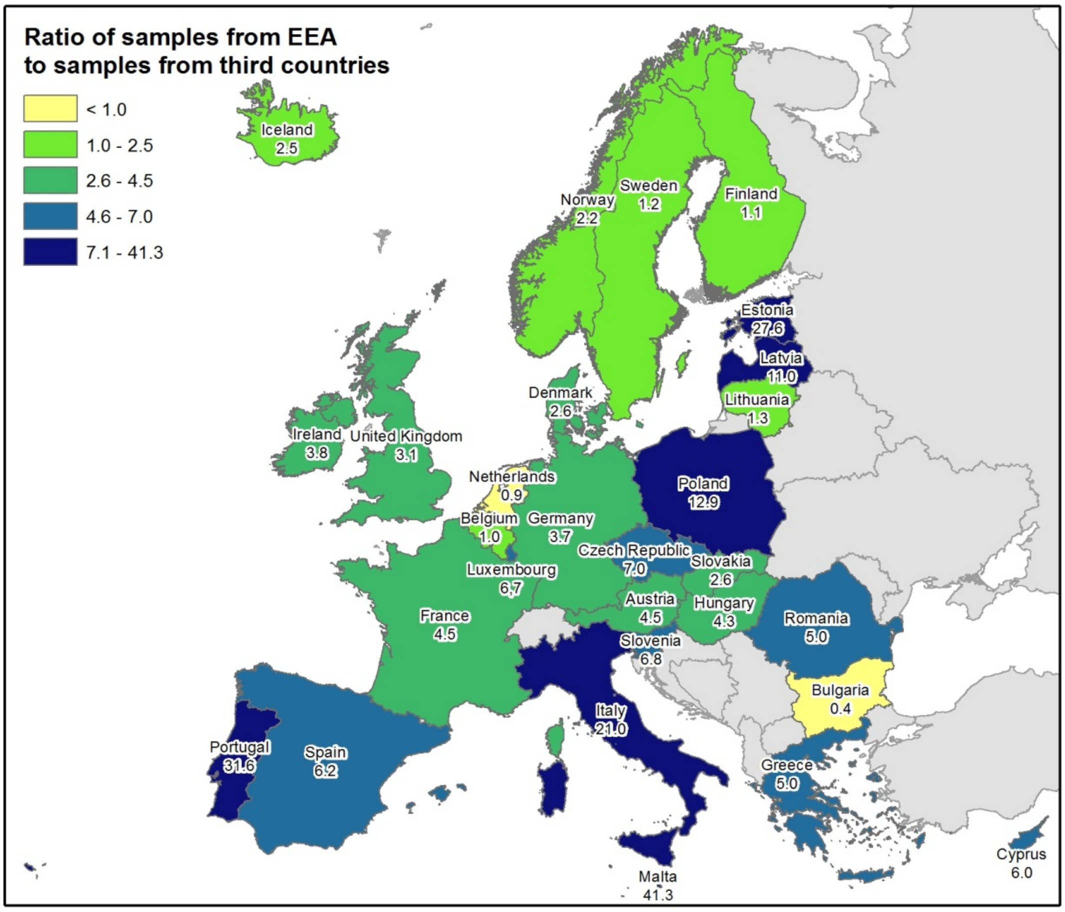
Origin (TC)	Number of samples		
	Surveillance	Enforcement	Total
Turkey	1578	1763	3341
Thailand	1230	370	1600
Dominican Republic	733	477	1210
South Africa	1196	7	1203
Egypt	714	185	899
Chile	784	20	804
Argentina	731	53	784
Israel	710	21	731
Brazil	688	32	720
Morocco	659	7	666

(a) Only the top 10 countries are listed in the table.

Table 2-11 shows the number of samples taken, which originated from third countries. It is noticed that the highest percentages of enforcement samples are taken from those countries mentioned in Regulation (EC) No 669/2009[34] on the increased control on imported food: Turkey (52.8% of enforcement samples out of the total number of Turkish samples), Thailand (23.1%), Dominican Republic (39.4%) and Egypt (20.6%).

Map 2-5 shows the ratio of samples originating from the EEA area and third countries for each reporting country. These data demonstrate that only a few countries focus the national control programmes on food products imported from third countries (ratio <1) whereas most reporting countries prioritise samples originating from EEA countries (ratio >1).

[34] Commission Regulation (EC) No 669/2009 of 24 July 2009 implementing Regulation (EC) No 882/2004 of the European Parliament and of the Council as regards the increased level of official controls on imports of certain feed and food of non-animal origin and amending Decision 2006/504/EC. Official Journal L 194, 25.7.2009, p. 11 – 21.



Map 2-5: EU+NCP – Ratio of EEA and third country samples taken in 2010 (surveillance and enforcement) by the 29 reporting countries.

2.3. Quality assurance

According to Regulation (EC) No 882/2004, laboratories designated for official controls must be accredited to ISO/IEC 17025 (ISO, 2005). A specific guidance document (EC, 2009) describes in detail the method validation and analytical quality control requirements to ensure the quality, accuracy and comparability of analytical results generated by the control laboratories with the purpose of checking compliance with MRLs.

In 2010, the control laboratories in the majority of countries were accredited, but in six countries part of the samples were analysed by non-accredited laboratories. These countries are: Bulgaria, France, Italy, Portugal, Romania and Spain. Although not all laboratories are accredited in these countries, the determinations belonging to the EU-control programme have a high accreditation percentage within the country. EFSA noted that there is not a common interpretation and implementation of the accreditation procedures throughout Europe. Therefore, EFSA is recommended to give the Member States further guidance on how to clearly and unambiguously report information on the status of accreditation/validation for each pesticide/matrix combinations analysed.

From the data submitted to EFSA it was also noted that not all the laboratories analysed and reported the monitoring results in line with the legal residue definitions set in the EU MRL legislation. Therefore, EFSA recommends that laboratories make an effort to analyse the pesticides as requested by Regulation (EC) No 396/2005. The EURLs could continue to provide assistance to the laboratories in enhancing their analytical capabilities (e.g. providing analytical standards); EFSA also suggests making profit of the SRM-PinBoard Service offered by the EURL-SRM to help the laboratories analysing the pesticides by means of a Single Residue Method trough collaboration with other national laboratories in the Union, together with the use of the Conversion Factors e-learning tool available on the EURL-FV web site to avoid conversion factor problems when submitting the official results[35].

[35] Services available at:http://www.eurl-pesticides.eu/docs/public/tmplt_article.asp?CntID=713&LabID=100&Lang=EN.

SUMMARY CHAPTER 2

EU Member States perform official controls to ensure the compliance of feed and food samples with regard to the pesticide MRL legislation. Furthermore, national control programmes (designed by each country) and the EU-coordinated control programme are in place.

The EU-coordinated control programme for 2010 was laid down in Commission Regulation (EC) No 901/2009. The food commodities to be analysed in 2010 were apples, head cabbage, leek, lettuce, milk, peaches, pears, rye or oats, strawberries, swine meat and tomatoes. This programme defined 157 pesticides to be analysed in food of plant origin (38 of them had to be analysed on a voluntary basis) and 34 pesticides in food of animal origin (six of them to be analysed on a voluntary basis), for a total of 178 distinct pesticides.

The control programme in Regulation (EC) No 901/2009 defines the minimum number of samples to be analysed in each country in the framework of the 2010 EU-coordinated programme; this number varies from 12 to 93 samples per food product, depending on the population of the Member State.

A total number of 12,168 samples of 12 different commodities were analysed in the 2010 EU-coordinated monitoring programme. It should be noted that seven commodities (apples, head cabbage, leek, pears, rye or oats, swine meat) were not analysed by all reporting countries. In pears only one pesticide had to be analysed (amitraz): for this pesticide no results were reported by 18 countries. For the commodities of animal origin – milk and swine meat – no results were reported by nine countries. For pears and swine meat, the minimum number of 642 samples required to obtain representative results at EU level was not achieved.

The total number of samples taken in the context of the national and the EU-coordinated programme in 2010 was 77,075. Compared with the previous year, this is an increase of 13.4%. In 2010, the majority of the samples taken were classified as surveillance samples (72,813 samples, 94.5% of the total number of samples). The total number of enforcement samples taken by all reporting countries was 4,262 (5.5% of the total number of samples). The number of pesticides sought in 2010 was 982 (excluding metabolites). In 2010, 529 different food commodities (including processed and unprocessed food samples) were surveyed.

Regarding baby food, a general default EU MRL of 0.01 mg/kg is applicable to all pesticides, unless specific MRLs lower than 0.01 mg/kg are established under specific EU legislation. In 2010, a total of 1,828 surveillance samples of baby food were reported by 28 countries.

At European level, no specific MRLs for organic products are established, but Regulation (EC) No 834/2007 and Regulation (EC) No 889/2008 on organic production of agricultural products define specific labelling provisions and production methods and list the pesticides that are allowed in organic farming. In 2010, a total of 3,571 samples of organic origin were taken by a total of 28 countries, which corresponds to 4.9% of all surveillance samples taken overall in the reporting countries.

In 2010, a total of 14,146 samples (surveillance and enforcement) of processed products (baby food excluded) were taken by 28 countries. This is 18.4% of the total samples taken in 2010.

The majority of total samples taken in 2010 were produced in one of the reporting countries (73%). 23% of the samples originated from third countries. For 4% of the total samples, the origin of the samples was not reported. The data submitted demonstrates that the ratio of samples with EU provenience and samples imported from third countries varied significantly among the reporting countries.

In 2010, the majority of countries used accredited laboratories for the control programmes, but in six countries part of the samples were analysed by non accredited laboratories.

Recommendations:

EFSA recommends that reporting countries should investigate for the reasons why not all pesticides included in the 2010 EU-coordinated programme were analysed by the laboratories in the reporting countries. If needed, support should be provided by the EU Reference Laboratories to improve the analytical capabilities and seek to make available necessary analytical standards and methods in order to cover all substances foreseen in the coordinated multiannual control programme. EFSA is recommended to provide the reporting countries with more guidance on how to clearly and unambiguously report information on the status of accreditation/validation of the analytical results.

EFSA recommends improving the compatibility of the EU legislation for baby food with the legislation for pesticide authorization and pesticide MRLs. In particular, the residue definitions set in Regulation (EC) No 396/2005 and in the specific legislation for baby food should be harmonised. In addition, the criteria for setting specific MRLs in baby food should be reconsidered and the MRL levels should be revised where necessary. Efforts have to be made to develop analytical methods, which are capable of quantifying low residue concentrations as required in the baby food MRL legislation. EFSA also recommends that in future EU Regulations on the EU-coordinated monitoring programme it should be specified that baby food samples have to be analysed for all pesticides listed in the baby food legislation with specific MRLs and for all the pesticides listed in the EU monitoring regulation.

In certain reporting countries the analytical methods used in the official food control have to be improved, including more pesticides in the analytical programme to ensure that the pesticides MRL legislation can be enforced. The currently established complex residue definitions, which often require expensive single-residue methods to be used in enforcement practice, should be reviewed and possibilities to simplify residue definitions to allow the use of multi-residue methods should be considered.

EFSA recommends making efforts to harmonise the accreditation approaches at EU level. Common standards would be desirable to improve Europe-wide comparability of the results generated by different laboratories. In particular, EFSA recommends the validation and accreditation of the whole pesticide scope including the metabolites and/or all parts of the residue definitions set in the European legislation. Finally, EFSA suggests taking advantage of the SRM-PinBoard Service offered by the EURL-SRM to help the laboratories analysing the pesticides by means of a Single Residue Method through the collaboration among other national laboratories in the EU and making use of the Conversion Factors e-learning tool available on the EURL-FV web site to avoid conversion factor problems when submitting the official results.

3. Results of the EU-coordinated programme

3.1. Overall results

The analysis of the results of the 2010 EU-coordinated programme shows that 1.6% of the samples taken exceeded the MRL (197 out of the 12,168 samples), while 47.7% of the samples (5,802 samples) had measurable residues above the reporting level, but below or at the MRL[36]. In 50.7% of the samples (6,169 samples) no residues were measured above the quantification limits (Figure 3-1). The percentage of samples exceeding the MRLs was rather stable over the last four years (2007 to 2010) with only small variations; the % of samples exceeding the legal limits in this reference period has ranged from 1.2% to 2.3%.

Taking into account all the individual analyses of pesticides on the 12 food commodities, 1,226,916 singular analytical determinations were reported under the EU-coordinated programme[37]. 0.02% of the determinations exceeded the MRL, while 1.22% of the determinations had measurable residues above the reporting level, but below or at the MRL. 98.76% of all data points were free of measurable residues (Figure 3-1).

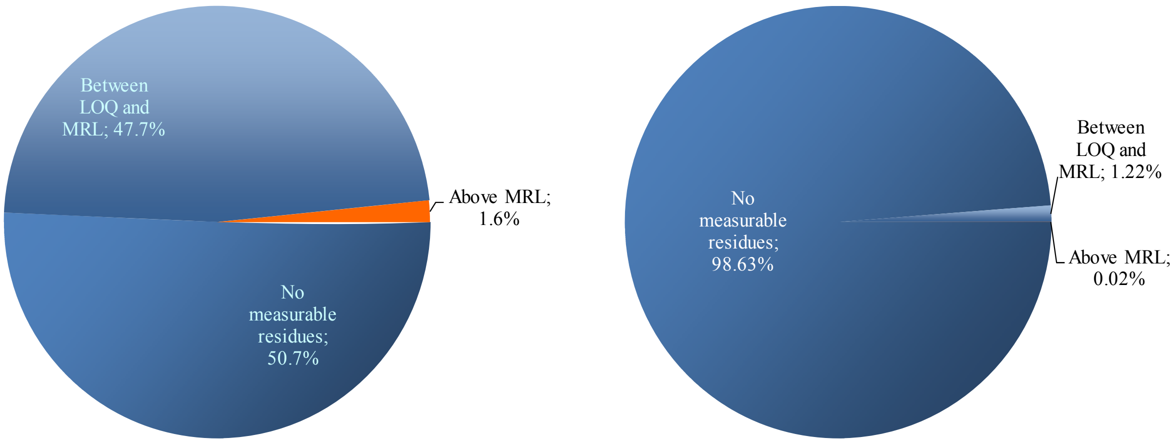


Figure 3-1: EUCP – Overall frequency of samples taken (left pie chart) and determinations carried out (right pie chart) without measurable residues, with measurable residue below the MRL and with residues exceeding the MRL.

Table 3-1 gives an overview of the results of the 2010 EU-coordinated programme for each pesticide/crop combination tested, presenting the percentages of samples exceeding the MRL (left part of the table) and the percentages of samples with measurable residues above the LOQ (right part of the table). White cells in Table 3-1 refer to pesticide/crop combinations which were not requested to be analysed. The lightest shaded cells on the right part of the table refer to pesticide/crop combinations where all determinations were found below the LOQ; the lightest shaded cells on the left part of the table refers to combinations for which no MRL exceedances were reported. Cells filled with darker colours (on the right and left parts of the table) correspond to higher percentages of samples with measurable residues and MRL exceedances, respectively. The numerical values of the percentages reported in this "heat map" can be found in Appendix III/Table E.

The pesticide/crop combinations for which residue concentrations above the reporting level were found most frequently were chlormequat/oats (64.6%), dithiocarbamates/head cabbage (50.3%), dithiocarbamates/leek (40.8%) and chlormequat/rye (35.9%), as can be seen in Figure 3-15, Figure 3-7, Figure 3-9 and Figure 3-19. Residues of chlormequat are due to the authorised use pattern of this

[36] See "MRL exceedance" in the Glossary.

[37] The term "determination" refers to the individual measurement obtained in the chemical analysis of a sample. If a sample is analysed for 200 different pesticides, 200 determinations are reported.

substance on cereals. The findings concerning dithiocarbamates may be due to the contribution of naturally occurring substances in brassica vegetables (e.g. head cabbage) or *Allium* species (e.g. leek); the analytical methods routinely applied are not able to distinguish between the natural occurrence of CS_2 precursors and the applied dithiocarbamates in these crops.

The highest percentages of MRL exceedances were found for chlormequat in oats, where the MRL was exceeded in 8.1% of all samples, followed by residues of ethephon in tomatoes (2.3%), amitraz in pears (1.3%) and bromide ion in lettuce (0.8%).

More detailed information on the findings for each commodity is reported in section 3.3, while in section 3.4 the results are summarised at pesticide level.

Table 3-1: EUCP – Heat maps on residues above the MRL and above the LOQ – 2010.

Pesticide	% above MRL												% above LOQ												
	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears (2)	Rye	Strawberries	Swine meat	Tomatoes	**Ranking of the MRL exceedances (more than 1% of the samples)**	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears	Rye	Strawberries	Swine meat	Tomatoes	**Ranking of the most frequent detections (more than 20% of the samples)**
2,4-D (sum)																										
Abamectin (sum)																										
Acephate																										
Acetamiprid																										
Acrinathrin																										
Aldicarb (sum)																										
Aldrin and Dieldrin																										
Amitraz (sum)													3 (pears)													
Amitrole																										
Azinphos-ethyl																										
Azinphos-methyl																										
Azoxystrobin																										
Benfuracarb																										
Bifenthrin																										
Bitertanol																										
Boscalid																										9 (strawberries)
Bromide ion																										6 (tomatoes); 7 (lettuce); 11 (rye)
Bromopropylate																										
Bromuconazole (sum)																										
Bupirimate																										
Buprofezin																										
Cadusafos																										
Camphechlor (sum AP)																										
Captan																										
Captan/Folpet (sum)																										
Carbaryl																										
Carbendazim and benomyl																										
Carbofuran (sum)																										
Carbosulfan																										
Chlordane (sum AP)																										
Chlorfenapyr																										
Chlorfenvinphos																										
Chlormequat													1 (oats)													1 (oats); 4 (rye)
Chlorobenzilate																										
Chlorothalonil																										
Chlorpropham (sum)																										
Chlorpyrifos																										
Chlorpyrifos-methyl																										
Clofentezine																										
Clofentezine (sum AP/cereals)																										
Clothianidin																										
Cyfluthrin (sum)																										
Cypermethrin (sum)																										
Cyproconazole																										
Cyprodinil																										5 (strawberries)

Pesticide	% above MRL													% above LOQ												
	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears (2)	Rye	Strawberries	Swine meat	Tomatoes	**Ranking of the MRL exceedances (more than 1% of the samples)**	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears	Rye	Strawberries	Swine meat	Tomatoes	**Ranking of the most frequent detections (more than 20% of the samples)**
DDT (sum)																										
Deltamethrin																										
Diazinon																										
Dichlofluanid																										
Dichlorvos																										
Dicloran																										
Dicofol (sum)																										
Difenoconazole																										
Dimethoate (1)																										
Dimethoate (sum)																										
Dimethomorph																										
Dinocap (sum)																										
Diphenylamine																										
Dithiocarbamates																										2 (head cabbage); 3 (leek); 13 (apples);14 (lettuce)
Endosulfan (sum)																										
Endrin																										
Epoxiconazole																										
Ethephon													2 (tomatoes)													
Ethion																										
Ethoprophos																										
Etofenprox																										
Fenamiphos (sum)																										
Fenarimol																										
Fenazaquin																										
Fenbuconazole																										
Fenbutatin oxide																										
Fenhexamid																										10 (strawberries)
Fenitrothion																										
Fenoxycarb																										
Fenpropathrin																										
Fenpropimorph																										
Fenthion (sum)																										
Esfenvalerate (sum)																										
Fipronil (sum)																										
Fluazifop-P-butyl (sum)																										
Fludioxonil																										8 (strawberries)
Flufenoxuron																										
Fluquinconazole																										
Flusilazole																										
Flutriafol																										
Folpet																										
Formetanate (sum)																										
Fosthiazate																										
Glyphosate																										12 (oats)
Haloxyfop including haloxyfop-R																										

Pesticide	% above MRL													% above LOQ												
	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears (2)	Rye	Strawberries	Swine meat	Tomatoes	**Ranking of the MRL exceedances (more than 1% of the samples)**	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears	Rye	Strawberries	Swine meat	Tomatoes	**Ranking of the most frequent detections (more than 20% of the samples)**
HCH alpha																										
HCH beta																										
Heptachlor (sum)																										
Hexachlorobenzene																										
Hexaconazole																										
Hexythiazox																										
Imazalil																										
Imidacloprid																										
Indoxacarb																										
Iprodione																										
Iprovalicarb																										
Kresoxim-methyl																										
Lambda-Cyhalothrin																										
Lindane																										
Linuron																										
Lufenuron																										
Malathion (sum)																										
Mepanipyrim (sum)																										
Mepiquat																										
Metalaxyl (sum)																										
Metconazole																										
Methamidophos																										
Methidathion																										
Methiocarb (sum)																										
Methomyl and Thiodicarb																										
Methoxychlor																										
Methoxyfenozide																										
Monocrotophos																										
Myclobutanil																										
Omethoate (1)																										
Oxadixyl																										
Oxamyl																										
Oxydemeton-methyl (sum)																										
Paclobutrazol																										
Parathion																										
Parathion-methyl (sum)																										
Penconazole																										
Pencycuron																										
Pendimethalin																										
Permethrin (sum)																										
Phenthoate																										
Phosalone																										
Phosmet (sum)																										
Phoxim																										
Pirimicarb (sum)																										

Pesticide	% above MRL													% above LOQ												
	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears (2)	Rye	Strawberries	Swine meat	Tomatoes	Ranking of the MRL exceedances (more than 1% of the samples)	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Pears	Rye	Strawberries	Swine meat	Tomatoes	Ranking of the most frequent detections (more than 20% of the samples)
Pirimiphos-methyl																										
Prochloraz (sum)																										
Procymidone																										
Profenofos																										
Propamocarb (sum)																										
Propargite																										
Propiconazole																										
Propyzamide																										
Prothioconazole-Desthio																										
Pyraclostrobin																										
Pyrazophos																										
Pyrethrins																										
Pyridaben																										
Pyrimethanil																										
Pyriproxyfen																										
Quinoxyfen																										
Quintozene (sum)																										
Resmethrin (sum)																										
Spinosad (sum)																										
Spiroxamine																										
tau-Fluvalinate																										
Tebuconazole																										
Tebufenozide																										
Tebufenpyrad																										
Tecnazene																										
Teflubenzuron																										
Tefluthrin																										
Tetraconazole																										
Tetradifon																										
Thiabendazole																										
Thiacloprid																										
Thiametoxam (sum)																										
Thiophanate-methyl																										
Tolclofos-methyl																										
Tolylfluanid (sum)																										
Triadimefon (sum)																										
Triazophos																										
Trichlorfon																										
Trifloxystrobin																										
Triflumuron																										
Trifluralin																										
Triticonazole																										
Vinclozolin (sum)																										
Zoxamide																										
Legend (in %)			>1	<1	<0.5	<0.2	<0.1	0	No Samples						>20	<20	<10	<5	<2	<1	<0.5	0	No Samples			

(1): The findings reported separately for dimethoate and omethoate are displayed in this table, but not further reported in other tables and graphs of the report. There, only the results reported in line with the full residue definition (sum of dimethoate and omethoate) are considered.
(2): In 2010 pears had to be analysed for amitraz only.

3.2. Results by food commodity

Among the 12 food commodities analysed in the 2010 EU-coordinated control programme, the highest percentage of samples exceeding the MRL was identified for oats (5.3%), followed by lettuce (3.4%), strawberries (2.8%), peaches (1.8%), apples (1.3%), pears[38] (1.3%), tomatoes (1.2%), leek (1.0%), head cabbage (0.9%) and rye (0.3%). In animal products (milk and swine meat) no MRL exceedances were identified.

Peaches had the highest percentage of samples with measurable pesticide residues below or at the MRL (71.2%), followed by 67.0% of the apple samples and 65.2% of the strawberry samples. Samples of pears, swine meat or milk less frequently contained measurable residues at or below the MRL (Figure 3-2).

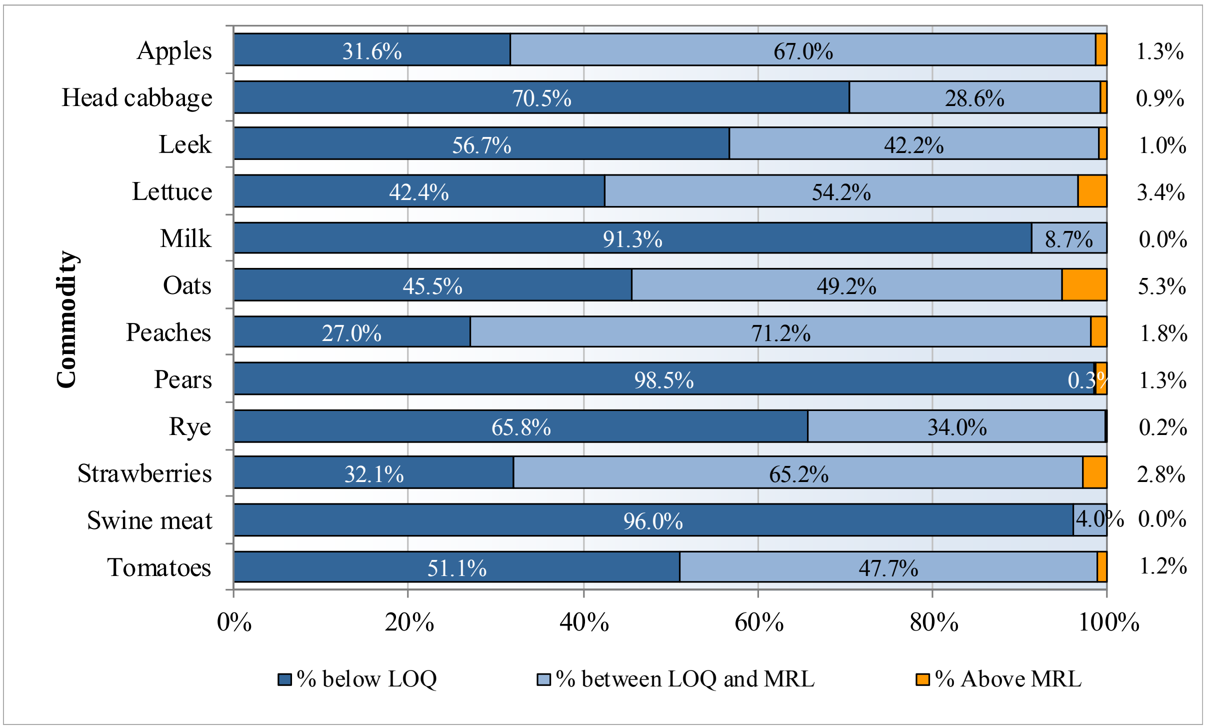


Figure 3-2: EUCP – Percentage of samples not measurable, below MRL and above MRL for the 12 food commodities in the EU-coordinated programme 2010[39].

Compared to the results of the 2007 EU-coordinated control programme, where the same food commodities of plant origin were analysed as in 2010 (except for pears), in 2010 the percentages of samples free of detectable residues were lower for all commodities except for strawberries where a slight increase was noticed (31.1% in 2007 to 32.1% in 2010[40]). The findings for the commodities analysed in both control years 2007 and 2010 are reported in Figure 3-3.

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[38] The results for pears refer only to amitraz. In 2010, no other pesticides had to be analysed on this crop.

[39] Due to the rounding of the single percentages, the summed percent may slightly differ from 100%.

[40] In 2007 and in 2010 the same commodities of plant origin were analysed (with the exception of pears). However, the number and pesticides included in 2007 and 2010 in the EUCP were different and therefore a direct comparison of the results is hampered.

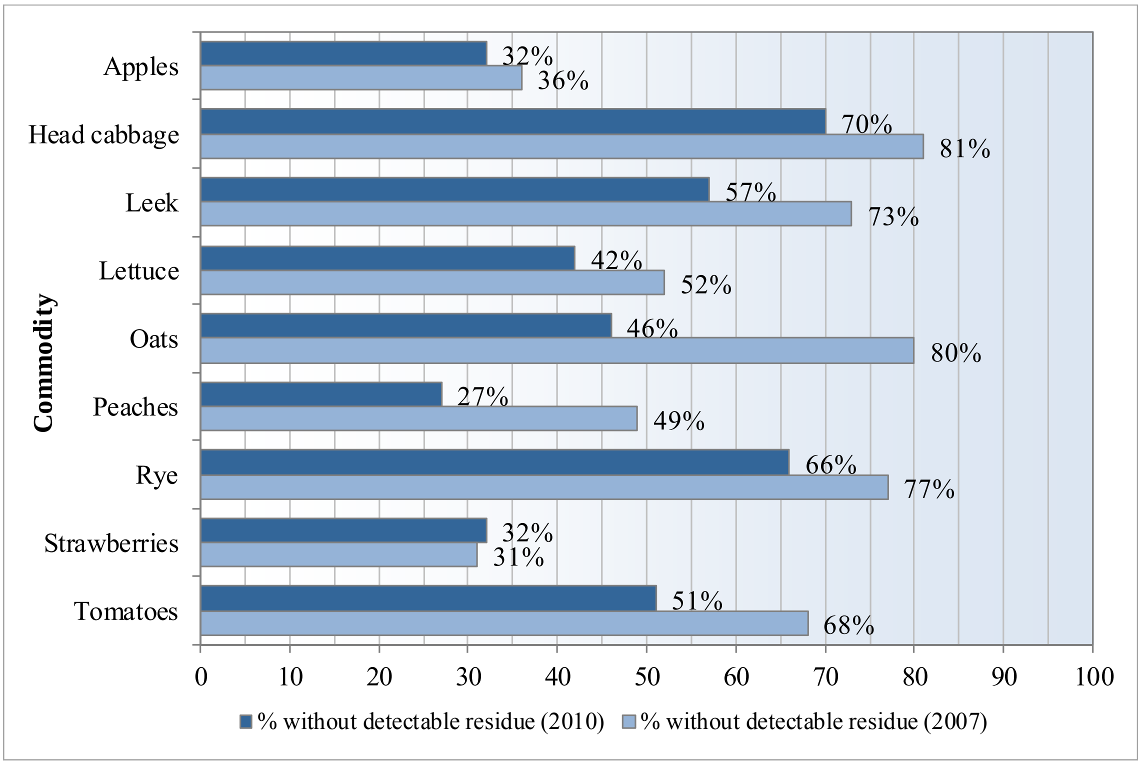


Figure 3-3: EUCP – Percentage of samples free from measurable residues for the nine food commodities analysed in the EU-coordinated programmes 2007 and 2010[39].

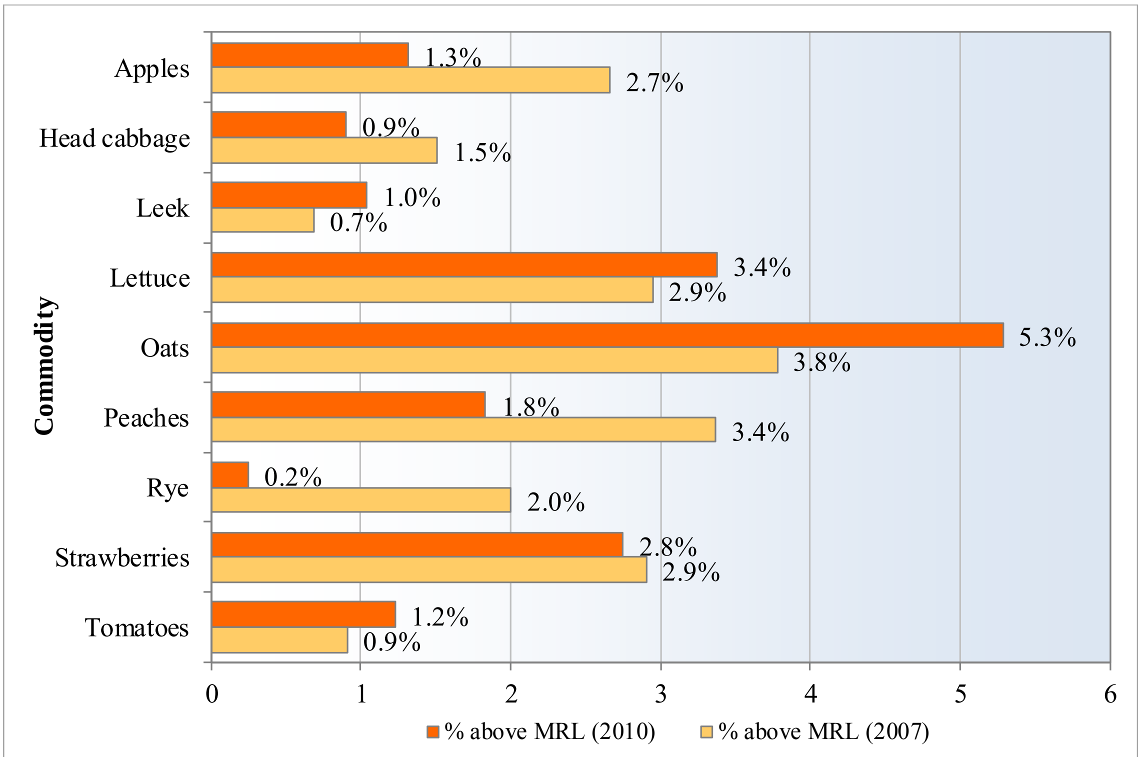


Figure 3-4: EUCP – Percentage of samples with residues above MRL for the nine food commodities analysed in both the EU-coordinated programmes 2007 and 2010[39].

Detailed results per commodity and reporting country of the EU-coordinated control programme are listed in Appendix III, Table F. For apples, head cabbage, peaches, rye and strawberries the percentage of samples exceeding the MRL was lower in 2010 compared to 2007, whereas for leek, lettuce, oats and tomatoes a slight increase was observed. The highest difference regarding the non-compliance rate was detected for rye (2007: 2.0%, 2010: 0.2%) followed by peaches (2007: 3.4% 2010: 1.8%). In Figure 3-4 the comparison of the MRL exceedances observed in 2007 and 2010 is depicted for all nine overlapping commodities.

3.3. Results by pesticide-commodity combination

In this section, more detailed information on the 12 commodities covered by the 2010 EU-coordinated programme is reported. For each commodity, the following analysis is reported:

- A chart presenting the pesticides found sorted according to the frequency of detection[41] (upper x-axis scale). In the same chart, the percentages of residues exceeding the MRLs (lower x-axis scale) are also included[42]. The total number of samples tested for each pesticide is reported in brackets next to the pesticide name.

- A table listing the pesticides most frequently found in the concerned commodity. Only the pesticides for which measurable residues were detected in at least 10% of the samples are reported. The tables also contain background information on the listed pesticides.

- A figure (made up of two plots) presenting the distribution of the measured residue levels (results above the LOQ only), expressed in percent of the MRL applicable for the specific pesticide/commodity combination[43]. The distributions of the results (first plot) are depicted as box plots (only for those pesticide/crop combinations for which residues were detected in at least four samples). There, the 25th percentile[44] (lower edge of the box), the median (line within the box) and the 75th percentile (upper edge of the box) of the distributions are represented. The whiskers of the bars (lines with margins) denote the minimum and the maximum residue level (expressed as percent of the MRL) among all samples analysed for each pesticide/crop combination. In the lower part of the figure (second plot), the findings for those pesticide/crop combinations for which the concerned pesticide was detected in measurable quantity only in less than four samples are plotted as dots. For each pesticide/crop combination, the number of samples with residues above the LOQ and the total number of samples tested for the concerned combination are reported in brackets next to the pesticide name.

3.3.1. Apples

In apples, 94 different pesticides were found. The most frequently found active substances (Figure 3-5) were dithiocarbamates (21.4% of samples analysed for this pesticide), captan/folpet (sum) (19.3%) and diphenylamine (14.6%). Background information on the use of these substances found in apples is reported in Table 3-2.

MRL exceedances were detected for 15 active substances in 27 samples. Samples with MRL exceedances originated mainly from Portugal (5), Chile (3) and Romania (3). For dicofol (sum) the median of the four residue levels (above the LOQ) was higher than 300% of the MRL (Figure 3-6); the

[41] It is noted that not all samples were analysed for all active substances. For this reason, the same number of samples with detection or instances of exceedance can result in different frequencies within the same commodity. In addition, analyses of a lower number of samples regarding a specific pesticide residue have an influence on the frequency.

[42] For pesticides with complex residue definitions (residue definition comprising the active substance and one or several metabolites, e.g., endosulfan) the MRL normally refers to the sum of the individual compounds covered by the definition, expressed as parent active substance (e.g. sum of alpha, and beta-isomers and endosulfan-sulphate, expressed as endosulfan). In some cases, the reporting countries did not analyse for all individual components covered by the residue definition. In the following figures, the results for samples fully compliant with the residue definition and those results which cover only part of the residue definition were aggregated.

[43] EFSA compared the reported residue levels with the MRL figures available in the DG SANCO database. In a few cases, the MRL used by the national authorities to check the sample compliance deviated from the values in the DG SANCO database (e.g. in cases where the MRL changed during the reference period). As a result, a few discrepancies may be observed in the frequency chart and in the box plot (e.g. some substances results may not appear in the plots).

[44] The 25th and the 75th percentile represent the residue levels (expressed in % of the MRL) below which 25% and 75% of the results are found, respectively.

origin of the samples exceeding the dicofol MRL was not reported. It is noted that dicofol is no longer authorised in Europe.

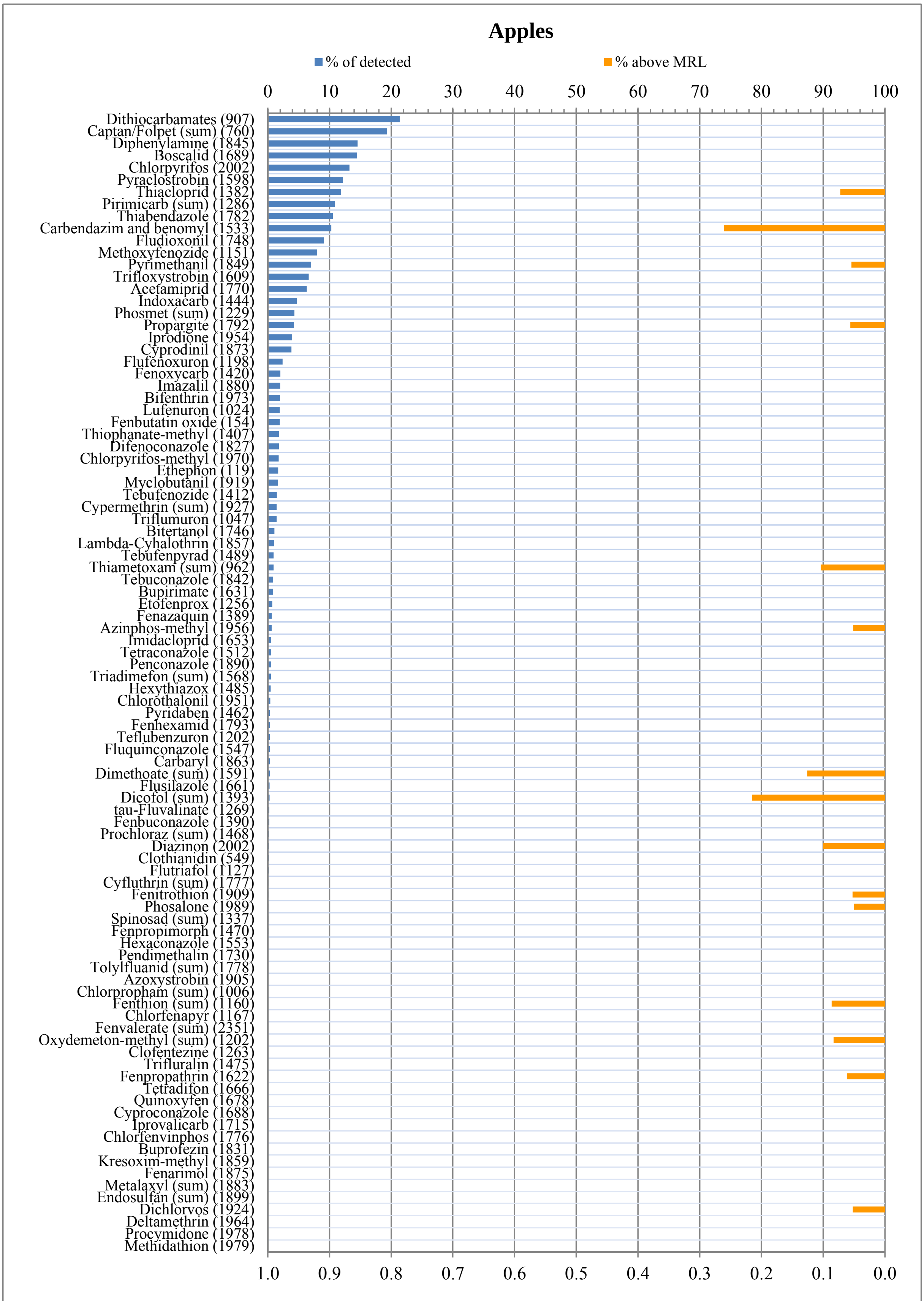


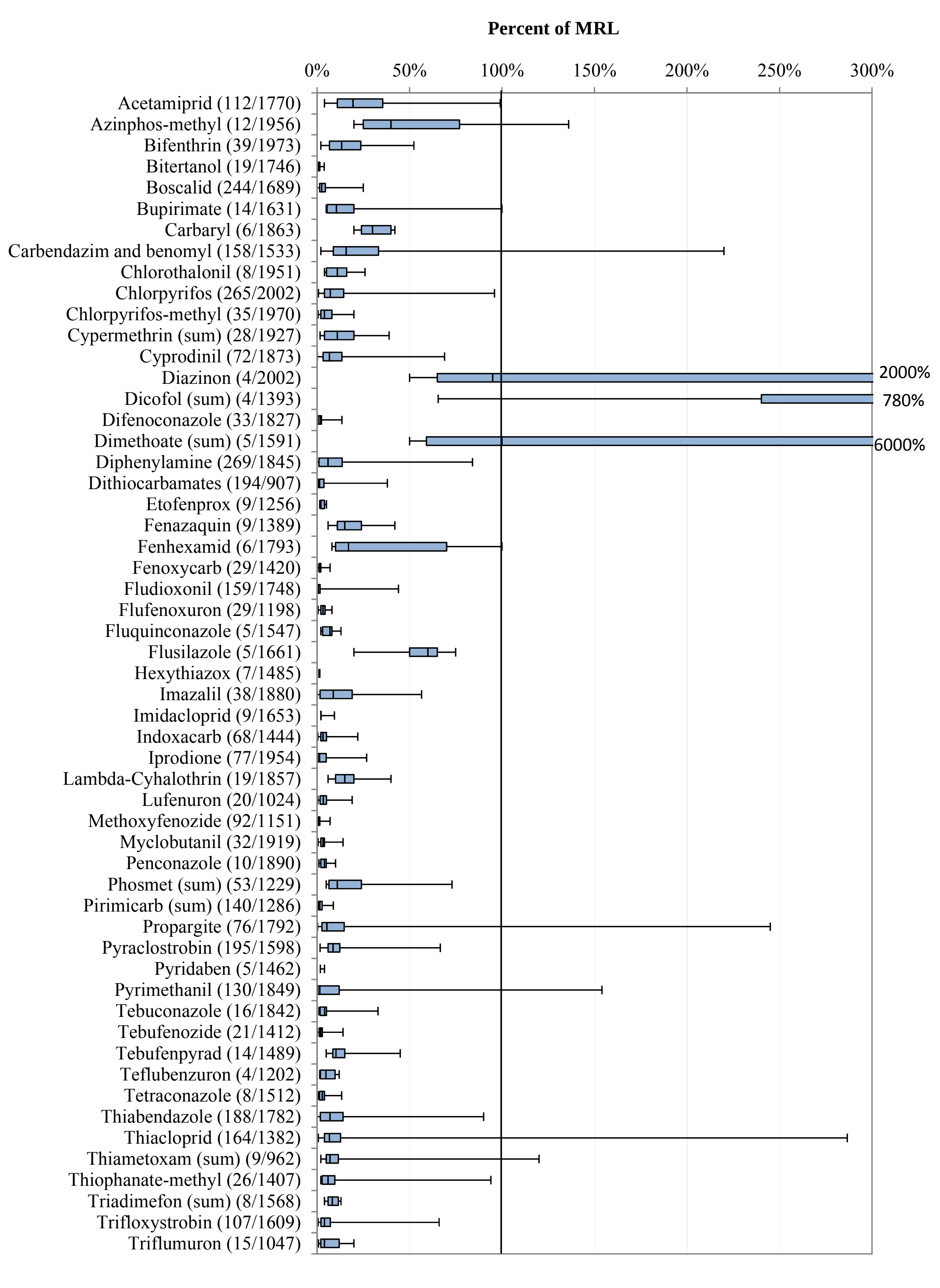
Figure 3-5: EUCP – Percentage of apple samples with measurable residues (upper x-axes scale) and

residues above the MRL (lower x-axis scale); the number of apple samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-2: EUCP – Pesticides most frequently detected in apples (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Apples	Dithiocarbamates	21.39	Group of non-systemic[45] fungicides used in a wide range of fruit and vegetables.
	Captan/Folpet (sum)	19.34	Non-systemic fungicide used to control fungal diseases in a wide range of fruit and other crops.
	Diphenylamine	14.58	Plant growth regulator; used for post harvest treatment of pome fruit against scald. Since May 2010 no longer authorized in the EU.
	Boscalid	14.45	Systemic fungicide used to control fungal diseases in a wide range of fruit and other crops.
	Chlorpyrifos	13.24	Non-systemic insecticide used to control different pests in fruit and other crops.
	Pyraclostrobin	12.20	Systemic fungicide used to control plant diseases in a wide range of fruit and other crops.
	Thiacloprid	11.87	Systemic insecticide used against different pests in a wide range of crops.
	Pirimicarb (sum)	10.89	Systemic insecticide used against different pests in a wide range of crops.
	Thiabendazole	10.55	Mainly used as post-harvest fungicide to control a wide range of plant pathogens and storage diseases.
	Carbendazim and benomyl	10.31	Carbendazim is a systemic fungicide. Since 2007 the use is restricted to certain crops only. The use on fruit is not permitted. Carbendazim is also formed as metabolite resulting from the use of thiophanate-methyl, a pesticide which is authorised in the EU. Benomyl, was used as fungicide in the past but is no longer authorised in Europe. Benomyl would also produce carbendazim as metabolite.

[45] See "Pesticide" in the Glossary.


Percent of MRL
0%
50%
100%
150%
200%
250%
300%
Acetamiprid (112/1770)
Azinphos-methyl (12/1956)
Bifenthrin (39/1973)
Bitertanol (19/1746)
Boscalid (244/1689)
Bupirimate (14/1631)
Carbaryl (6/1863)
Carbendazim and benomyl (158/1533)
Chlorothalonil (8/1951)
Chlorpyrifos (265/2002)
Chlorpyrifos-methyl (35/1970)
Cypermethrin (sum) (28/1927)
Cyprodinil (72/1873)
Diazinon (4/2002)
Dicofol (sum) (4/1393)
Difenoconazole (33/1827)
Dimethoate (sum) (5/1591)
Diphenylamine (269/1845)
Dithiocarbamates (194/907)
Etofenprox (9/1256)
Fenazaquin (9/1389)
Fenhexamid (6/1793)
Fenoxycarb (29/1420)
Fludioxonil (159/1748)
Flufenoxuron (29/1198)
Fluquinconazole (5/1547)
Flusilazole (5/1661)
Hexythiazox (7/1485)
Imazalil (38/1880)
Imidacloprid (9/1653)
Indoxacarb (68/1444)
Iprodione (77/1954)
Lambda-Cyhalothrin (19/1857)
Lufenuron (20/1024)
Methoxyfenozide (92/1151)
Myclobutanil (32/1919)
Penconazole (10/1890)
Phosmet (sum) (53/1229)
Pirimicarb (sum) (140/1286)
Propargite (76/1792)
Pyraclostrobin (195/1598)
Pyridaben (5/1462)
Pyrimethanil (130/1849)
Tebuconazole (16/1842)
Tebufenozide (21/1412)
Tebufenpyrad (14/1489)
Teflubenzuron (4/1202)
Tetraconazole (8/1512)
Thiabendazole (188/1782)
Thiacloprid (164/1382)
Thiametoxam (sum) (9/962)
Thiophanate-methyl (26/1407)
Triadimefon (sum) (8/1568)
Trifloxystrobin (107/1609)
Triflumuron (15/1047)
2000%
780%
6000%

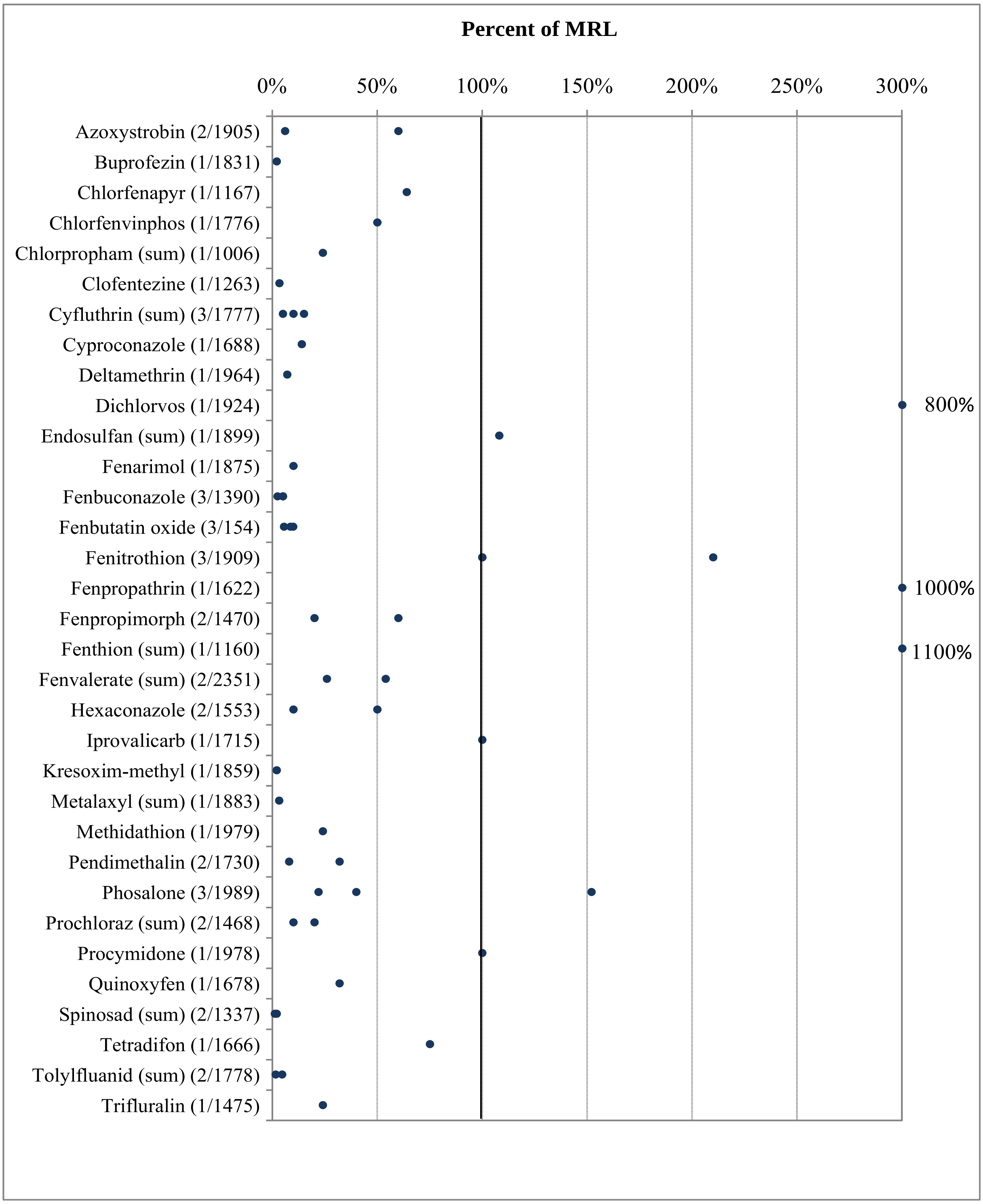


Figure 3-6: EUCP – Apples: measured residues (>LOQ) expressed as % of the MRL.

3.3.2. Head Cabbage

In head cabbage, 49 different pesticides were found (see Figure 3-7). The most frequently found active substances were dithiocarbamates (50.3% of the samples analysed for this group of pesticides), bromide ion (2.2%), iprodione and imidacloprid (both 1.7%). The prominent results regarding the high frequency of dithiocarbamates detections (Figure 3-7) are probably not the consequence of a pesticide treatment, but in most cases false positive results. Brassica vegetables naturally contain substances which may lead to the formation of CS_2 during the analytical process (Perz *et al*., 2000) and may mimic the occurrence of dithiocarbamates residues on food. At the moment, no routine analytical methods are available to distinguish the applied dithiocarbamates pesticides from the naturally occurring CS_2 precursors.

Information on the use of the pesticides detected in head cabbage samples is reported in Table 3-3.

MRL exceedances were observed for eight active substances (Figure 3-7). MRL exceedances for dimethoate (sum) and dimethomorph were found in two samples each, the remaining residues in just one sample. Head cabbage samples exceeding the MRL were reported to originate mainly from France (2), Czech Republic (2) and Thailand (2).

The distribution of the measured residue levels (results above the LOQ only), expressed in percent of the MRL applicable for the specific pesticide/commodity combination is reported in Figure 3-8.

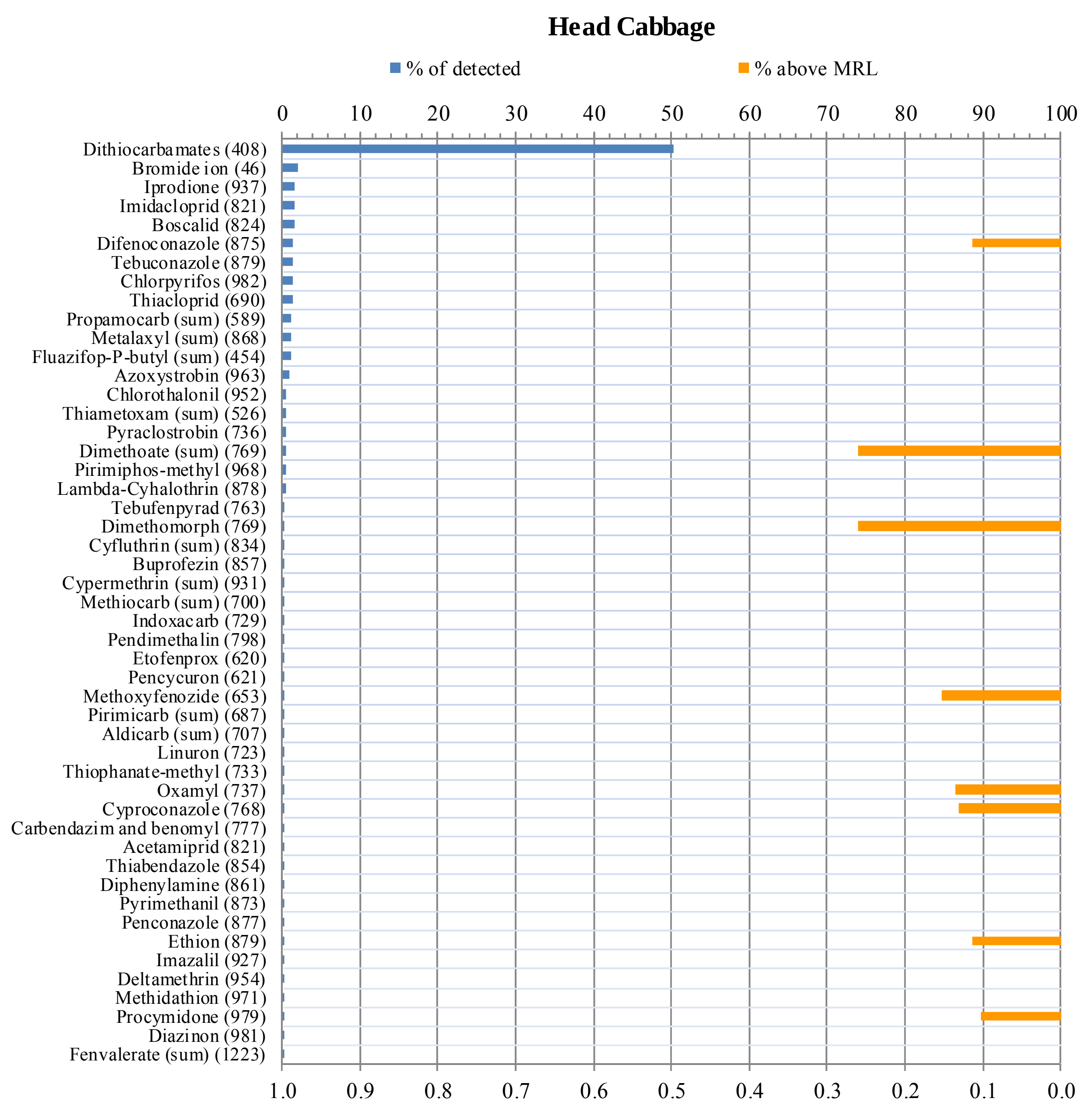
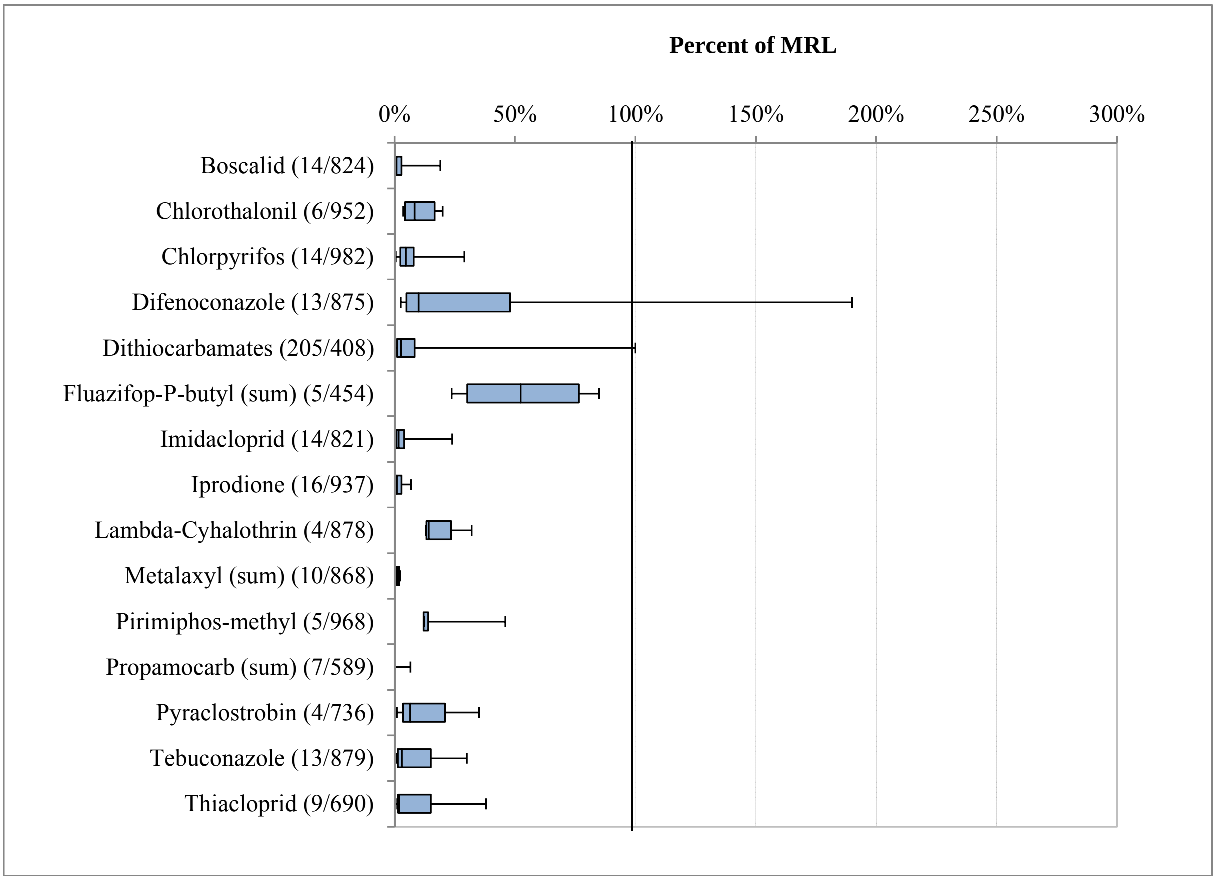


Figure 3-7: EUCP – Percentage of head cabbage samples with measurable residues (upper x-axis scale) and residues above the MRL (lower x-axis scale); the number of head cabbage samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-3: EUCP – Pesticides most frequently detected in head cabbage (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Head cabbage	Dithiocarbamates	50.25	Group of non-systemic fungicides used on a wide range of fruit and vegetables. Probably false positive results arising from natural occurring substances in brassica vegetables mimicking the presence of dithiocarbamates.



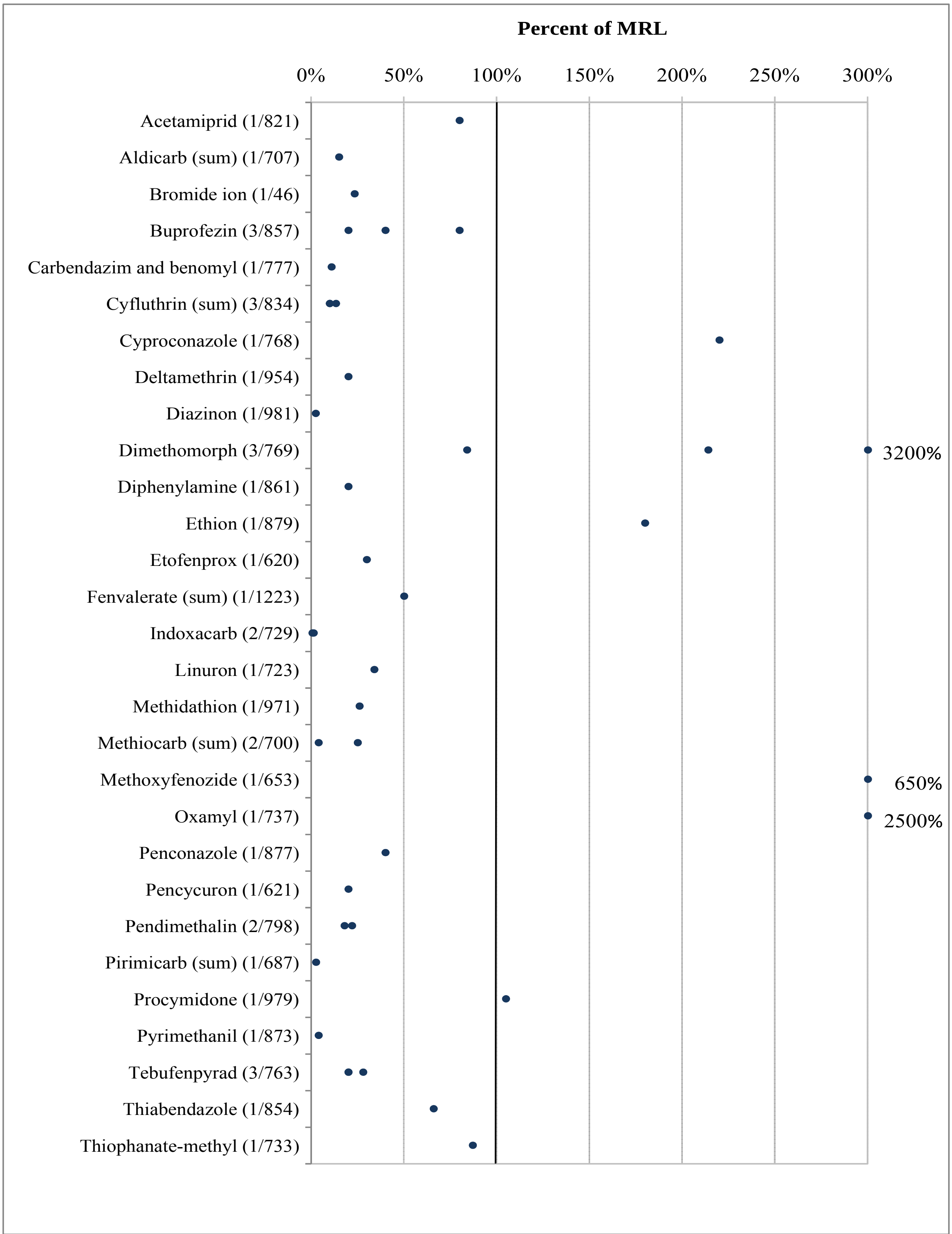


Figure 3-8: EUCP – Head cabbage: measured residues (>LOQ) expressed as % of the MRL.

3.3.3. Leek

In leek, 45 different pesticides were found. Dithiocarbamates were found most often (40.8% of samples analysed for this pesticide), followed by boscalid (17.6%) and tebuconazole (16.4%). As previously indicated for head cabbage (see section 3.3.2) the findings regarding the high frequency of dithiocarbamates detections are probably not the result of a pesticide treatment but are most likely false positive results in leek.

Additional information on the pesticides found and their uses in leek samples in below reported (Figure 3-9).

Nine different pesticides were found in concentrations exceeding the MRL. Bromopropylate was found exceeding the legal limit most frequently (3 samples; 0.33% of the samples), followed by iprodione (2 samples; 0.22% of the samples). For the other residues, MRL exceedances were found in one sample each. Samples reported as exceeding the MRL originated mostly from Portugal (3), Denmark (2), France (2) and Spain (2).

The distribution of the measured residue levels (results above the LOQ only), expressed in percent of the MRL applicable for the specific pesticide/commodity combination is reported in Figure 3-10.

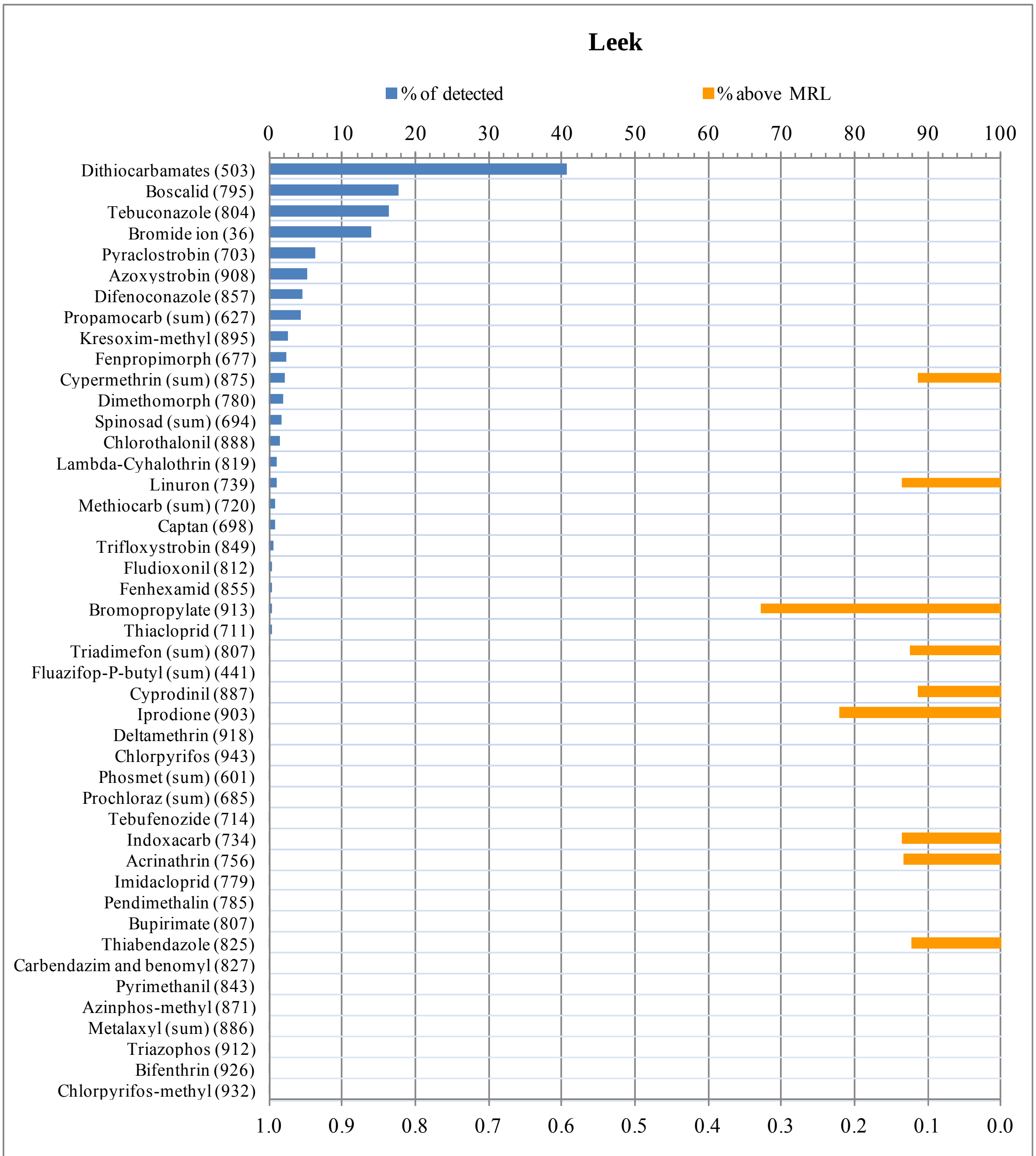
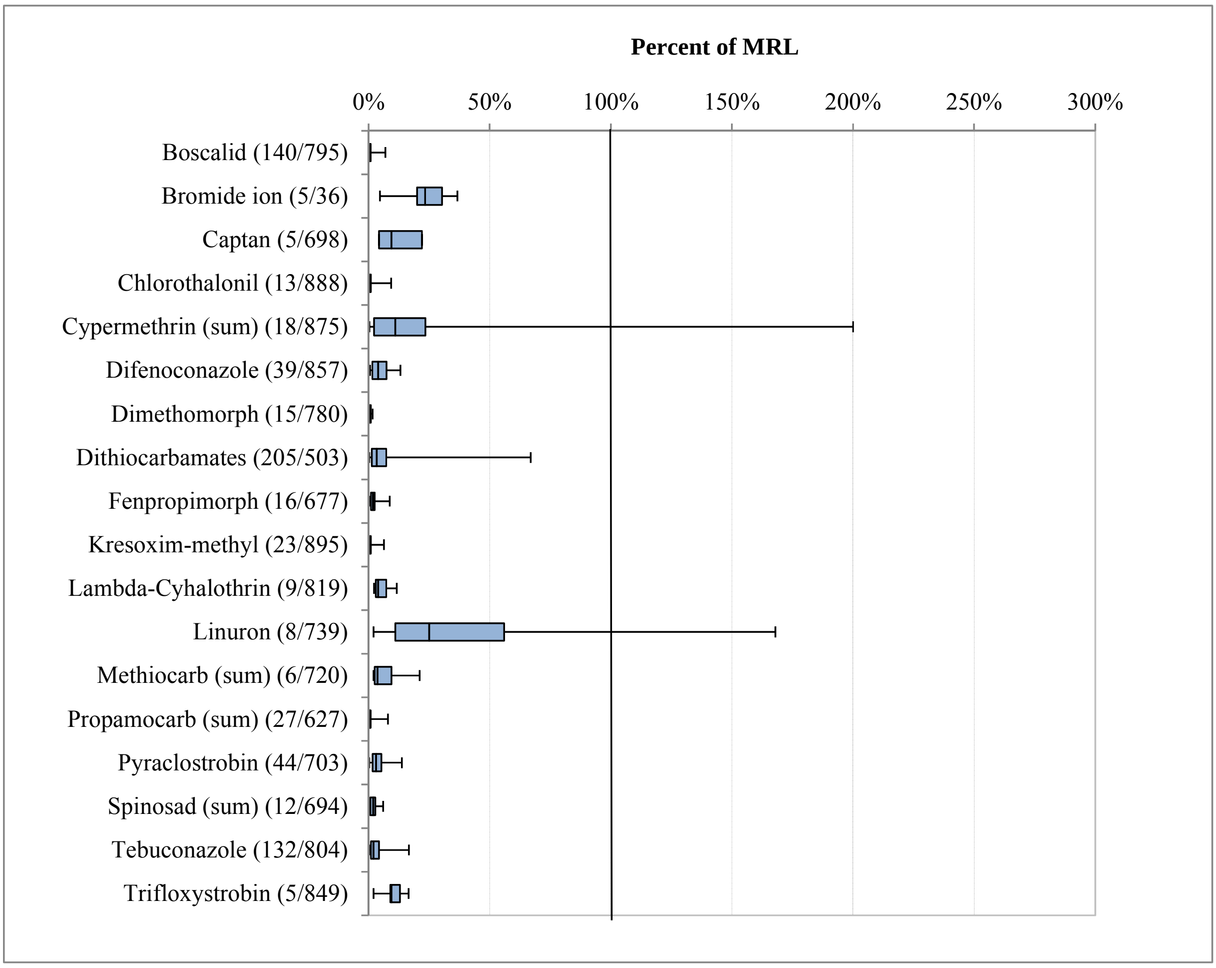


Figure 3-9: EUCP – Percentage of leek samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of leek samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-4: EUCP – Pesticides most frequently detected in leek (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Leek	Dithiocarbamates	40.76	Group of non-systemic fungicides used on a wide range of fruit and vegetables. Probably false positive results resulting from natural occurring substances in leek mimicking the presence of dithiocarbamates.
	Boscalid	17.61	Systemic fungicide used to control plant diseases in a wide range of crops.
	Tebuconazole	16.42	Systemic fungicide used to control plant diseases in a wide range of crops.
	Bromide ion	13.89	Naturally occurring substance and metabolite of the pesticide methylbromide. As from 2009 methyl bromide is no longer approved at EU level.



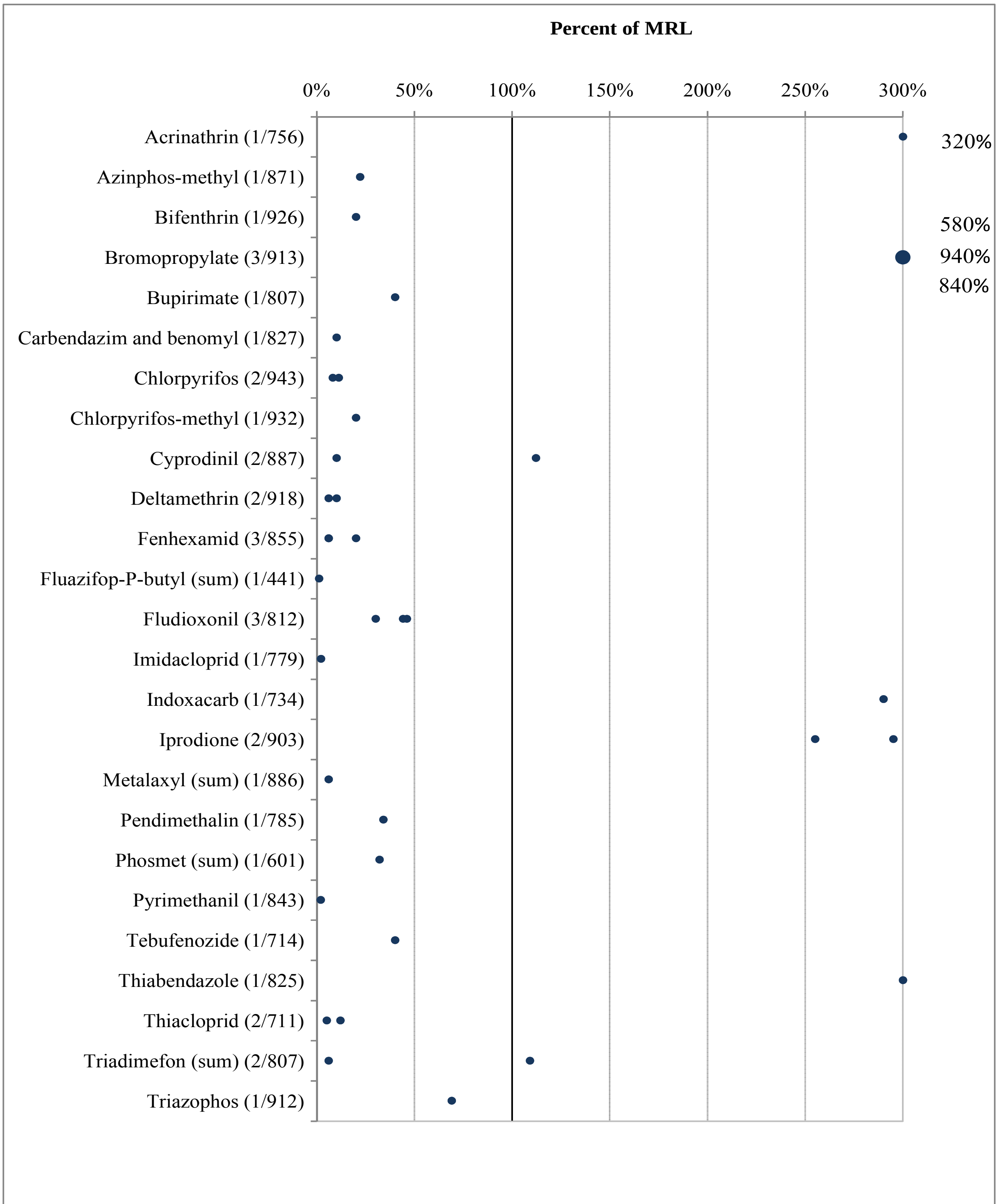


Figure 3-10: EUCP – Leek: measured residues (>LOQ) expressed as % of the MRL.

3.3.4. Lettuce

In lettuce, 68 different pesticides were found. The most frequently found pesticides were bromide ion, dithiocarbamates and iprodione: 31.0%, 21.0% and 17.3% of the lettuce samples analysed for these pesticide residues, respectively. For first two of these residues also the highest percentage of MRL exceedances was reported (see Figure 3-11).

In lettuce samples, 25 active substances where found above the MRL. Samples with residues most frequently above the MRL originated from France (20), Germany (6), Cyprus (4), Greece (4) and Romania (4).

The highest median residue level calculated on the basis of seven samples with residues above the LOQ was identified for chlorothalonil (4,070% of the MRL), being this value derived from the seven samples with measurable residues (the highest residue level amounted to 3.28 mg/kg; the MRL is set at the LOQ of 0.01 mg/kg). It is noted that this finding was notified to the RASFF[46]. The use of chlorothalonil is only authorised in land cress (MRL of 5 mg/kg) but not in other varieties of lettuce.

Furthermore, for carbendazim/benomyl the median residue level calculated on the basis of five samples with residues above the LOQ exceeded the MRL (125%).

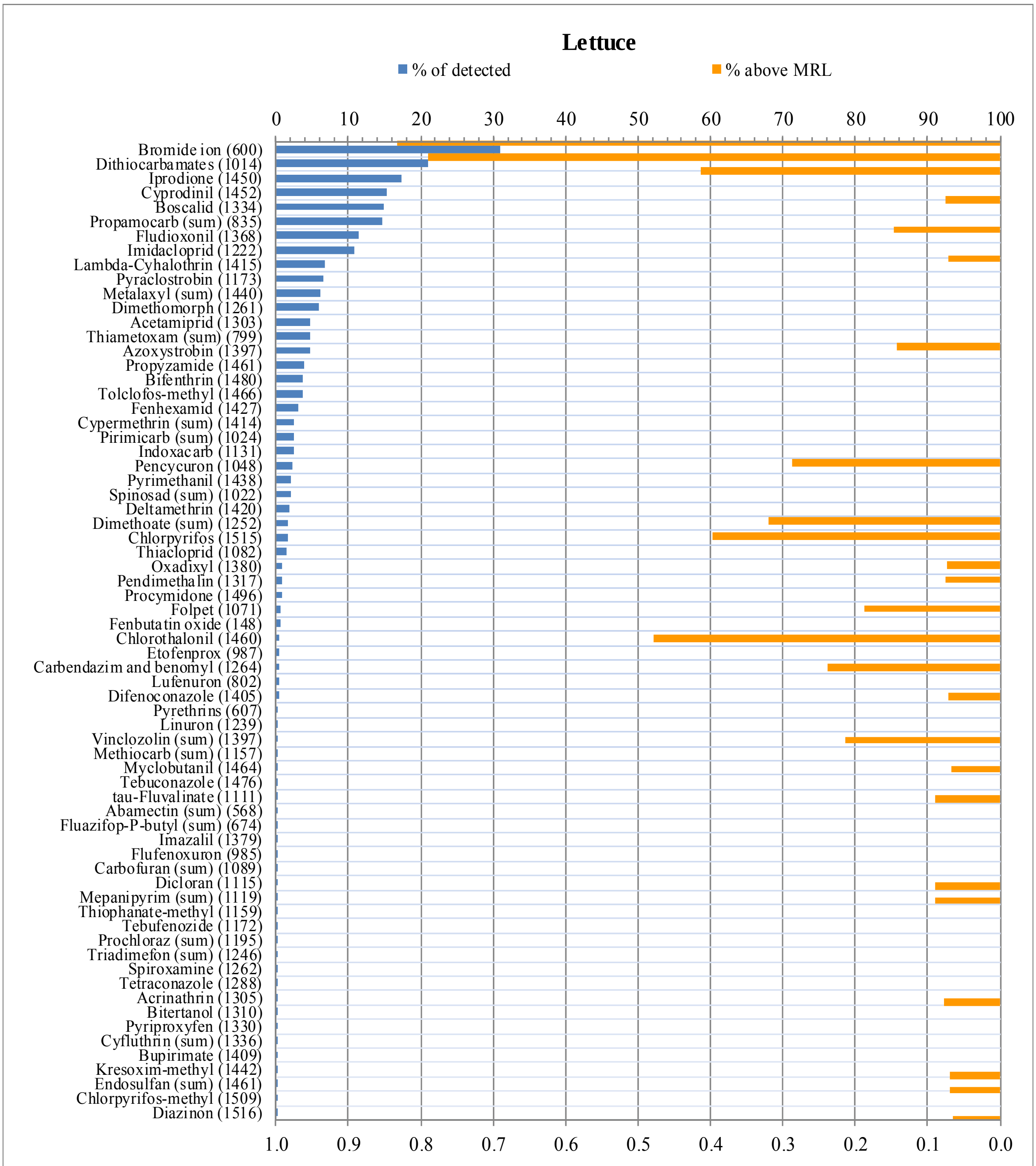
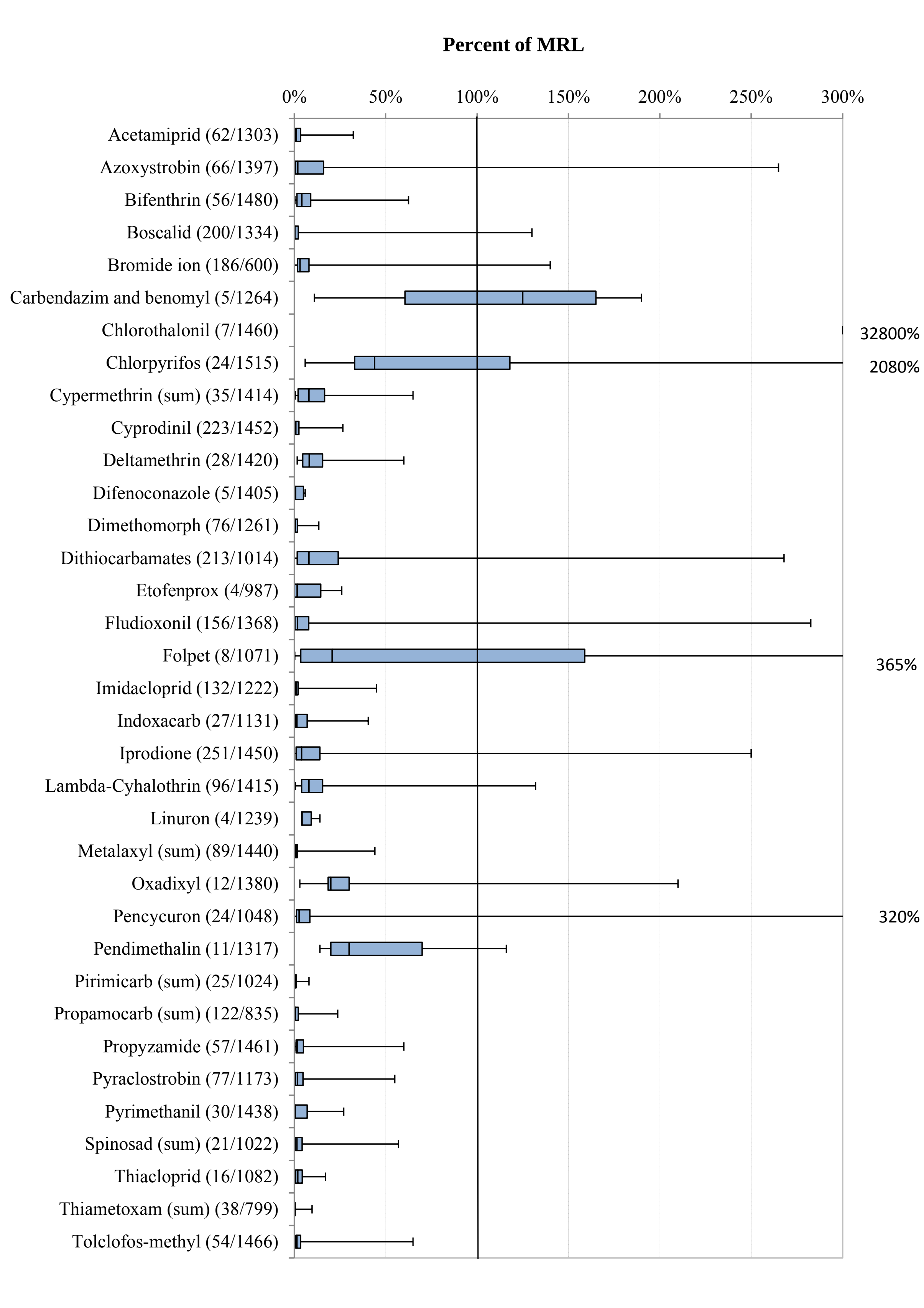


Figure 3-11: EUCP – Percentage of lettuce samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of lettuce samples tested for the specific pesticide is reported in brackets next to the pesticide name.

46 See "RASFF" in the Glossary.

Table 3-5: EUCP – Pesticides most frequently detected in lettuce (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Lettuce	Bromide ion	31.00	Naturally occurring substance and metabolite of the pesticide methylbromide. As from 2009 methyl bromide is no longer approved at EU level.
	Dithiocarbamates	21.01	Group of non-systemic fungicides used on a wide range of fruit and vegetables.
	Iprodione	17.31	Non-systemic fungicide used to control plant diseases in a wide range of fruit and other crops.
	Cyprodinil	15.36	Systemic foliar fungicide used for control of plant diseases in a range of fruit and vegetables.
	Boscalid	14.99	Systemic fungicide used to control plant diseases in a wide range of fruit and other crops.
	Propamocarb (sum)	14.61	Systemic fungicide used to control plant diseases in a wide range of vegetables and other crops.
	Fludioxonil	11.40	Systemic fungicide used against plant diseases in fruit and vegetable crops.
	Imidacloprid	10.80	Systemic insecticide used against different pests in a wide range of crops.


Percent of MRL
0%
50%
100%
150%
200%
250%
300%
Acetamiprid (62/1303)
Azoxystrobin (66/1397)
Bifenthrin (56/1480)
Boscalid (200/1334)
Bromide ion (186/600)
Carbendazim and benomyl (5/1264)
Chlorothalonil (7/1460)
Chlorpyrifos (24/1515)
Cypermethrin (sum) (35/1414)
Cyprodinil (223/1452)
Deltamethrin (28/1420)
Difenoconazole (5/1405)
Dimethomorph (76/1261)
Dithiocarbamates (213/1014)
Etofenprox (4/987)
Fludioxonil (156/1368)
Folpet (8/1071)
Imidacloprid (132/1222)
Indoxacarb (27/1131)
Iprodione (251/1450)
Lambda-Cyhalothrin (96/1415)
Linuron (4/1239)
Metalaxyl (sum) (89/1440)
Oxadixyl (12/1380)
Pencycuron (24/1048)
Pendimethalin (11/1317)
Pirimicarb (sum) (25/1024)
Propamocarb (sum) (122/835)
Propyzamide (57/1461)
Pyraclostrobin (77/1173)
Pyrimethanil (30/1438)
Spinosad (sum) (21/1022)
Thiacloprid (16/1082)
Thiametoxam (sum) (38/799)
Tolclofos-methyl (54/1466)
32800%
2080%
365%
320%

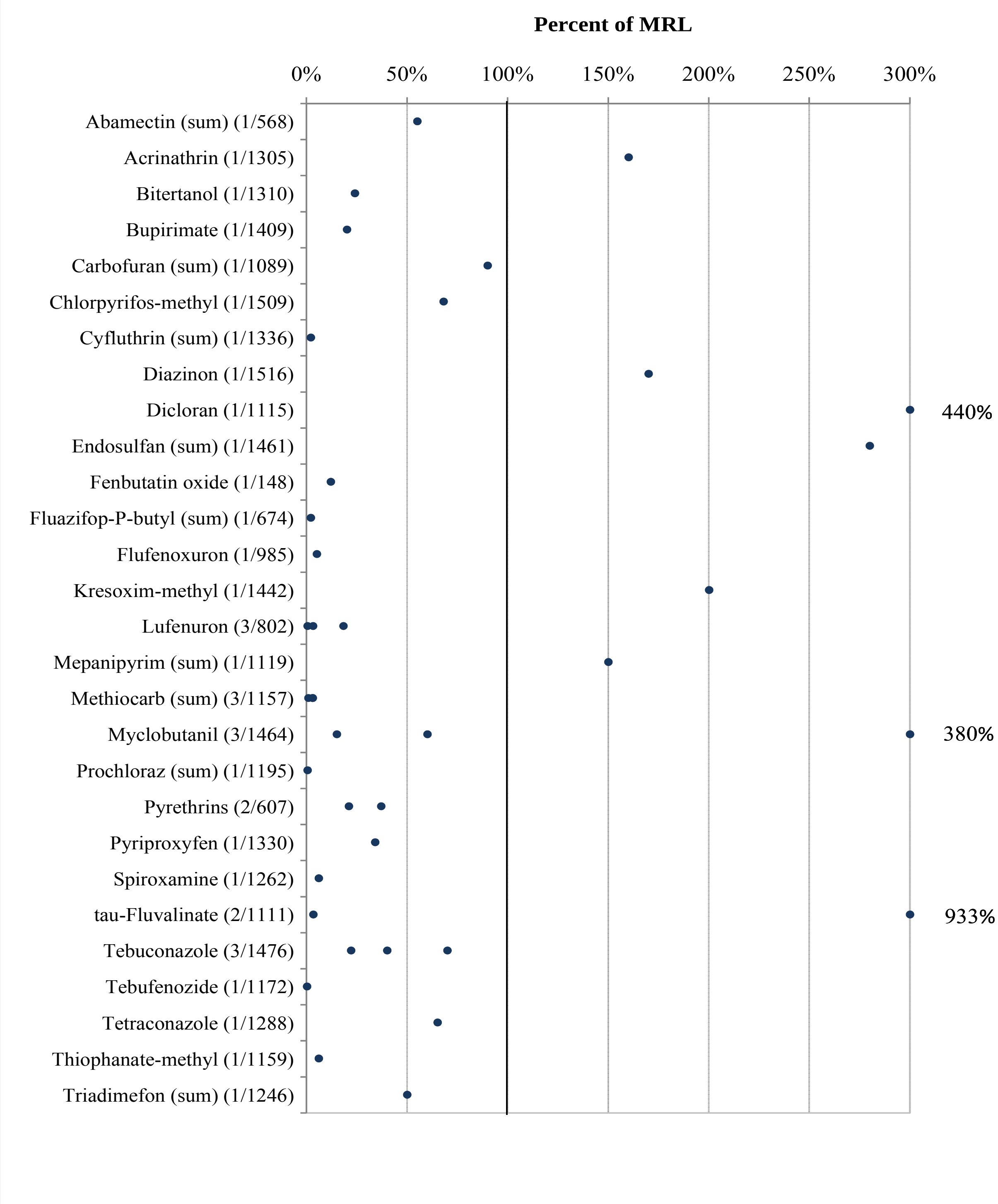


Figure 3-12: EUCP – Lettuce: measured residues (>LOQ) expressed as % of the MRL.

3.3.5. Milk

In milk, four different pesticides (DDT (sum), hexachlorobenzene, HCH (beta-isomer) and chlorpyrifos were found. No MRL exceedances were reported (Figure 3-13). The highest residue reported in milk samples (expressed in % of the MRL) was measured for HCH (beta isomer); this accounted for 90% of the MRL (Figure 3-14) and the median residue calculated over three residues exhausted 60% of the MRL.

The four pesticides measured in milk samples are considered fat soluble and all but one (chlorpyrifos) are persistent organic pollutants. Only one pesticide (DDT (sum)) was measured with a frequency of more than 10% of the sample (Table 3-6).

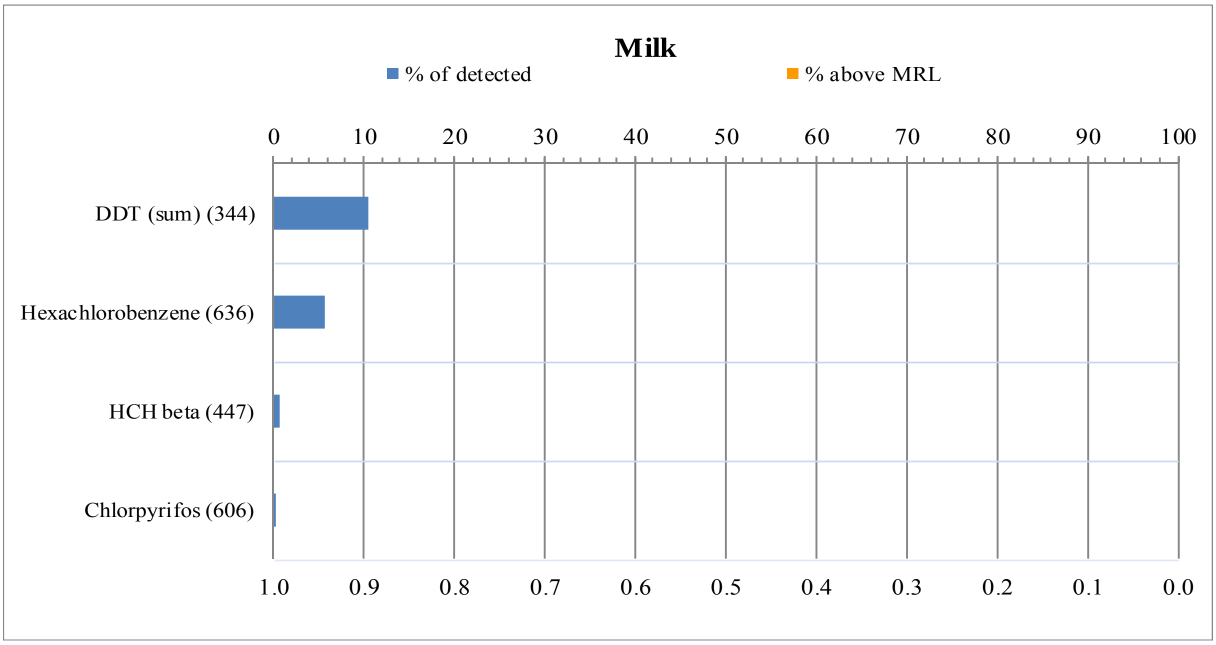


Figure 3-13: EUCP – Percentage of milk samples with measurable residues and number of milk samples tested for the specific pesticide (reported in brackets next to the pesticide name).

Table 3-6: EUCP – Pesticides most frequently detected in milk (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substance found
Milk	DDT (sum)	10.47	Persistent organic pollutant, in Europe banned since 1979.

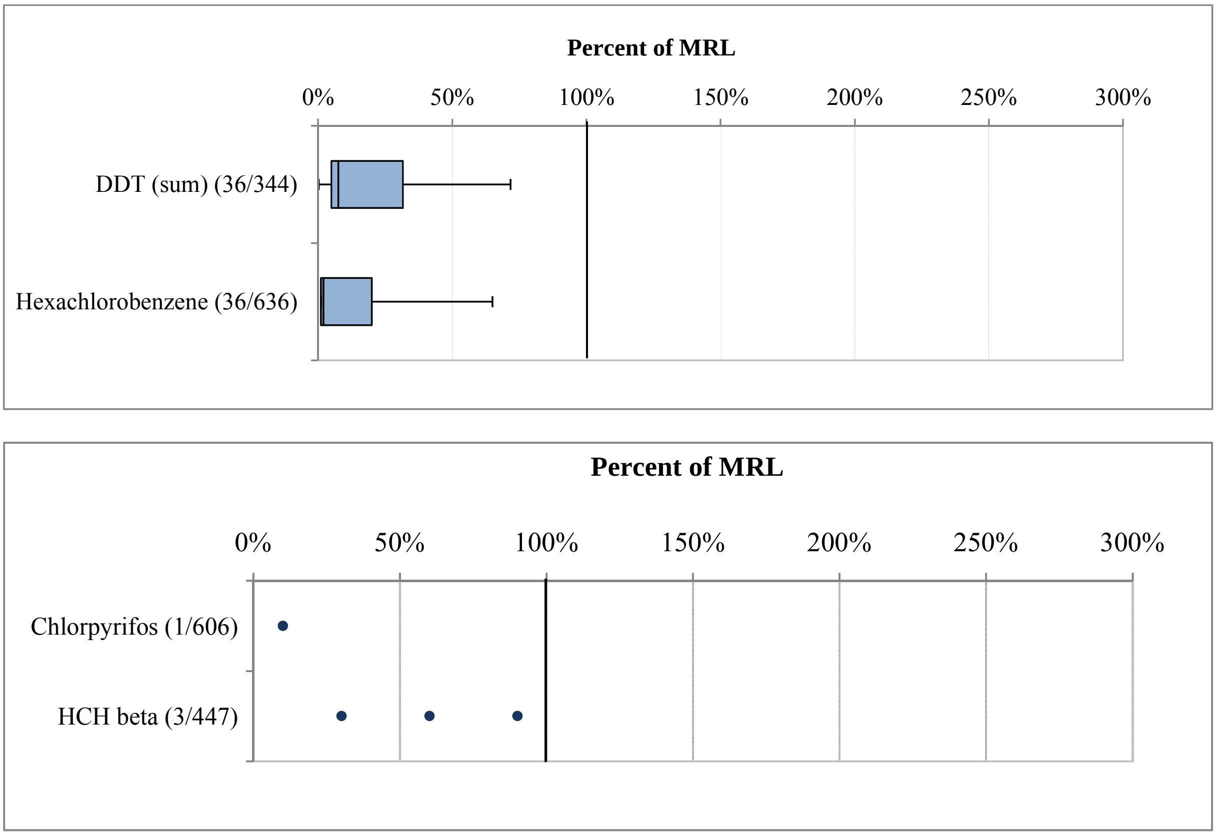


Figure 3-14: EUCP – Milk: measured residues (>LOQ) expressed as % of the MRL.

3.3.6. Oats

In oats, 20 different pesticides were found (Figure 3-15). The most frequently found substances were chlormequat (64.6% of samples analysed for this pesticide), glyphosate (23.8%) and pirimiphos-methyl (12.9%). Only chlormequat was found exceeding the MRL (8.1% of all oat samples). The median chlormequat value calculated on the basis of 104 determinations above the LOQ accounted for 37% of the MRL (Figure 3-16). The 13 samples exceeding the chlormequat MRL originated from the United Kingdom (12) and Denmark (1).

Additional information on the pesticides found and their uses in oat samples is reported below (Table 3-7).

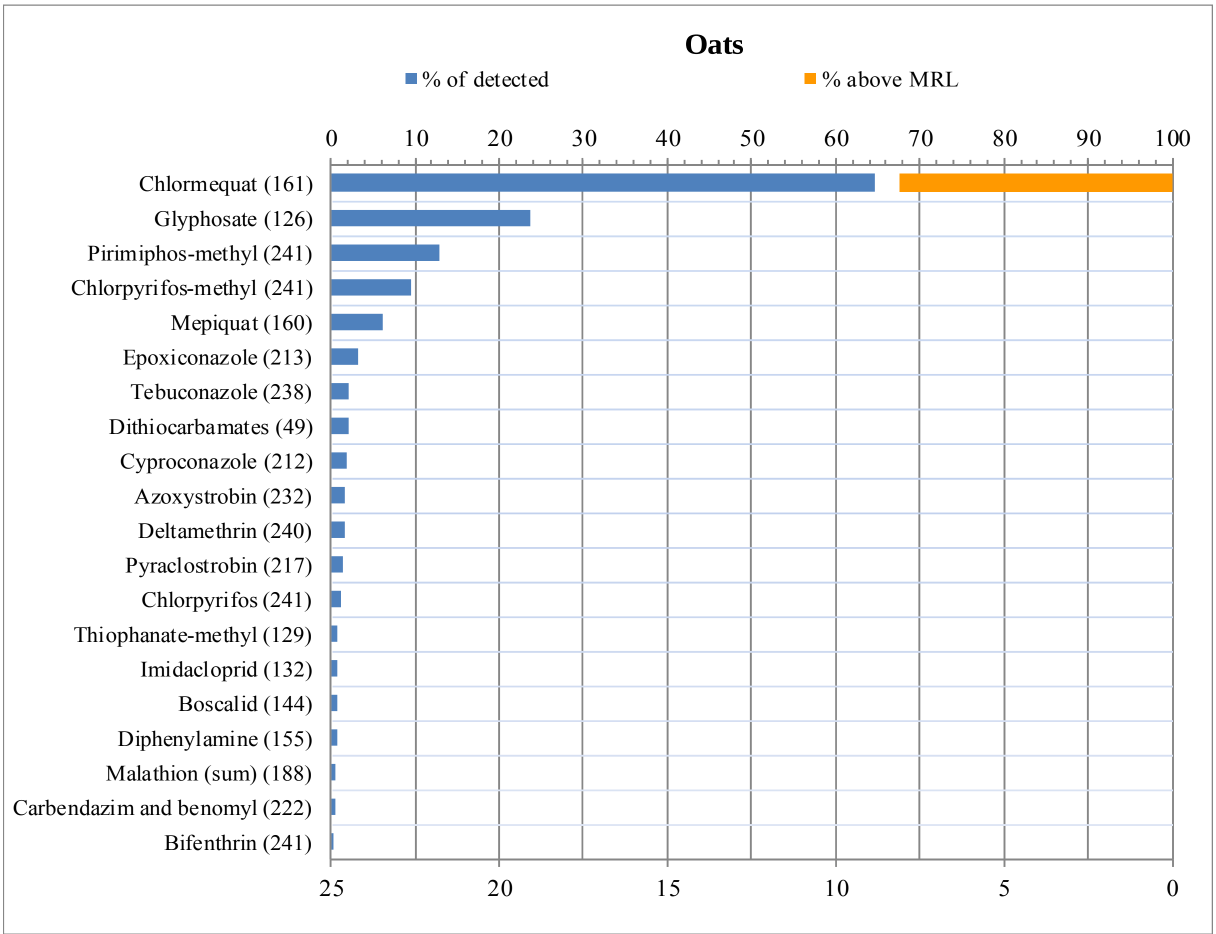
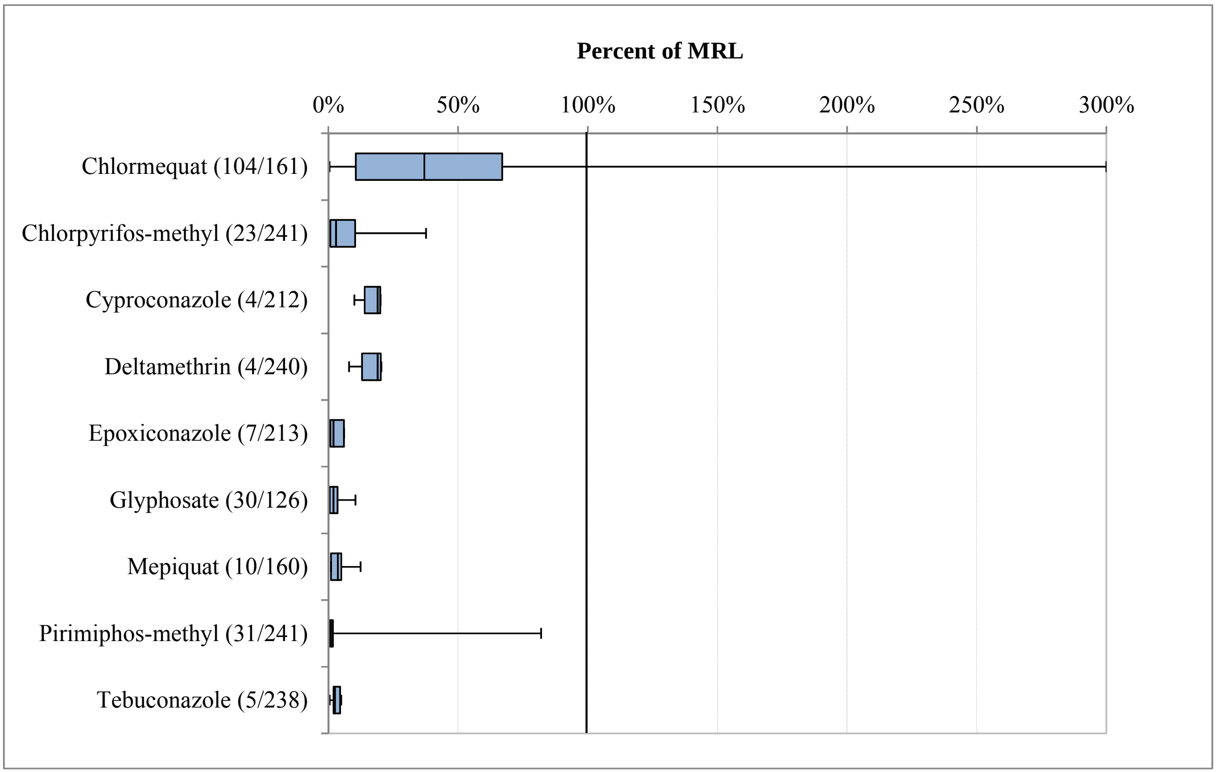


Figure 3-15: EUCP – Percentage of oat samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of oat samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-7: EUCP – Pesticides most frequently detected in oats (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Oats	Chlormequat	64.60	Plant growth regulator used in cereals for strengthening the stems.
	Glyphosate	23.81	Non-selective systemic herbicide, also used as desiccant for harvest management.
	Pirimiphos-methyl	12.86	Insecticide used for post-harvest treatment of stored cereals.



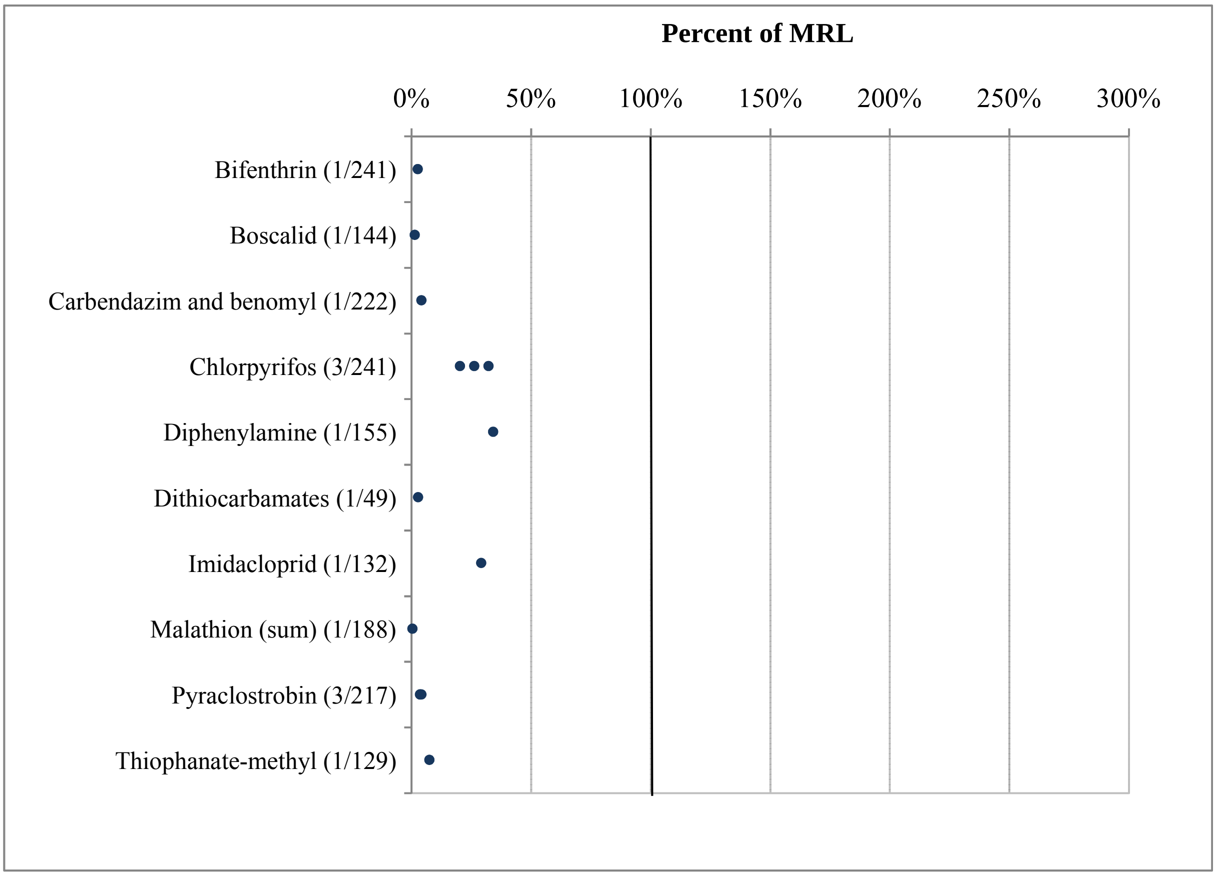


Figure 3-16: EUCP – Oats: measured residues (>LOQ) expressed as % of the MRL.

3.3.7. Peaches

In peaches, 79 different pesticides were found. The pesticides most frequently found were tebuconazole (19.8%), followed by the dithiocarbamates (19.4%) and iprodione (15.6%). 17 substances were found in concentrations exceeding the MRL (Figure 3-17). The samples that most often exceeded the legal limits originated from Spain (5), Turkey (4) and Malta (3).

Captan showed the highest rate of samples exceeding the MRL (6 samples). For captan the median residue value calculated on the basis of seven samples with measurable residues exceeded 100% of the MRL (Figure 3-18).

Information on the pesticides found and their uses in peach samples is reported in Table 3-8.

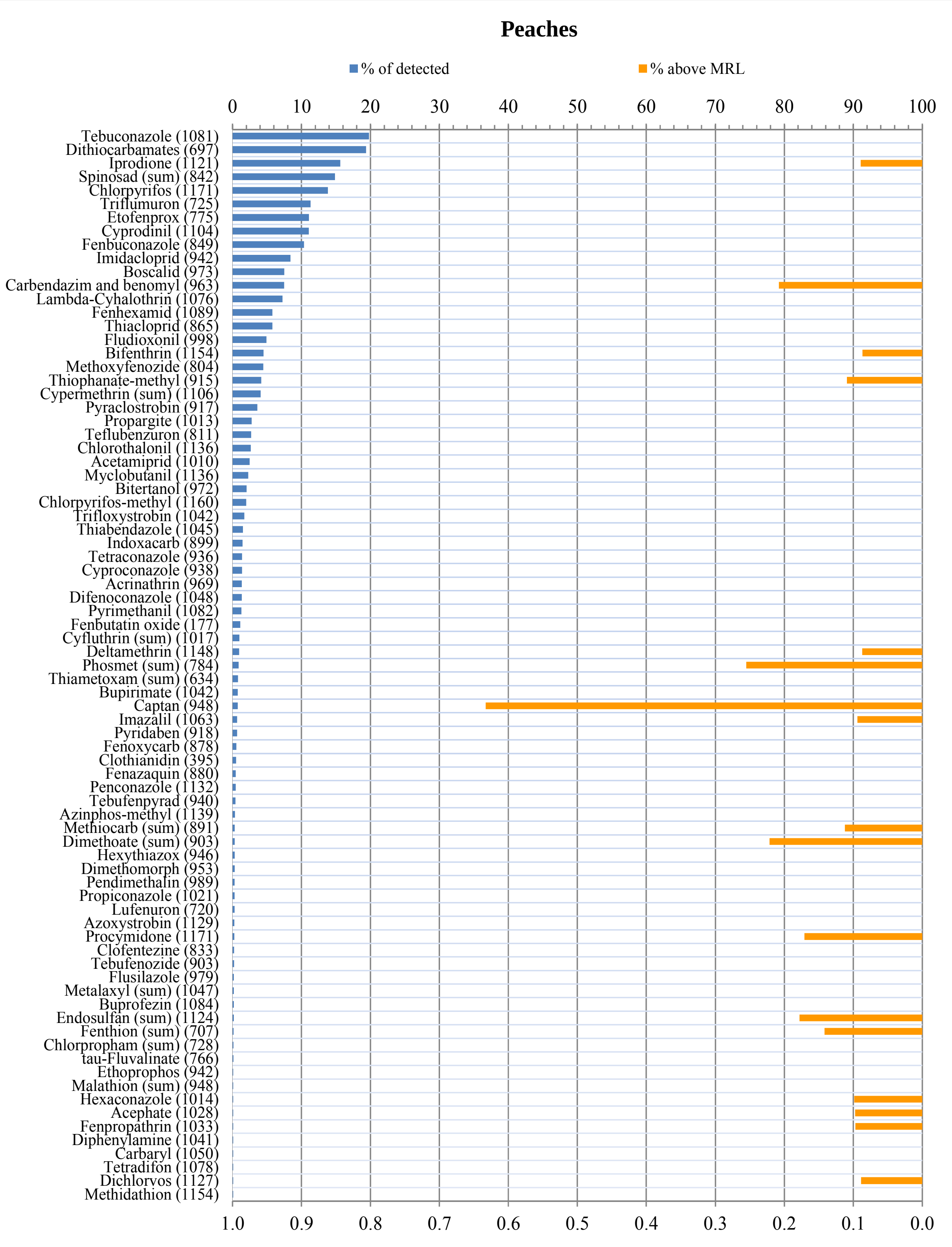
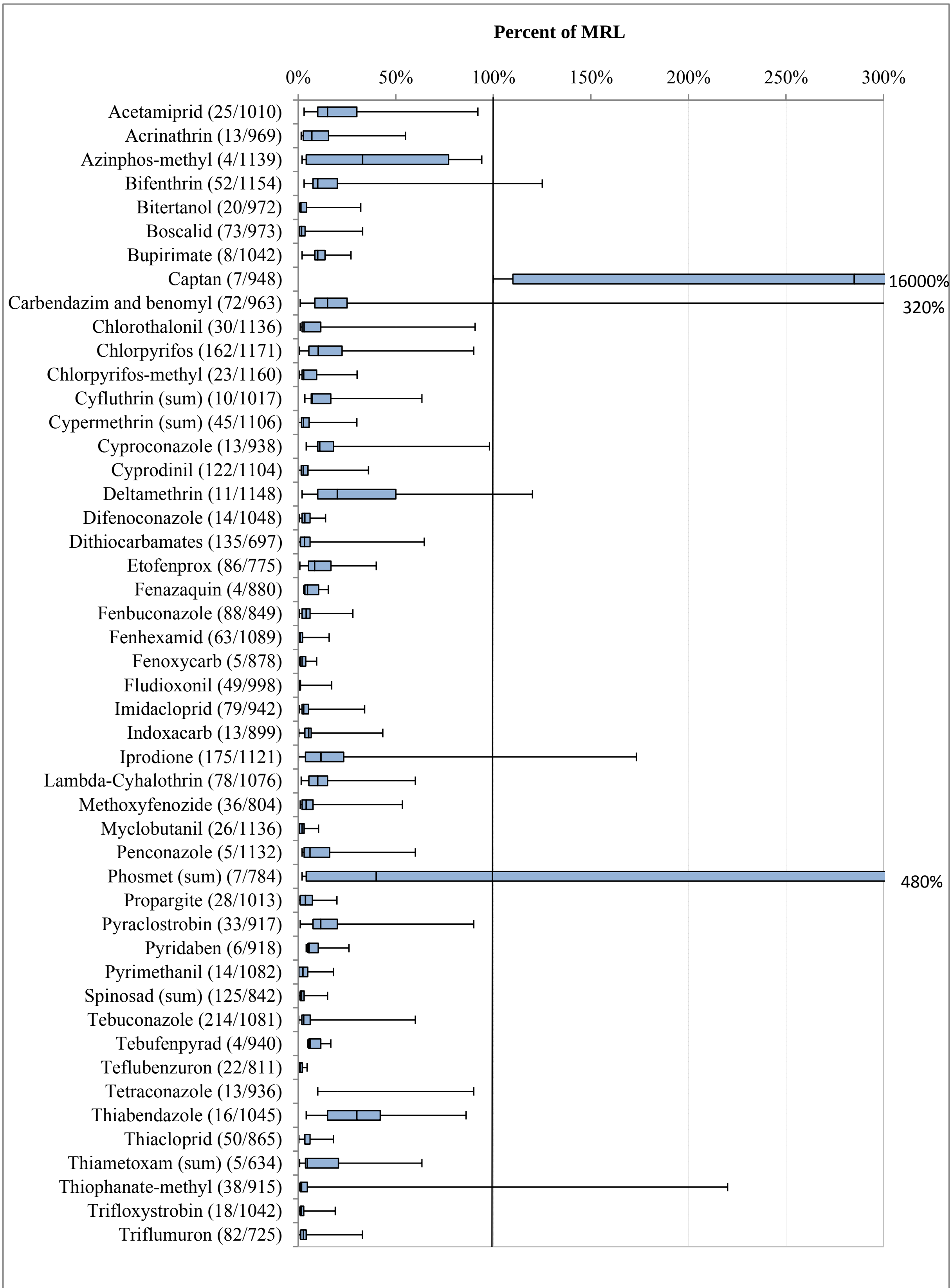


Figure 3-17: EUCP – Percentage of peach samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of peach samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-8: EUCP – Pesticides most frequently detected in peaches (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Peaches	Tebuconazole	19.80	Systemic fungicide used to control plant diseases in a wide range of fruit, vegetables and other crops.
	Dithiocarbamates	19.37	Non-systemic fungicide used for foliar treatment of fruit and vegetables.
	Iprodione	15.61	Non-systemic fungicide used to control fungal diseases in a wide range of fruit and other crops.
	Spinosad (sum)	14.85	Insecticide used against different pests in fruits and other crops. Under certain conditions spinosad is also allowed to be used in organic farming.
	Chlorpyrifos	13.83	Non-systemic insecticide used to control different pests in fruit and other crops.
	Triflumuron	11.31	Non-systemic insecticide used to control different pests on foliage in fruit and other crops.
	Etofenprox	11.10	Non-systemic insecticide used to control different pests in fruit and other crops.
	Cyprodinil	11.05	Systemic fungicide used for control of plant diseases in a wide range of fruit and vegetables.
	Fenbuconazole	10.37	Systemic fungicide used to control plant diseases.


Percent of MRL
0%
50%
100%
150%
200%
250%
300%
Acetamiprid (25/1010)
Acrinathrin (13/969)
Azinphos-methyl (4/1139)
Bifenthrin (52/1154)
Bitertanol (20/972)
Boscalid (73/973)
Bupirimate (8/1042)
Captan (7/948)
Carbendazim and benomyl (72/963)
Chlorothalonil (30/1136)
Chlorpyrifos (162/1171)
Chlorpyrifos-methyl (23/1160)
Cyfluthrin (sum) (10/1017)
Cypermethrin (sum) (45/1106)
Cyproconazole (13/938)
Cyprodinil (122/1104)
Deltamethrin (11/1148)
Difenoconazole (14/1048)
Dithiocarbamates (135/697)
Etofenprox (86/775)
Fenazaquin (4/880)
Fenbuconazole (88/849)
Fenhexamid (63/1089)
Fenoxycarb (5/878)
Fludioxonil (49/998)
Imidacloprid (79/942)
Indoxacarb (13/899)
Iprodione (175/1121)
Lambda-Cyhalothrin (78/1076)
Methoxyfenozide (36/804)
Myclobutanil (26/1136)
Penconazole (5/1132)
Phosmet (sum) (7/784)
Propargite (28/1013)
Pyraclostrobin (33/917)
Pyridaben (6/918)
Pyrimethanil (14/1082)
Spinosad (sum) (125/842)
Tebuconazole (214/1081)
Tebufenpyrad (4/940)
Teflubenzuron (22/811)
Tetraconazole (13/936)
Thiabendazole (16/1045)
Thiacloprid (50/865)
Thiametoxam (sum) (5/634)
Thiophanate-methyl (38/915)
Trifloxystrobin (18/1042)
Triflumuron (82/725)
16000%
320%
480%

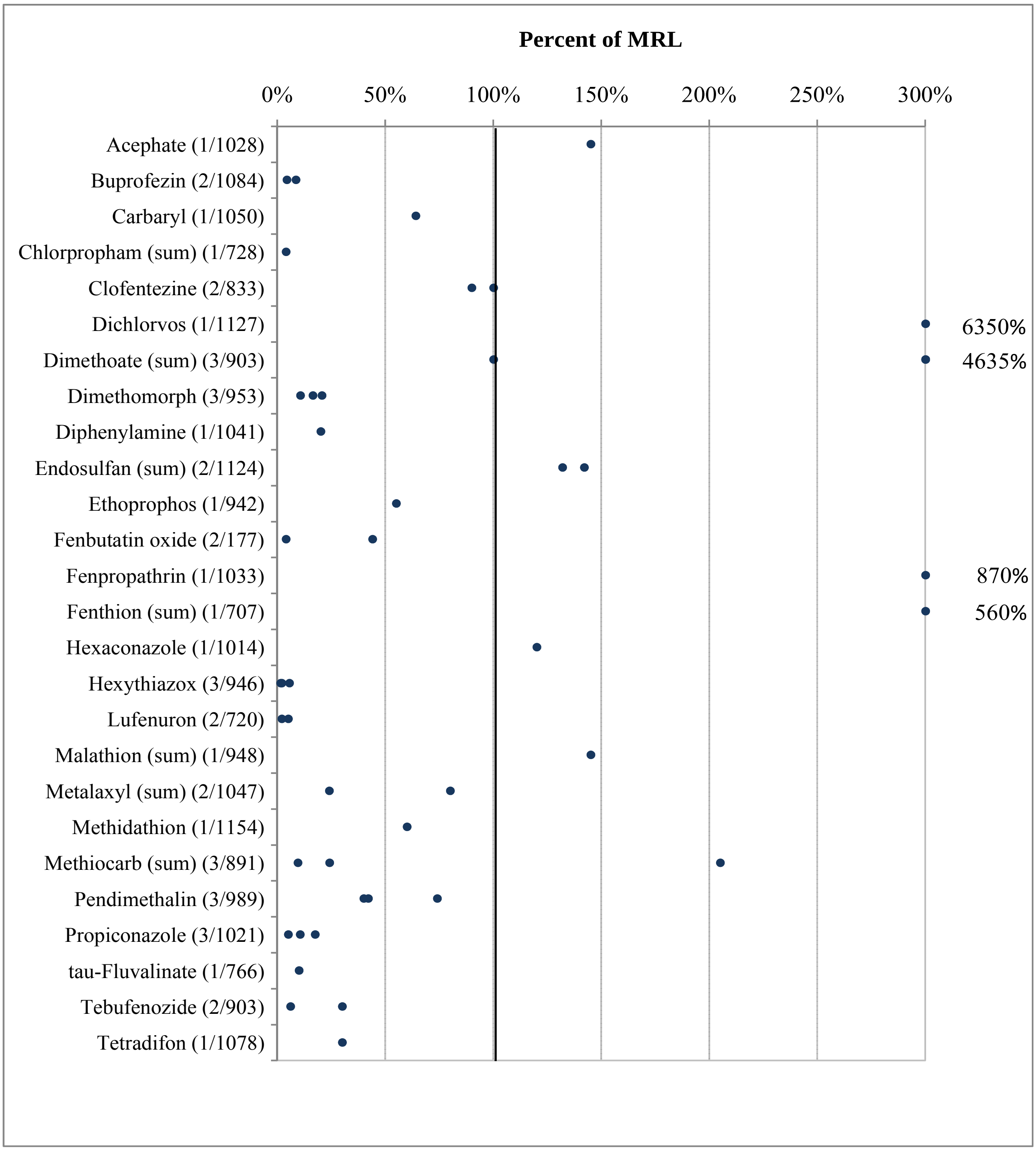


Figure 3-18: EUCP – Peaches: measured residues (>LOQ) expressed as % of the MRL.

3.3.8. Pears

In 2010, the analysis for amitraz was only required for pear samples and not for the remaining commodities included in the 2010 EU-coordinated programme. The reason for including amitraz in the 2010 European control programme was the high rate of MRL violations reported in the past years for pears available on the EU market and originating from Turkey[47].

Of the 388 pear samples, amitraz was found in six samples, five of these had residues above the MRL (1.3%). The five pear samples found exceeding the MRL of amitraz originated from the United

[47] The findings concerning the residues of amitraz measured in pears were notified to the European Commission through the Rapid Alert System for Food and Feed (RASFF) notification system: http://ec.europa.eu/food/food/rapidalert/docs/report2009_en.pdf It should be noted that the analysis of this specific pesticide/crop combination was included in Regulation (EC) No 901/2009 on the 2010 EU-coordinated control programme and that at the time of the preparation of this monitoring plan Regulation (EC) No 669/2009 on the increased level of official controls on imports of certain food had not yet been in place.

Kingdom (4) and France (1). The highest residue level reported amounted to 0.1 mg/kg (200% of the MRL), while the median residue level accounted for 160% of the legal limit set at the LOQ (0.05 mg/kg). None of the samples analysed in the framework of the EU-coordinated programme originated from Turkey nor have Turkish samples been analysed in the framework of the national control programmes.

3.3.9. Rye

In rye, 18 different pesticides were found (Figure 3-19). The most frequently found pesticide residues were chlormequat (35.9%), bromide ion (25.8%) and mepiquat (10.9%) (Table 3-9). The MRL was exceeded in only one sample containing chlormequat. This sample originated from Slovakia.

The distribution of the measured residue levels (results above the LOQ only), expressed in the percentage of the MRL applicable for the specific pesticide/commodity combination is reported in Figure 3-20.

In Table 3-9 information on the pesticides found and their uses in rye samples is reported.

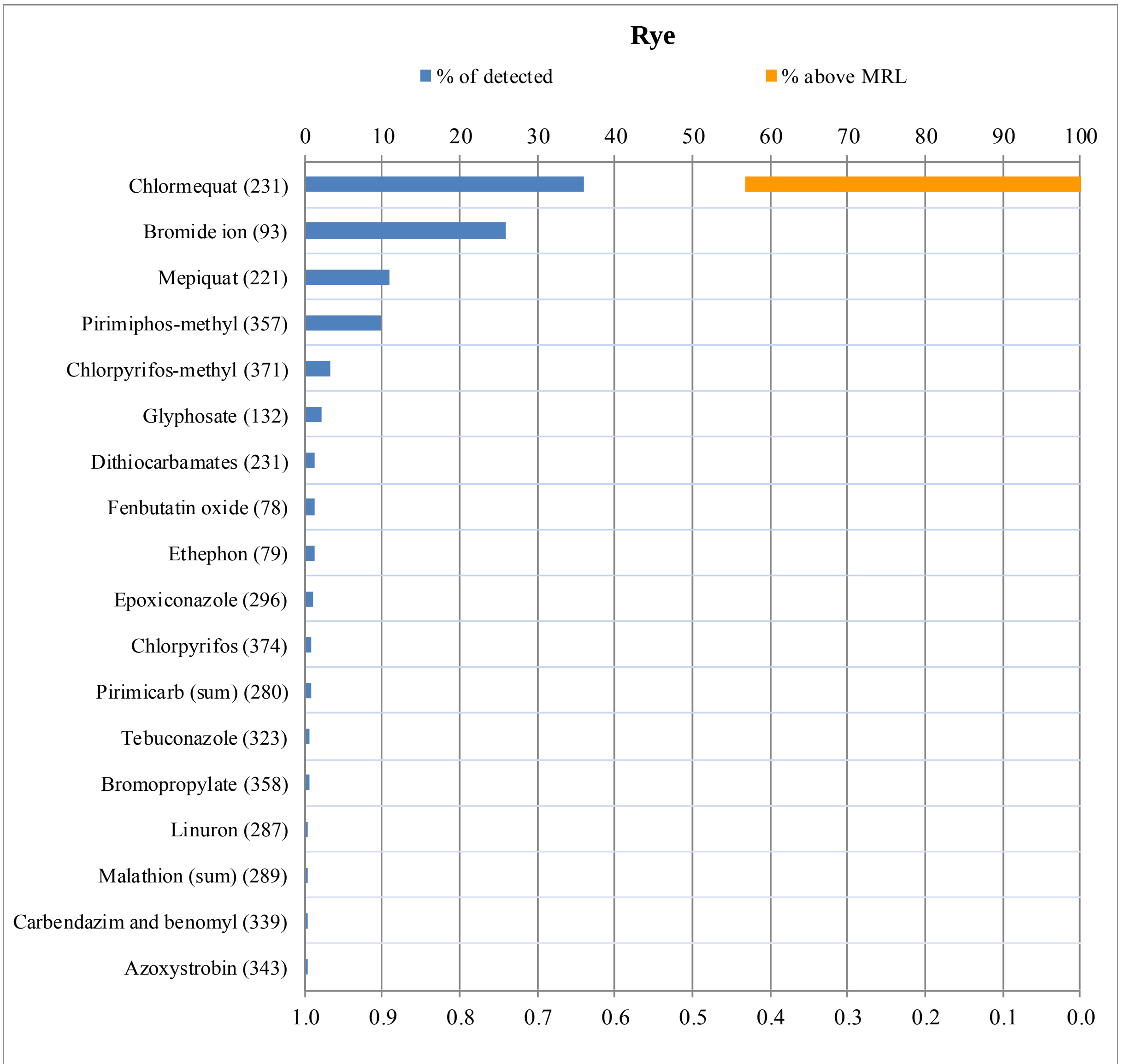
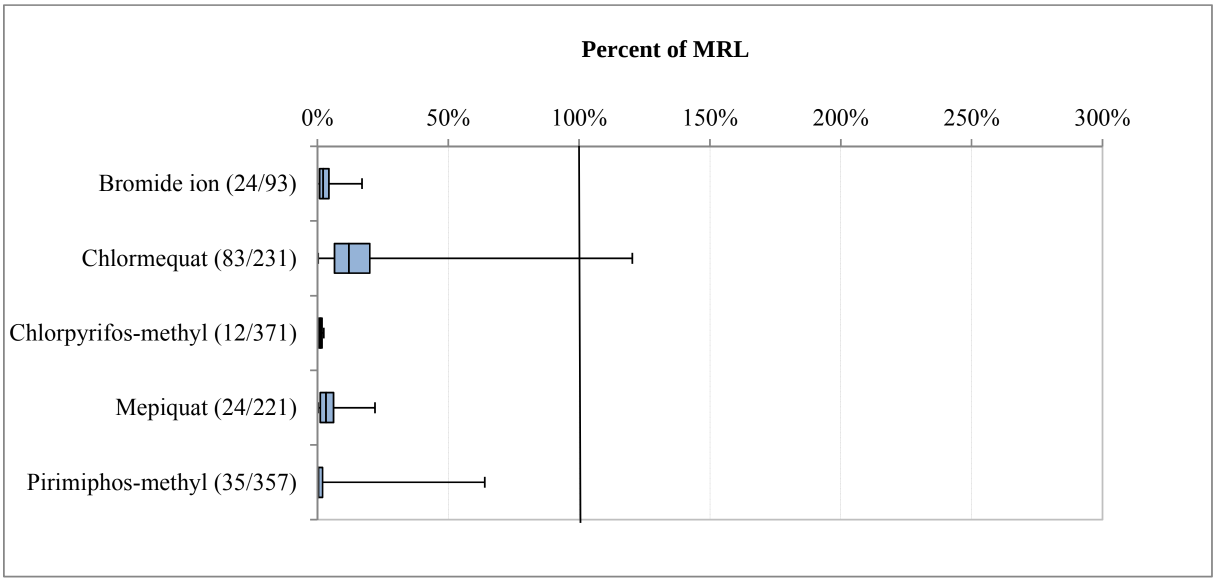


Figure 3-19: EUCP – Percentage of rye samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of rye samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-9: EUCP – Pesticides most frequently detected in rye (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Rye	Chlormequat	35.93	Plant growth regulator used in cereals for strengthening the stems.
	Bromide ion	25.81	Naturally occurring substance and metabolite of the pesticide methylbromide. As of 2009 methyl bromide is no longer approved at EU level.
	Mepiquat	10.86	Plant growth regulator used in cereals. Similar mode of action as chlormequat.



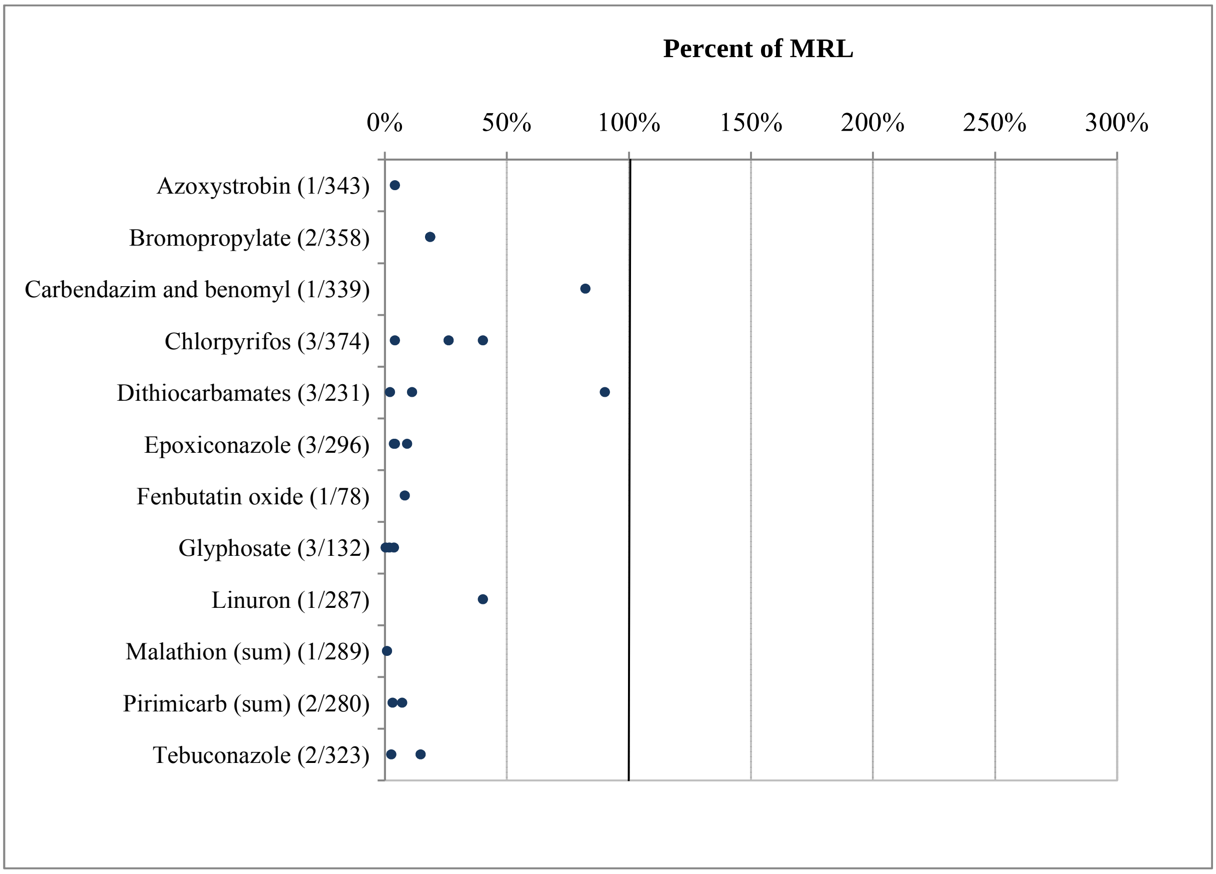


Figure 3-20: EUCP – Rye: measured residues (>LOQ) expressed as % of the MRL.

3.3.10. Strawberries

In strawberries, 82 different pesticides were found (Figure 3-21). Cyprodinil was most often found (31.6% of the samples), followed by fludioxonil (28.2%) and boscalid (28.0%) (Table 3-10). MRL exceedances were observed for 21 different residues (Figure 3-21). The countries of origin with the highest number of strawberry samples exceeding the legal limits were Egypt (10), France (8), Cyprus (3), Greece (3), Slovenia (3) and Spain (3).

Table 3-10 lists the pesticides found, as well as information on their uses. The median residue level for acetamiprid, calculated on the basis of the four samples containing residues above the LOQ, accounted for 195% of the MRL (Figure 3-22).

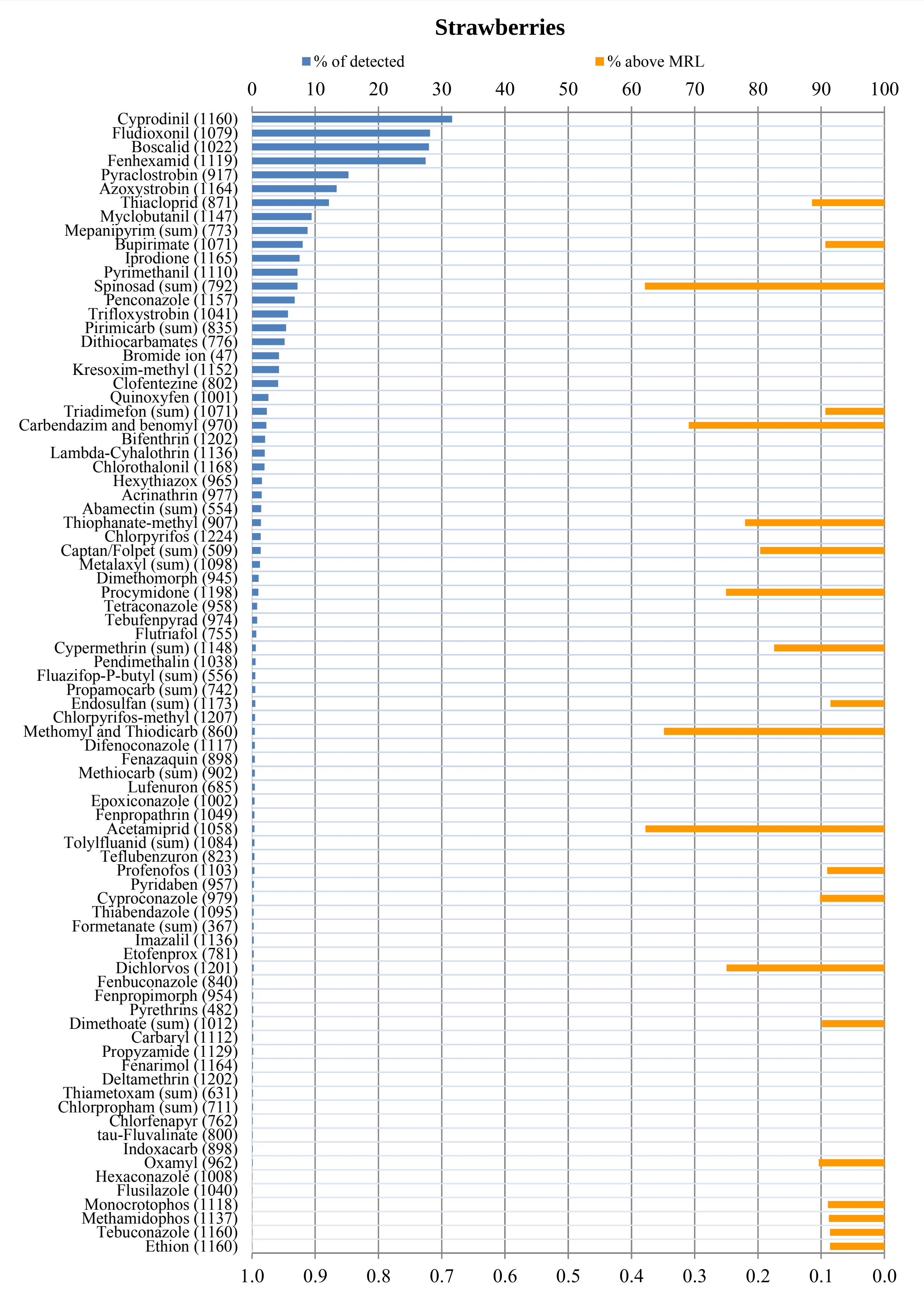
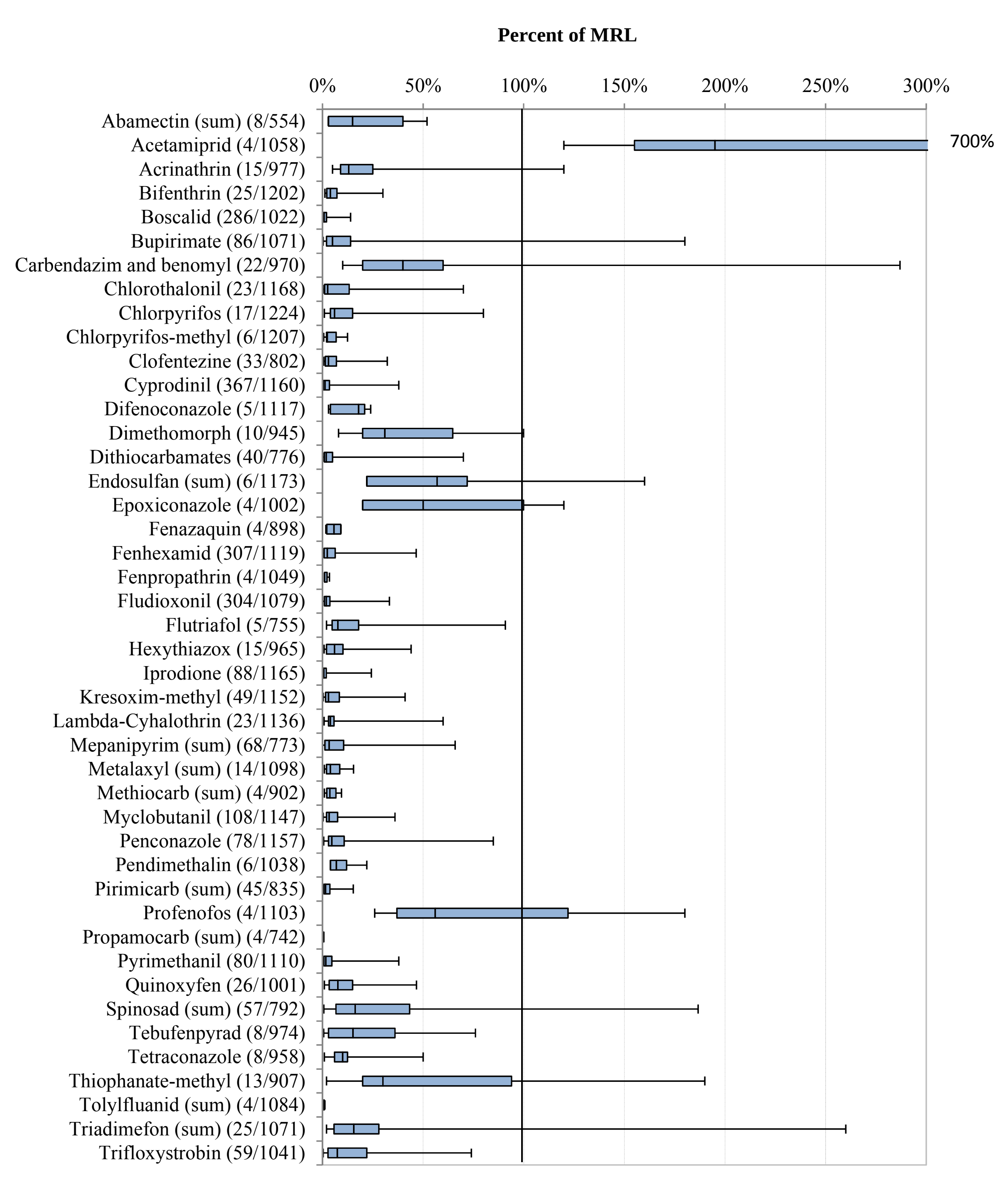


Figure 3-21: EUCP – Percentage of strawberry samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of strawberry samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-10: EUCP – Pesticides most frequently detected in strawberries (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Strawberries	Cyprodinil	31.64	Foliar fungicide used for control of plant diseases in a range of fruit and vegetables.
	Fludioxonil	28.17	Systemic fungicide used against powdery mildew in vines and different diseases in fruit and vegetable crops.
	Boscalid	27.98	Systemic fungicide used to control plant diseases in a wide range of fruit and other crops.
	Fenhexamid	27.44	Systemic fungicide used as foliar spray in fruit and other crops.
	Pyraclostrobin	15.27	Systemic fungicide used to control plant diseases in a wide range of fruit and other crops.
	Azoxystrobin	13.40	Systemic fungicide used to control plant diseases in a wide range of fruit and other crops.
	Thiacloprid	12.17	Systemic insecticide used against different pests in a wide range of crops.


Percent of MRL
0%
50%
100%
150%
200%
250%
300%
700%
Abamectin (sum) (8/554)
Acetamiprid (4/1058)
Acrinathrin (15/977)
Bifenthrin (25/1202)
Boscalid (286/1022)
Bupirimate (86/1071)
Carbendazim and benomyl (22/970)
Chlorothalonil (23/1168)
Chlorpyrifos (17/1224)
Chlorpyrifos-methyl (6/1207)
Clofentezine (33/802)
Cyprodinil (367/1160)
Difenoconazole (5/1117)
Dimethomorph (10/945)
Dithiocarbamates (40/776)
Endosulfan (sum) (6/1173)
Epoxiconazole (4/1002)
Fenazaquin (4/898)
Fenhexamid (307/1119)
Fenpropathrin (4/1049)
Fludioxonil (304/1079)
Flutriafol (5/755)
Hexythiazox (15/965)
Iprodione (88/1165)
Kresoxim-methyl (49/1152)
Lambda-Cyhalothrin (23/1136)
Mepanipyrim (sum) (68/773)
Metalaxyl (sum) (14/1098)
Methiocarb (sum) (4/902)
Myclobutanil (108/1147)
Penconazole (78/1157)
Pendimethalin (6/1038)
Pirimicarb (sum) (45/835)
Profenofos (4/1103)
Propamocarb (sum) (4/742)
Pyrimethanil (80/1110)
Quinoxyfen (26/1001)
Spinosad (sum) (57/792)
Tebufenpyrad (8/974)
Tetraconazole (8/958)
Thiophanate-methyl (13/907)
Tolylfluanid (sum) (4/1084)
Triadimefon (sum) (25/1071)
Trifloxystrobin (59/1041)

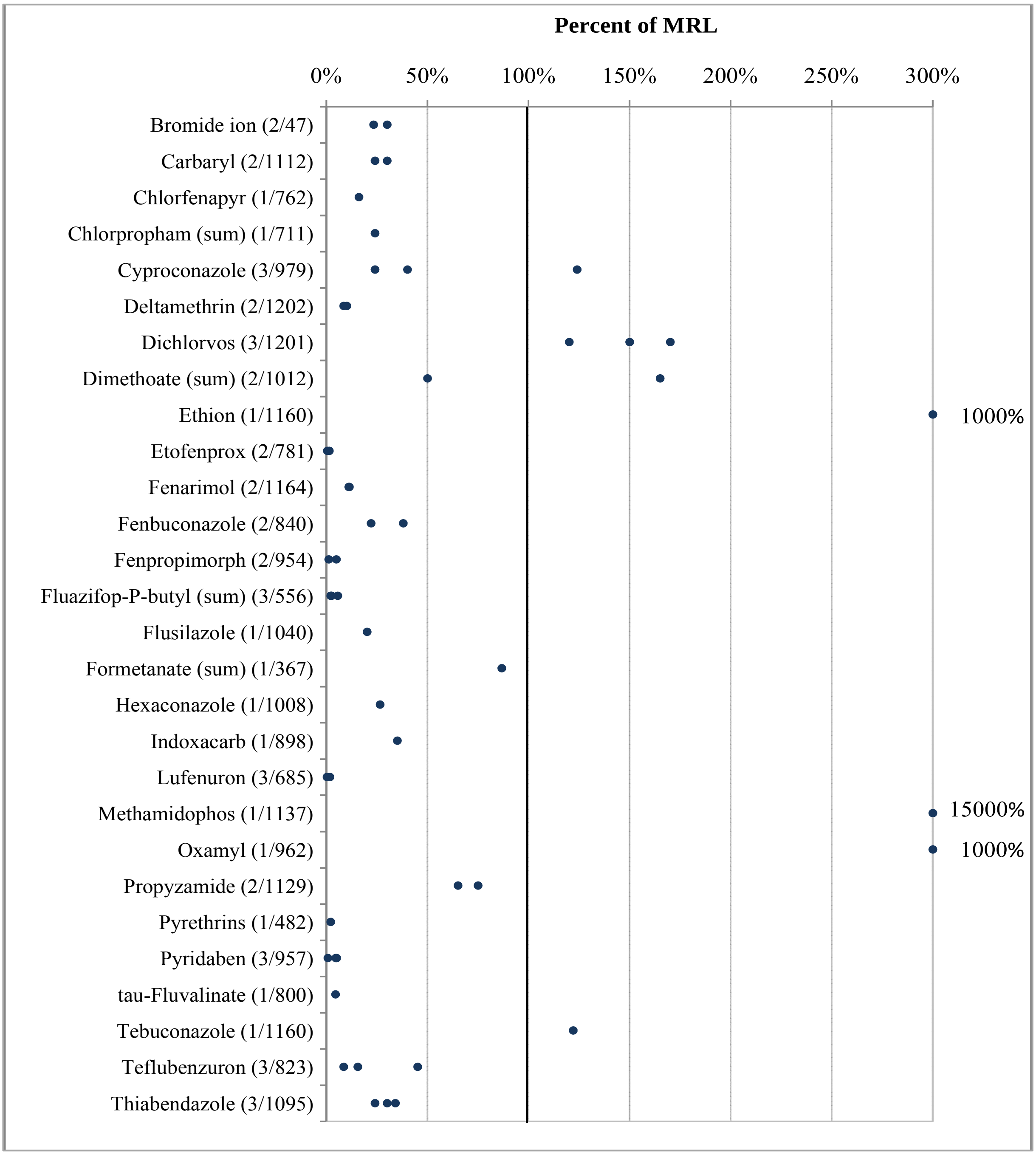


Figure 3-22: EUCP – Strawberries: measured residues (>LOQ) expressed as % of the MRL.

3.3.11. Swine meat

In swine meat, eight different pesticides were found (Figure 3-23) but no samples were reported above the MRL (Figure 3-24). The most frequently found pesticide residues were DDT (sum) (3.3%), lindane (1.4%) and hexachlorobenzene (0.7%).

The occurrence of the above mentioned substances in products of animal origin most likely result from environmental contamination due to past uses of the pesticides rather than of the direct use of these substances in agriculture or livestock husbandry. EFSA noted that not all measured residue levels were reported in accordance to the legal provisions for fat soluble substances and therefore more guidance is needed.

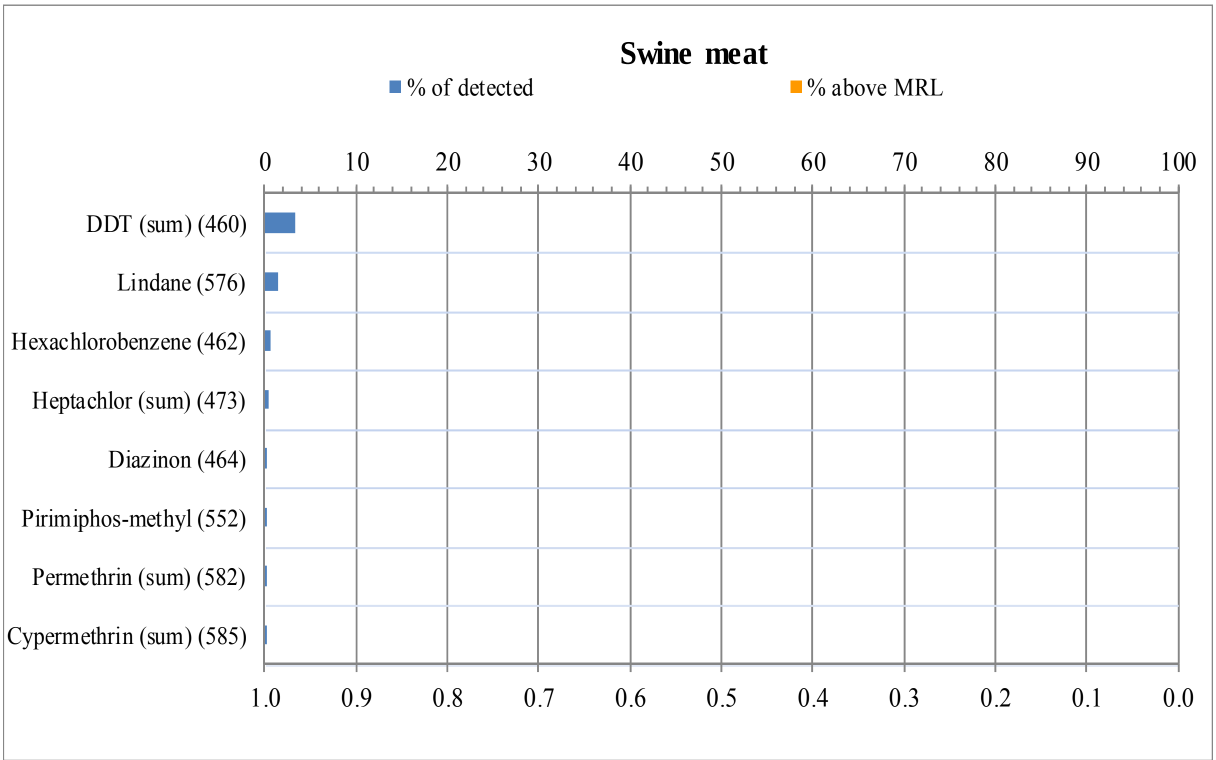


Figure 3-23: EUCP – Percentage of swine meat samples with measurable residues and residues above the MRL and number of swine meat samples tested for the specific pesticide (reported in bracket on the y-axis).

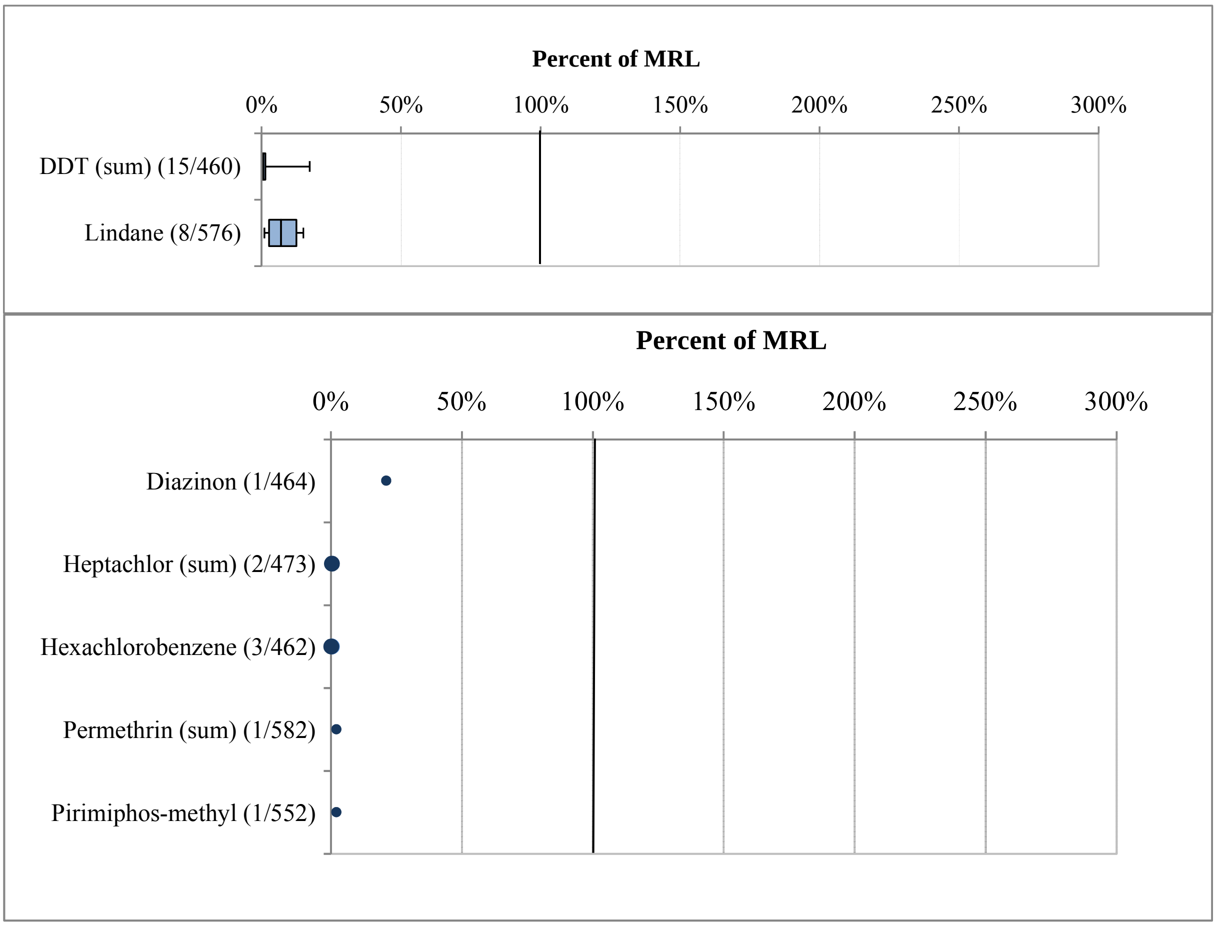


Figure 3-24: EUCP – Swine meat: measured residues (>LOQ) expressed as % of the MRL.

3.3.12. Tomatoes

In tomatoes, 84 different pesticides were found (Figure 3-25). Bromide ion was the substance most often found (31.5% of samples analysed for this pesticide residue), followed by the dithiocarbamates (16.3%) and cyprodinil (9.5%). MRL exceedances were observed for eight different residues (Figure 3-25). The countries of origin for which the tomato MRLs were most frequently exceeded were Spain (6), Turkey (4) and the Netherlands (3).
Information on the pesticides found in tomatoes and their uses is reported in Table 3-11.

The distribution of the measured residue levels (results above the LOQ only), expressed in the percentage of the MRL applicable for the specific pesticide/commodity combination is reported in Figure 3-26.

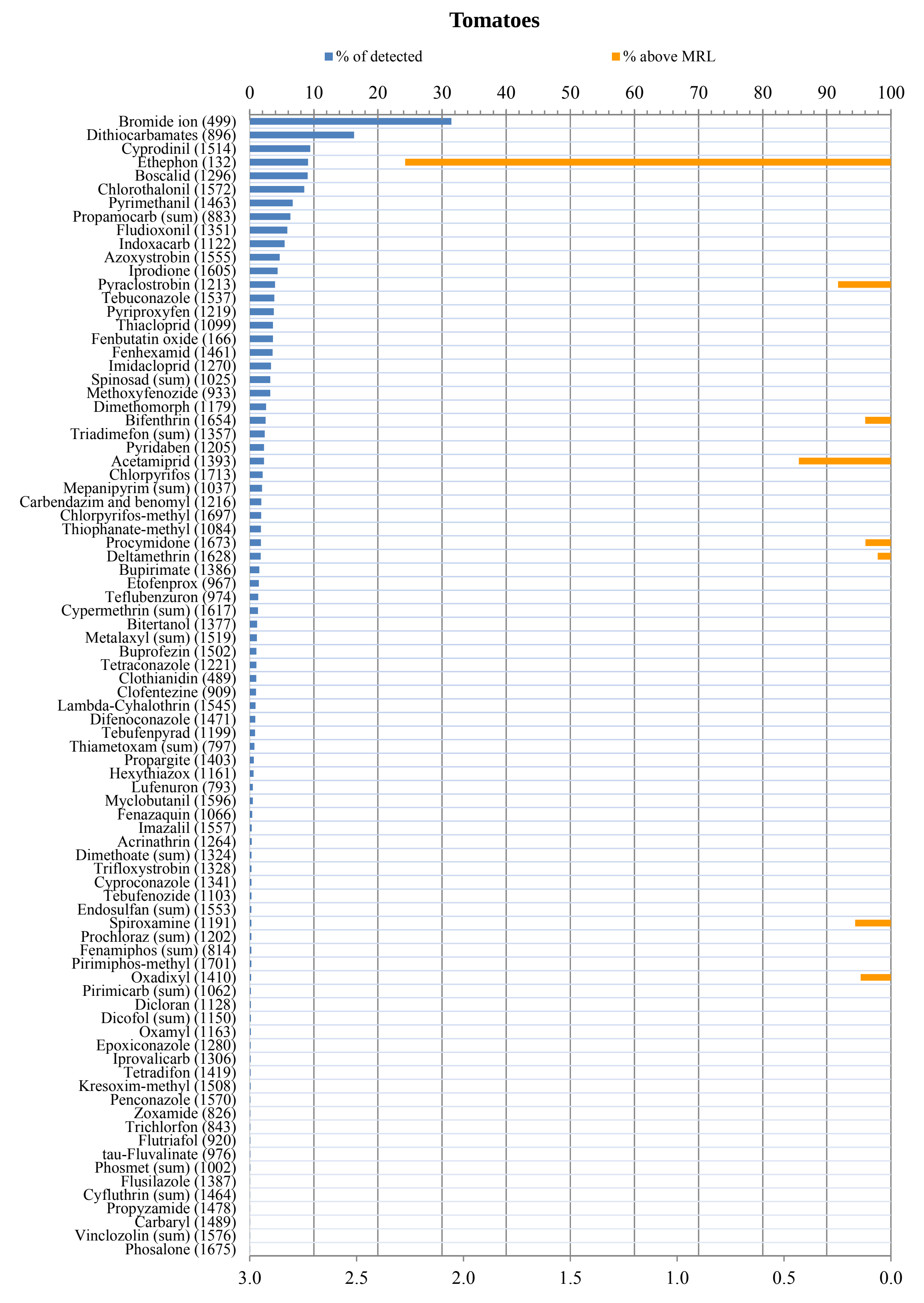
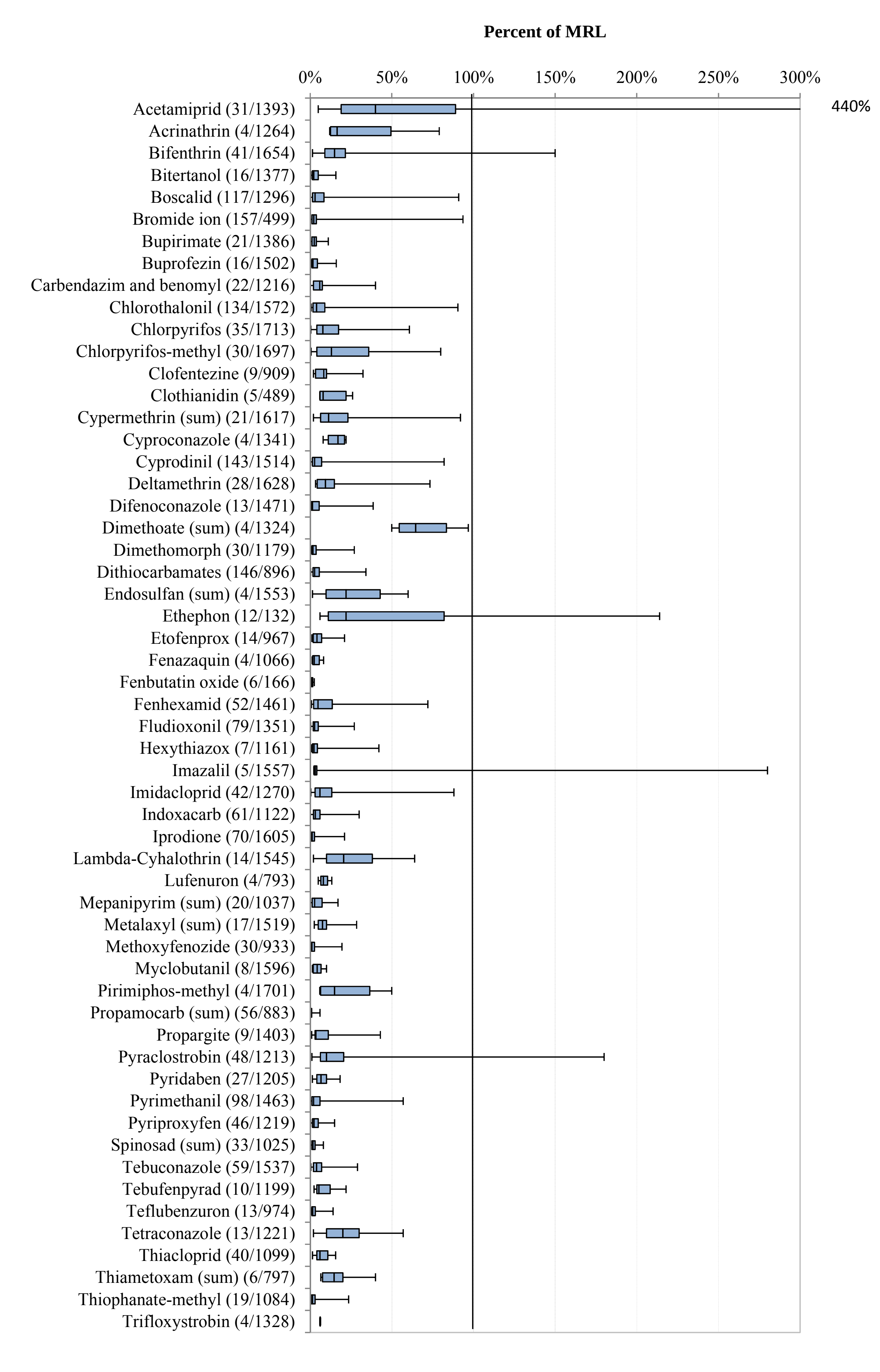


Figure 3-25: EUCP – Percentage of tomato samples with measurable residues (upper x-axes scale) and residues above the MRL (lower x-axis scale); the number of tomato samples tested for the specific pesticide is reported in brackets next to the pesticide name.

Table 3-11: EUCP – Pesticides most frequently detected in tomatoes (only results above 10% are reported).

Product	Compound	% samples above LOQ	Background information on the active substances found
Tomatoes	Bromide ion	31.46	Naturally occurring substance and metabolite of the pesticide methylbromide. As of 2009 methyl bromide is no longer approved at EU level.
	Dithiocarbamates	16.29	Group of non-systemic fungicides used on a wide rang of crops.


Percent of MRL
0%
50%
100%
150%
200%
250%
300%
440%
Acetamiprid (31/1393)
Acrinathrin (4/1264)
Bifenthrin (41/1654)
Bitertanol (16/1377)
Boscalid (117/1296)
Bromide ion (157/499)
Bupirimate (21/1386)
Buprofezin (16/1502)
Carbendazim and benomyl (22/1216)
Chlorothalonil (134/1572)
Chlorpyrifos (35/1713)
Chlorpyrifos-methyl (30/1697)
Clofentezine (9/909)
Clothianidin (5/489)
Cypermethrin (sum) (21/1617)
Cyproconazole (4/1341)
Cyprodinil (143/1514)
Deltamethrin (28/1628)
Difenoconazole (13/1471)
Dimethoate (sum) (4/1324)
Dimethomorph (30/1179)
Dithiocarbamates (146/896)
Endosulfan (sum) (4/1553)
Ethephon (12/132)
Etofenprox (14/967)
Fenazaquin (4/1066)
Fenbutatin oxide (6/166)
Fenhexamid (52/1461)
Fludioxonil (79/1351)
Hexythiazox (7/1161)
Imazalil (5/1557)
Imidacloprid (42/1270)
Indoxacarb (61/1122)
Iprodione (70/1605)
Lambda-Cyhalothrin (14/1545)
Lufenuron (4/793)
Mepanipyrim (sum) (20/1037)
Metalaxyl (sum) (17/1519)
Methoxyfenozide (30/933)
Myclobutanil (8/1596)
Pirimiphos-methyl (4/1701)
Propamocarb (sum) (56/883)
Propargite (9/1403)
Pyraclostrobin (48/1213)
Pyridaben (27/1205)
Pyrimethanil (98/1463)
Pyriproxyfen (46/1219)
Spinosad (sum) (33/1025)
Tebuconazole (59/1537)
Tebufenpyrad (10/1199)
Teflubenzuron (13/974)
Tetraconazole (13/1221)
Thiacloprid (40/1099)
Thiametoxam (sum) (6/797)
Thiophanate-methyl (19/1084)
Trifloxystrobin (4/1328)

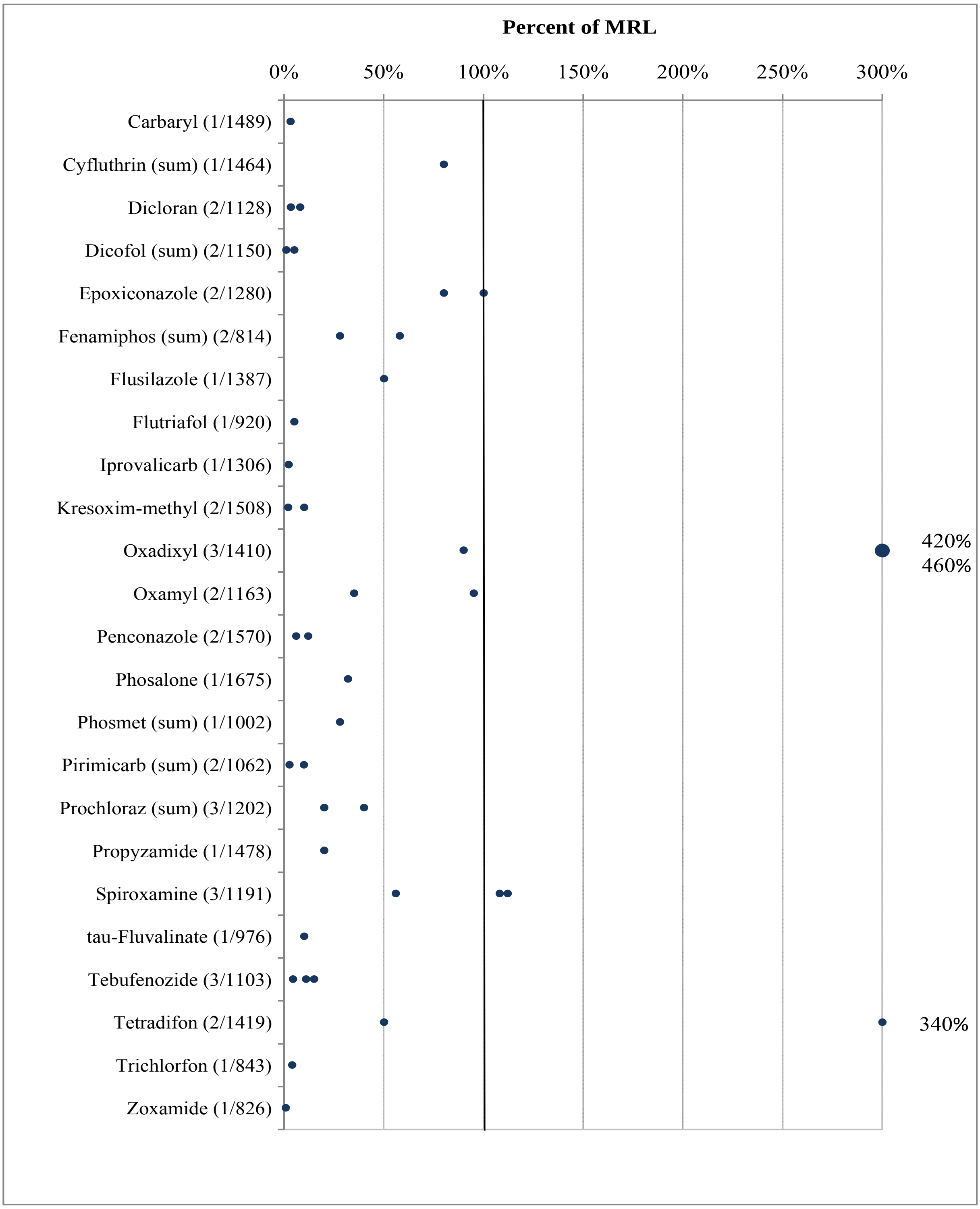


Figure 3-26: EUCP – Tomatoes: measured residues (>LOQ) expressed as % of the MRL.

3.4. Results by pesticides

For the following 33 pesticides[48], no samples with measurable residues were identified in the EU-coordinated control programme: 2,4-D, aldrin and dieldrin, amitrole, azinphos-ethyl, benfuracarb, bromuconazole, cadusafos, camphechlor, carbosulfan, chlordane, chlorobenzilate, clofentezine, dichlofluanid, dinocap, endrin, fipronil, fosthiazate, haloxyfop including haloxyfop-R, HCH alpha,

[48] The pesticides listed were analysed according to the legal residue definition; in cases of complex residue definition (i.e. definitions that contain more than one component), the full definition is not reported in the list.

metconazole, methoxychlor, paclobutrazol, parathion, parathion-methyl, phenthoate, phoxim, prothioconazole-desthio, pyrazophos, quintozene, resmethrin, tecnazene, tefluthrin, triticonazole.

Measurable residues were found for 143 different substances. In Figure 3-27 the pesticides above 0.15% of the detected pesticides are shown (94 substances). All the remaining pesticides were found in less than 0.15% of the samples. Chlormequat was found most frequently (47.7% of total 392 samples). Bromide ion, dithiocarbamates, boscalid, glyphosate, cyprodinil, mepiquat, captan/folpet, fludioxonil, pyraclostrobin, iprodione, DDT, thiacloprid and fenhexamid occurred in 5 – 25% of the samples analysed. Tebuconazole, chlorpyrifos, pyrimethanil, azoxystrobin, spinosad, propamocarb, hexachlorobenzene, carbendazim and benomyl, imidacloprid, pirimicarb, diphenylamine, acetamiprid, lambda-cyhalothrin, methoxyfenozide, ethephon, indoxacarb, thiabendazole, chlorothalonil and trifloxystrobin were found with frequencies between 2 and 5% of the samples.

Residues exceeding the MRL were found for 73 different pesticides or group of pesticides (in Figure 3-27 the pesticides exceeding the MRL are reported only for those pesticides most frequently found). The most frequent MRL exceedances (expressed in % of samples analysed for the respective pesticide) were detected for residues of chlormequat (3.6%)[49]. Amitraz (sum) exceeded the MRL in 1.3% of the samples[50]. The third most frequently found pesticide exceeding the MRL was ethephon (0.5%).

Results for all pesticides analysed in the 2010 EU-coordinated control programme are tabulated in Appendix III, Table E.

[49] According to the 2010 EU-coordinated plan, the analysis of chlormequat was only requested for cereal samples.
[50] According to the 2010 EU-coordinated plan, the analysis of amitraz was only requested for pear samples.

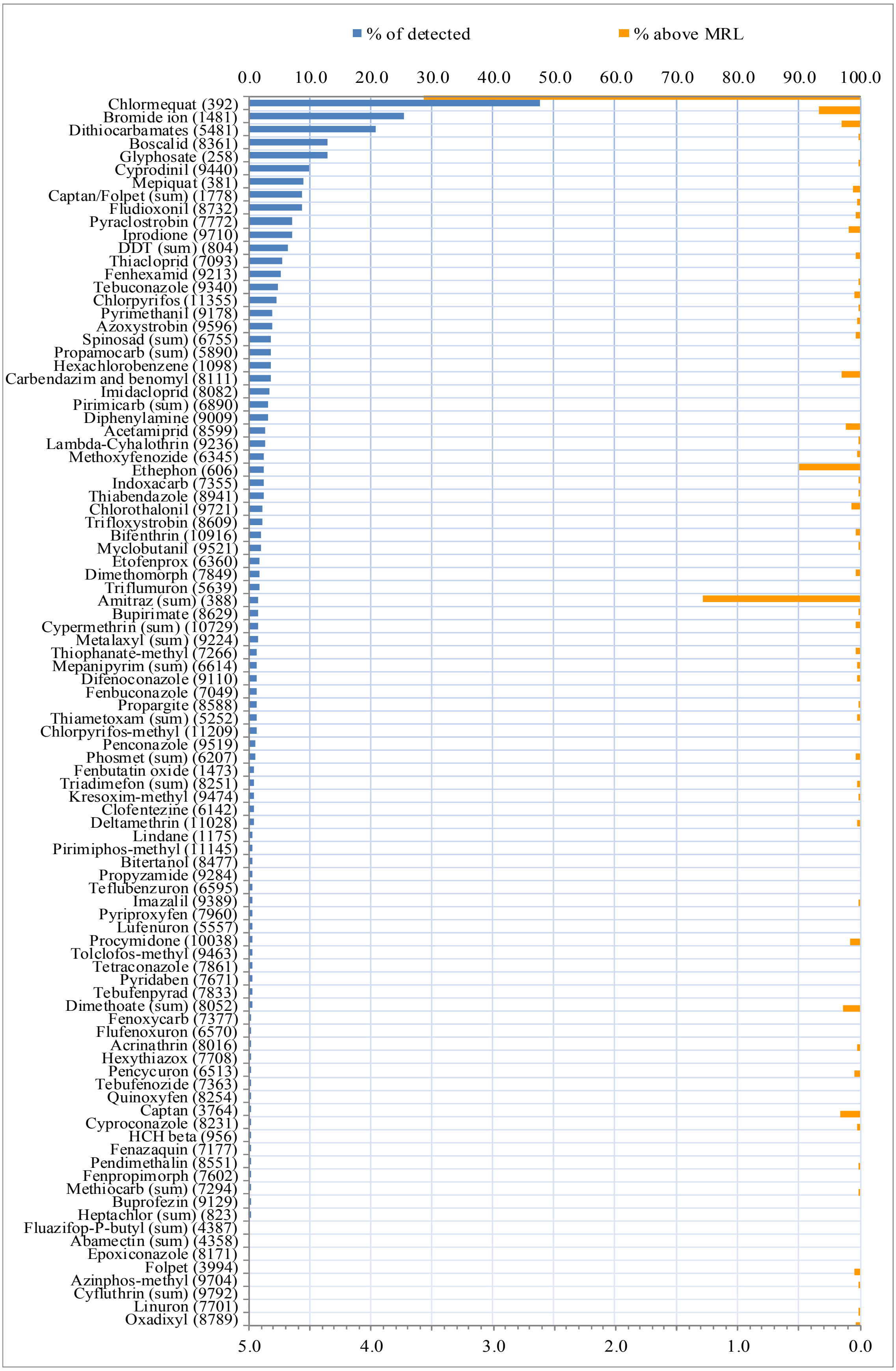


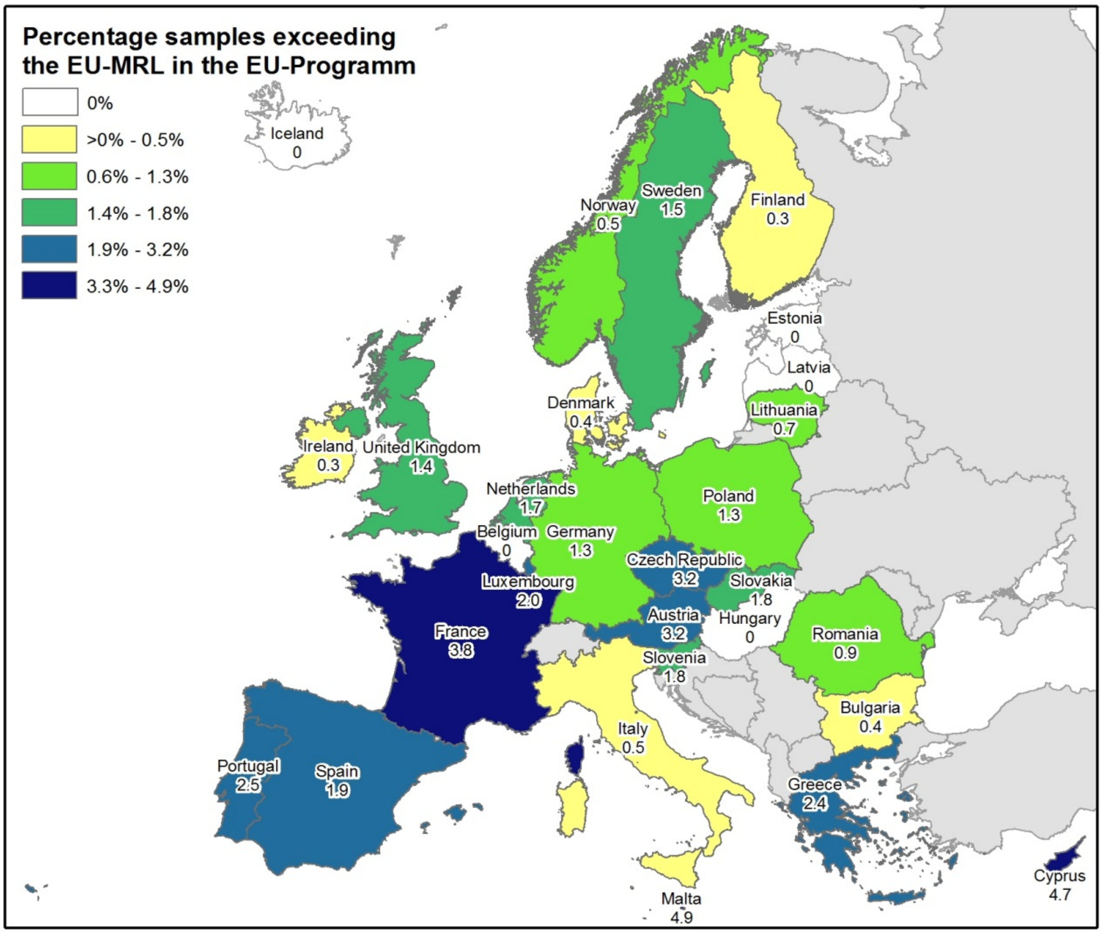
Figure 3-27: EUCP – Percentage of samples with measurable residues (upper x-axes scale, only pesticides with measurable residues in at least 0.15% of the samples) and residues above the MRL (lower x-axis scale); the number of samples tested for the specific pesticide is reported in brackets next to the pesticide name.

3.5. Results by country

The MRL exceedance rate, as reported by each country, is depicted in Map 3-1. The rates vary among the reporting countries, ranging from 0% to 4.9% of the samples analysed.

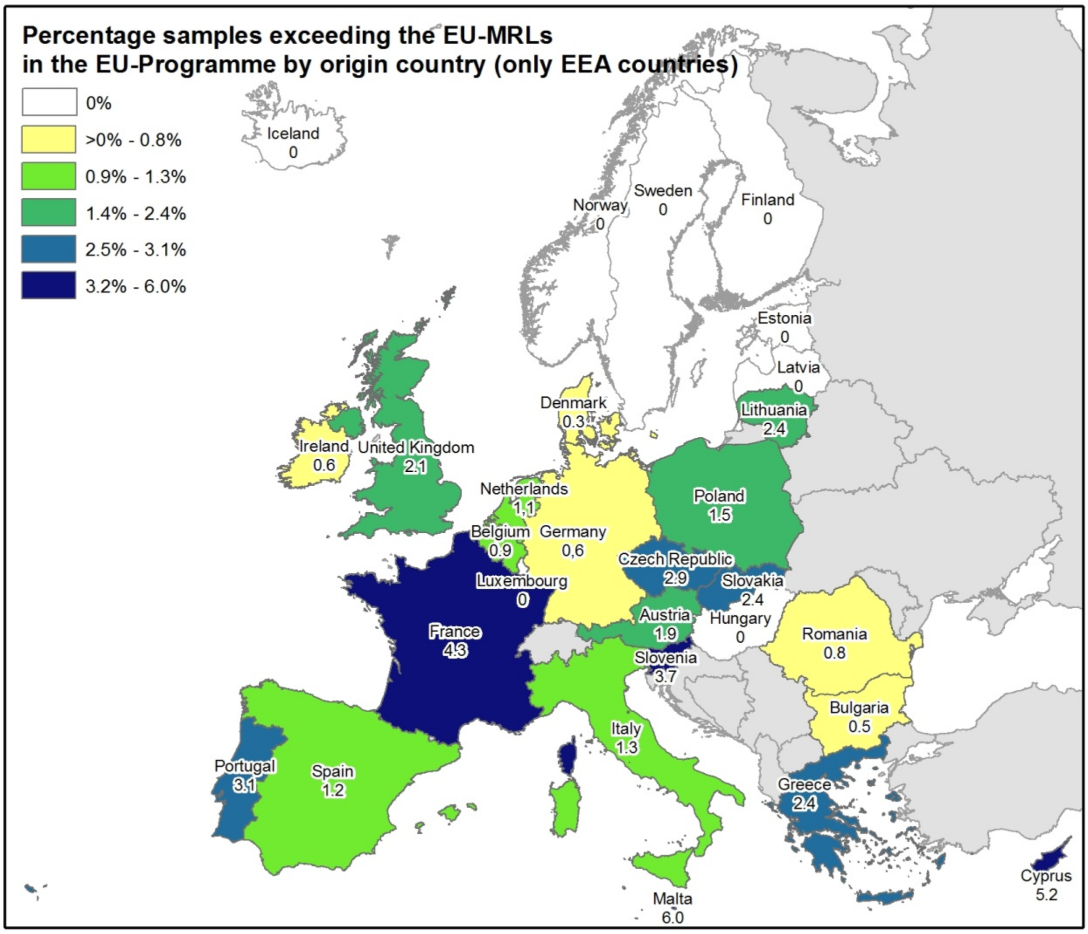
The observed differences may partly be explained by the ratio of three different groups (imported/EU/domestic food) available at country level and by the pesticide use patterns in the producing countries. Furthermore, the percentage of organic samples taken at country level may also have biased the result.

More details on findings in the 2010 EU-coordinated programme by reporting country are reported in Tables D and F of Appendix III.

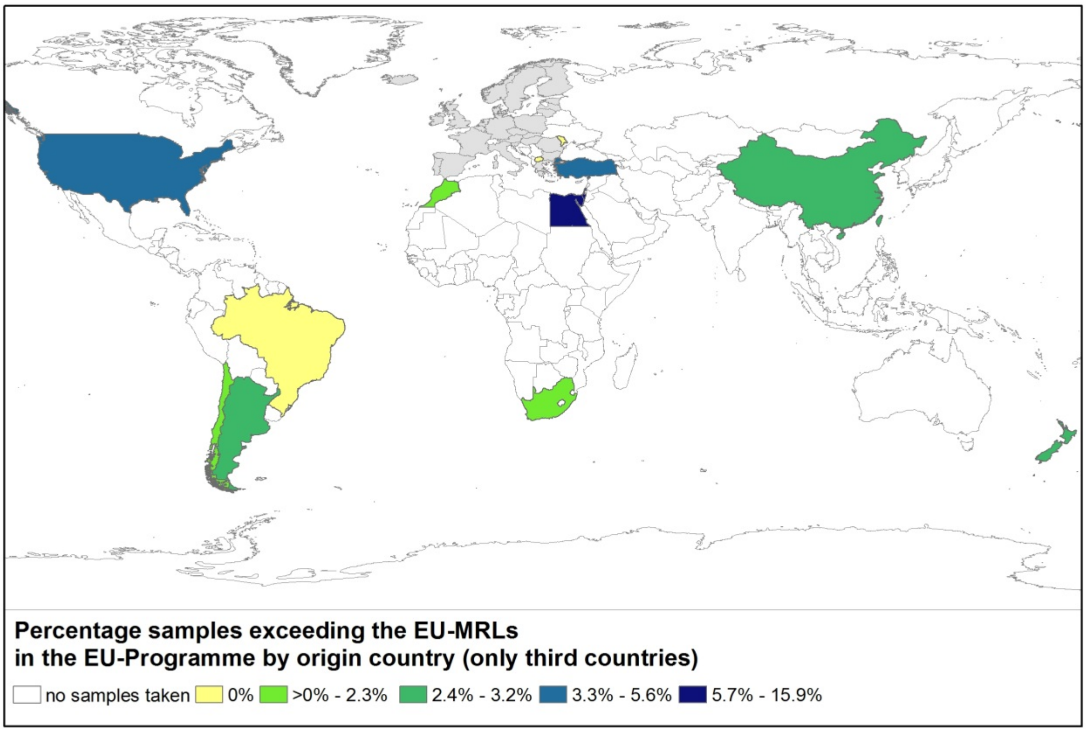


Map 3-1: EUCP – Rate of MRL-exceeding samples by reporting country.

In Map 3-2 and Map 3-3 the percentage of the MRL exceedances according to the country of origin is reported for the EEA countries and the third countries, respectively.



Map 3-2: EUCP – Rate of MRL-exceeding samples by country of origin (EEA countries only).



Map 3-3: EUCP – Rate of MRL-exceeding samples by country of origin (third countries only).

3.6. Organic food

The EU-coordinated programme requested Member States to sample and analyse organic food. However, since the total number of organic samples taken in the framework of the European programme among all reporting countries (540 samples among all the 12 commodities tested) was not sufficient to perform reliable statistical analysis, EFSA decided to present the results on the organic food in section 4 of the report. There, the results concerning the national and EU-coordinated programme are combined and summarised.

SUMMARY CHAPTER 3

The analysis of the results of the 2010 EU-coordinated programme shows that 197 (1.6%) of the 12,168 samples exceeded the MRL, while 5,802 (47.7%) of the samples had measurable residues above the reporting level but below or at the MRL. 6,169 of the samples (50.7%) were free from measurable pesticide residues.

In 2007 and 2010, the same food commodities of plant origin (except pears) were analysed under the EU-coordinated programme. The percentage of samples exceeding the MRLs was rather stable over the last four years (2007 to 2010) with only small variations; the % of samples exceeding the legal limits in this reference period has ranged from 1.2% to 2.3%.

The MRL exceedance rates ranged among the reporting countries from 0.0% to 4.9% of the samples analysed. The highest percentage of samples exceeding the MRL was identified for oats (5.3%), followed by lettuce (3.4%), strawberries (2.8%), peaches (1.8%), apples (1.3%), pears (1.3%), tomatoes (1.2%), leek (1.0%), head cabbage (0.9%) and rye (0.2%). Peaches had the highest percentage of samples with measurable pesticide residues above the LOQ (73%), followed by 68% of the apple samples and 68% of the strawberries. Comparing the results of the 2007 and 2010 EU-coordinated control programmes, it was noted that the only commodity for which the percentage of samples without detectable residues increased was strawberries (from 31.1% in 2007 to 32.1% in 2010); the highest decrease in the percentage of detectable residues was observed for oats (79.7% in 2007 to 45.5% in 2010). The percentage of samples exceeding the MRLs has increased from 2007 to 2010 for the following crops: leek, lettuce, oats, and tomatoes.

Apples: 2,057 apple samples were analysed and residues of 94 different pesticides were measured in quantifiable amounts. The most frequently found active substances were dithiocarbamates, captan/folpet (sum), diphenylamine, boscalid, chlorpyrifos, pyraclostrobin, thiacloprid, pirimicarb (sum), thiabendazole and carbendazim and benomyl.

Head cabbage: 49 different pesticides were found in the 999 head cabbage samples tested. The dithiocarbamates were detected at the highest frequency rate (on 50.3% of samples); however, it is likely that this result was biased by the presence of naturally occurring substances in brassica vegetables that mimic the occurrence of the dithiocarbamates. The other pesticides were found in 2.2% or less of head cabbage samples. Eight pesticides were found in concentrations exceeding the MRL (dimethoate (sum), dimethomorph, methoxyfenozide, oxamyl, cyproconazole, difenoconazole, ethion and procymidone).

Leek: 45 different pesticides were found in the 961 leek samples surveyed. The most frequently found pesticides were the dithiocarbamates, boscalid, tebuconazole and bromide ion. MRL exceedances were observed for nine active substances: bromopropylate, iprodione, indoxacarb, linuron, acrinathrin, triadimefon (sum), thiabendazole, cypermethrin and cyprodinil.

Lettuce: 68 different pesticides were found in the 1,568 lettuce samples analysed. The most frequently found pesticides were bromide ion, the dithiocarbamates, iprodione, cyprodinil, boscalid, propamocarb, fludioxonil and imidacloprid. MRL exceedances were observed for 25 active substances. The highest exceedance rate was observed for bromide ion, dithiocarbamates, chlorothalonil, iprodione, chlorpyrifos and dimethoate.

Milk: four different pesticides were found in the 654 milk samples taken. These active substances were DDT, hexachlorobenzene, HCH beta and chlorpyrifos. MRL exceedances were not observed.

Oats: 20 different pesticides were found in the 246 oat samples analysed. The most frequently found pesticides were chlormequat, glyphosate and pirimiphos-methyl. Chlormequat was the only pesticide found exceeding the MRL, which it did in 8.1% of all oats samples.

Peaches: 79 different pesticides were found in the 1,200 peaches samples. The most frequently found pesticides were tebuconazole, dithiocarbamates, iprodione, spinosad (sum), chlorpyrifos, triflumuron, etofenprox, cyprodinil and fenbuconazole. 17 pesticides were found in concentrations exceeding the MRL; the most frequent MRL exceedances concerned captan, phosmet, dimethoate (sum) and carbendazim and benomyl.

Pears: In pears, only amitraz (sum) was analysed in 388 samples. Amitraz (sum) was found in six samples, five of these had residues above the MRL.

Rye: 18 different pesticides were found in the 406 rye samples tested. The most frequently found pesticide residues were chlormequat, bromide ion and mepiquat. In one sample chlormequat exceeded the MRL.

Strawberries: 82 different pesticides were found in the 1,272 samples surveyed. The most frequently found pesticides were cyprodinil, fludioxonil, boscalid, fenhexamid, pyraclostrobin, azoxystrobin and thiacloprid. 21 pesticides were found in concentrations exceeding the MRL; the most frequent MRL exceedances concerned spinosad, acetamiprid, methomyl and thiodicarb, carbendazim and benomyl, procymidone and dichlorvos.

Swine meat: Eight different pesticides were found in the 623 samples of swine meat controlled. The active substances were DDT, lindane, hexachlorobenzene, heptachlor, diazinon, pirimiphos-methyl, permethrin and cypermethrin. MRL exceedances were not observed. Some of the residues detected in swine meat may have been caused by environmental contamination due to past uses of these substances (most of those are banned in Europe) rather than direct use of these substances in agriculture or livestock husbandry.

Tomatoes: 84 different pesticides were found in the 1,794 samples analysed. The most frequently found pesticides were bromide ion and dithiocarbamates. Eight pesticides were found in concentrations exceeding the MRL: ethephon, acetamiprid, pyraclostrobin, spiroxamine, oxadixyl, bifenthrin, procymidone and deltamethrin.

Overall, the pesticide/crop combinations for which residue concentrations above the reporting level were found most frequently were chlormequat/oats (64.6% of the samples), dithiocarbamates/head cabbage (50.3%) and dithiocarbamates/leek (40.8%).

The highest percentage of MRL exceedances was found for chlormequat in oats, where the MRL was exceeded in 8.1% of all samples.

Of the 178 substances included in the 2010 EU-coordinated programme, residues exceeding the MRL were found for 73 different pesticides. The most frequent MRL exceedances were detected for residues of chlormequat (3.6% of the samples) and amitraz, which exceeded the MRL in 1.3% of the samples. Measurable residues were found for 144 different substances.

Recommendations

EFSA recommends providing the reporting countries with more guidance on the submission of the control results concerning food of animal origin and on the checking of sample compliance against the MRL in line with the legal provisions set out for the samples of animal origin.

4. Results of the national control programmes, including results of the EU-coordinated programme

The findings reported in this section refer to results from both the national and the EU-coordinated control activities. Since samples taken in the framework of the EU-coordinated programme were in many cases analysed for a wider range of active substances than defined in the coordinated programme, they were also counted as samples falling under the national control programmes. A strict separation of the two programmes is therefore not possible.

4.1. Overall results

In total, 77,075 samples were analysed in 2010. The reporting countries submitted results for more than 14 million[51] individual analytical determinations.

97.2% of the surveillance samples analysed (70,771 samples) were below or at the legal MRLs. In 2.8% of the samples the legal limits were exceeded for one or more pesticides (2,042 samples).

In total, residues of 412 different pesticides were found in measurable quantities for surveillance samples. As in previous years, the number of different pesticide residues found in fruit and nuts and vegetables in 2010 (301 and 328 different pesticides, respectively) was higher than the number of pesticides found in cereals (88 pesticides), which also reflects the larger number of plant protection products used in the fruit and vegetables category and the diversity of crops included in this category.

4.2. MRL exceedance rate over time

Considering all samples submitted in the framework of the national and the EU-coordinated monitoring programmes, the percentage of samples exceeding the legal limits was slightly higher in 2010 (2.8%) compared with the results of 2009 (2.6%). From 1996 to 2010, the exceedance rate ranged from 2.6% (2009) to 5.5% (2002).

The overall MRL exceedance rate is a statistical descriptor summarising the findings of the reference year. However, it is important to note that this figure is influenced by a number of factors such as the pesticide use patterns, the design of the monitoring programmes and the legal framework. Since these factors have changed significantly during the last years, the results of 2010 can not directly be compared with the results of previous years to perform trend analysis regarding the actual "quality" of food with respect to pesticide occurrence, or to compare the food available on the EU market with other markets.

4.3. Origin of samples exceeding the EU MRLs (surveillance only)

In 2010, the harmonised EU MRLs were more often exceeded for surveillance samples from third countries (7.9%) than for samples from the EU (1.5%) (Table 4-1).

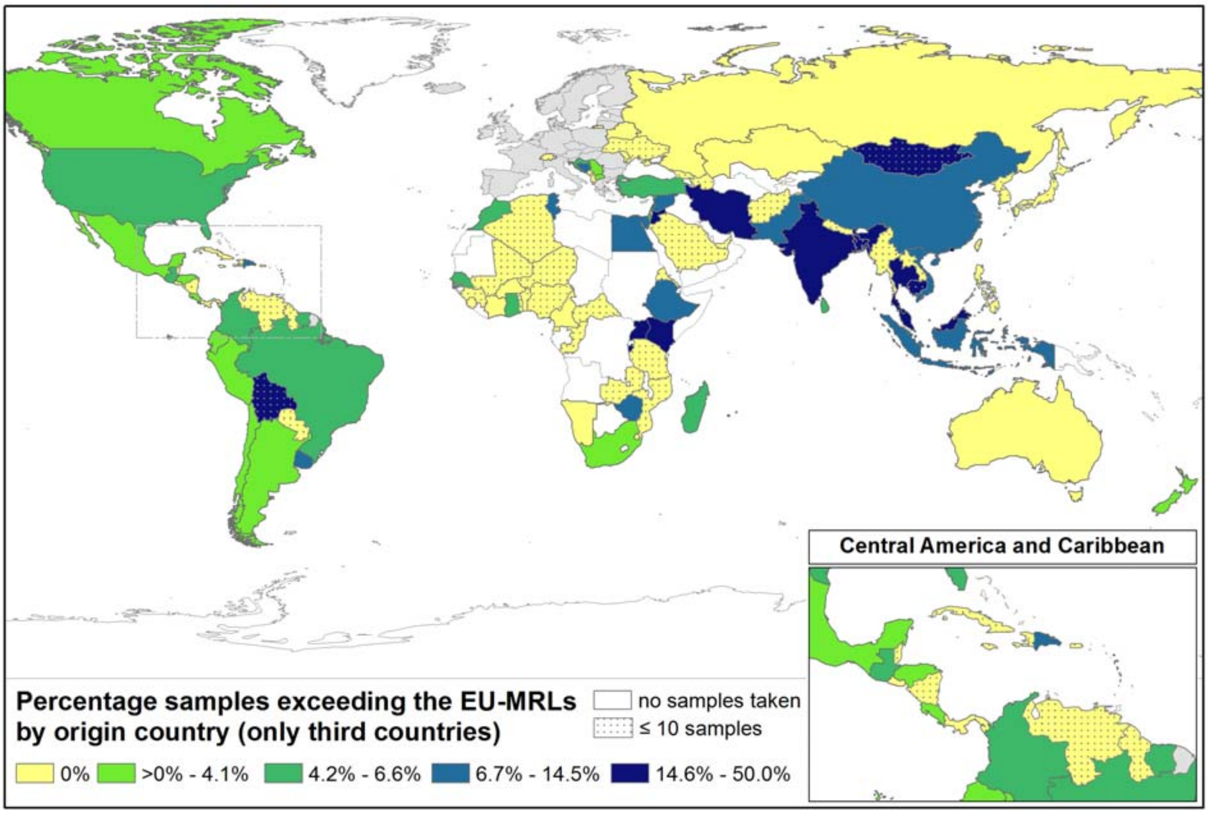
Table 4-1: EU+NCP – Exceedances of MRLs according to the sample origin (EU, imported, unknown) for surveillance samples - 2010.

Sample origin	Number of samples	Above MRL	%	LCL(a)	LCL(b)
EEA	55210	809	1.5	1.4	1.6
Third country	14818	1173	7.9	7.5	8.4
Unknown	2785	60	2.2	1.7	2.8
	72813	**2042**			

(a): Lower confidence limit[52]
(b): Upper confidence limit

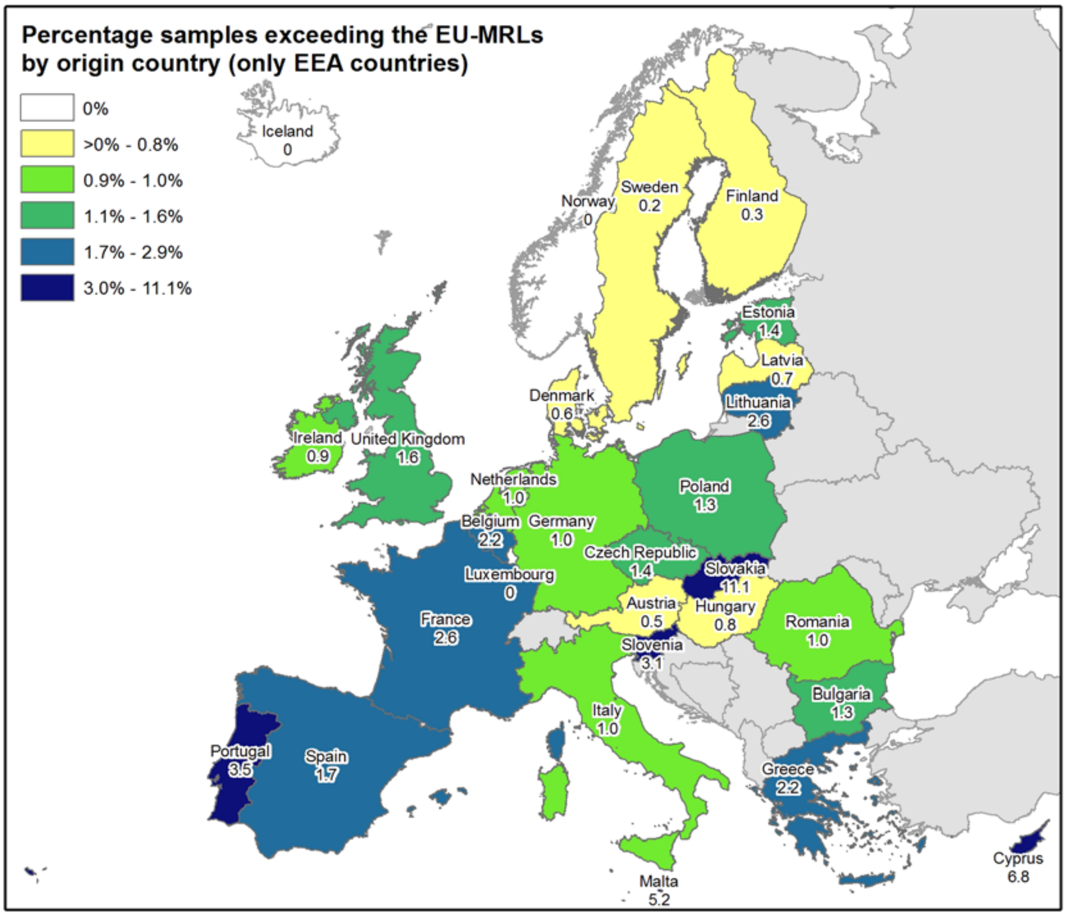
[51] This is the number of determinations in line with the legal residue definition.
[52] See "Confidence interval" in the Glossary.

The results concerning the MRL exceedances in products produced in third countries and in EEA countries are presented separately in Map 4-1 and Map 4-2. Considering the number of samples taken, the results reported for some countries are subject to high statistical uncertainty. The highest MRL exceedance rates (expressed in percentage of samples analysed) were identified for food originating from Cambodia (50.0% of the samples), Mongolia (50.0%), Hong Kong (47.8%), Bangladesh (44.4%), Bolivia (33.3%), India (28.3%), Uganda (23.6%), Burundi (22.2%), Jordan (21.7%), Iran (21.4%), Thailand (20.9%) and Mauritius (20.0%)[53]. The countries for which a low number of samples were taken (less than or equal to 10) - and therefore their results are affected by high uncertainties - are represented with dots in Map 4-1.



Map 4-1: EU+NCP – Percentage of surveillance samples exceeding the MRL by origin country (third countries only) - 2010.

[53] Taking into account that the total number of samples from these countries differ widely (e.g. less than or equal to 10 samples were reported for Cambodia, Mongolia, Bangladesh, Bolivia, Burundi, and Mauritius), the results are affected by statistical uncertainty.



Map 4-2: EU+NCP – Percentage of surveillance samples exceeding the MRLs by origin country (countries from the EEA area only) - 2010.

For the EEA area, MRL exceedance rates above 3% were identified for products originating from Slovakia, Cyprus, Malta, Portugal and Slovenia.

Table 4-2 focuses on country/commodity combinations for which at least 10 samples were analysed and more than 15% of the samples exceeded the MRL.

Table 4-2: EU+NCP – Imported food products most frequently exceeding the MRL (sorted alphabetically by country of origin) - 2010.

Origin country(*)	Food item(*)	No. of samples	% of samples above MRL
Brazil	Yams	17	35.29
	Papaya	56	19.64
Canada	Cherries	10	20
China	Chinese cabbage	12	83.33
	Broccoli	13	76.92
	Tomatoes	22	40.91
Colombia	Passion fruit	22	18.18
Dominican Republic	Peppers	68	27.94
	Beans (with pods)	151	25.83
	Aubergines	59	15.25
Ecuador	Papaya	23	17.39
Egypt	Oranges	117	25.64

Origin country(*)	Food item(*)	No. of samples	% of samples above MRL
	Peppers	19	21.05
	Strawberries	94	19.15
Ethiopia	Strawberries	12	16.67
India	Peppers	17	58.82
	Okra	42	54.76
	Table grapes	198	52.53
	Pomegranate	14	28.57
Israel	Pomegranate	17	23.53
	Strawberries	19	15.79
Jordan	Okra	23	30.43
	Peppers	37	18.92
Kenya	Peas (with pods)	68	38.24
Morocco	Beans (with pods)	103	15.53
Peru	Mandarins	29	17.24
Thailand	Celery leaves	32	56.25
	Lychee	21	52.38
	Beans, dry	10	50
	Peppers	108	46.3
	Chinese cabbage	13	46.15
	Broccoli	24	41.67
	Flowering brassica	13	38.46
	Basil	60	26.67
	Guava	18	22.22
	Okra	18	16.67
	Beans (with pods)	182	15.38
Turkey	Vine leaves	14	64.29
	Pomegranate	31	38.71
Uganda	Peppers	25	48
United States	Walnuts	30	20
Uruguay	Oranges	20	20
Vietnam	Guava	17	29

(*) Only countries where at least 10 samples were taken and 15% or more of the samples exceeded the MRL.

In Table 4-3 additional information on the pesticides found in food items for which a high MRL exceedance rate was identified are reported. The table lists only those combinations of food items, country of origin and compounds for which at least 10 samples were analysed and the MRL exceedances rate accounted for more than 25%. The highest proportion of MRL exceedances was found for acetamiprid in Chinese cabbage from China (83% of the total number of Chinese cabbage samples from China analysed for this pesticide exceeded the MRL). Broccoli with acetamiprid and dimethomorph originating from China had exceedance rates of 77% and 69%, respectively. Also for table grapes from India, a high exceedance rate of 65% was found for chlormequat residues.

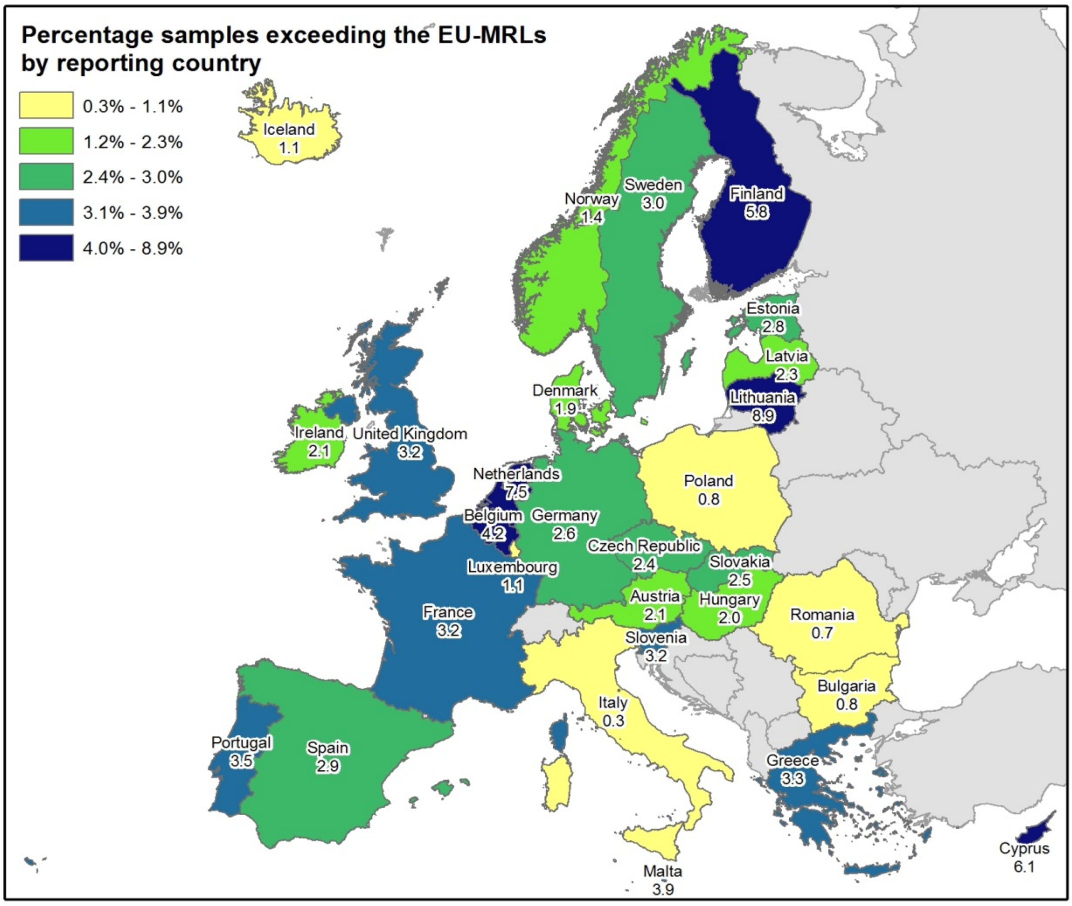
Table 4-3: EU+NCP – Combinations of country of origin/food item/ pesticide (sorted alphabetically by country) with the highest percentages of MRL exceedances (surveillance samples only) - 2010.

Country of origin	Product	Compound	No. of samples analysed(*)	% of samples analysed with residues above the MRL(*)
Argentina	Garlic	2,4,6-Tribromophenol	12	25%
Brazil	Yams	Carbendazim and benomyl	17	35%
China	Broccoli	Acetamiprid	13	77%
		Dimethomorph	13	69%
	Chinese cabbage	Acetamiprid	12	83%
		Dimethomorph	12	58%
		Pyridaben	12	25%
	Tomatoes	Acetamiprid	19	47%
Cyprus	Celery leaves	Chlorpyrifos	13	31%
India	Peppers	Profenofos	12	42%
		Ethion	16	38%
		Acephate	12	25%
	Table grapes	Chlormequat	144	65%
Jordan	Okra	Acetamiprid	23	26%
Kenya	Peas (with pods)	Dimethoate (sum)	68	35%
Import (unknown country)	Rice	Isoprothiolane	40	33%
Slovakia	Infant formulae	Captan	57	46%
Slovenia	Pears	Chlormequat	12	25%
Thailand	Lychee	Carbendazim and benomyl	21	38%
Turkey	Pomegranate	Acetamiprid	31	35%
	Vine leaves	Boscalid	13	46%
		Azoxystrobin	13	46%
		Kresoxim-methyl	12	25%

(*) The full list of results per country of origin for both enforcement and surveillance sampling is given in Appendix III, Table K.

4.4. Results by reporting country

The MRL exceedance rate, calculated for the food sampled in the EEA countries (surveillance samples only), is represented in Map 4-3. Similar to the results found in the EU-coordinated programme (see section 3.5), the results vary significantly among the countries, ranging from an 8.9% MRL exceedance rate in Lithuania to 0.3% in Italy. MRL exceedance rates above the average (2.8%) were observed in Lithuania (8.9%), the Netherlands (7.5%), Cyprus (6.1%), Finland (5.8%), Belgium (4.2%), Malta (3.9%), Portugal (3.5%), Greece (3.3%), France (3.2%), United Kingdom (3.2%), Slovenia (3.2%) and Sweden (3.0%).



Map 4-3: EU+NCP – Percentage of surveillance samples exceeding the EU MRLs by sampling country - 2010.

4.5. Results by food commodity group

In Figure 4-1 the MRL exceedance rates are reported for food commodity groups. The highest MRL exceedance rates were detected for legume vegetables (e.g. beans with pods), spices and nuts. High MRL exceedance rates were also observed in table and wine grapes and leafy vegetables (e.g. lettuce) and fresh herbs.

Figure 4-2 shows the MRL exceedance rates (surveillance samples) by larger food groups (processed and unprocessed commodities) with their confidence levels; above the bars for each group the number of samples taken is indicated.

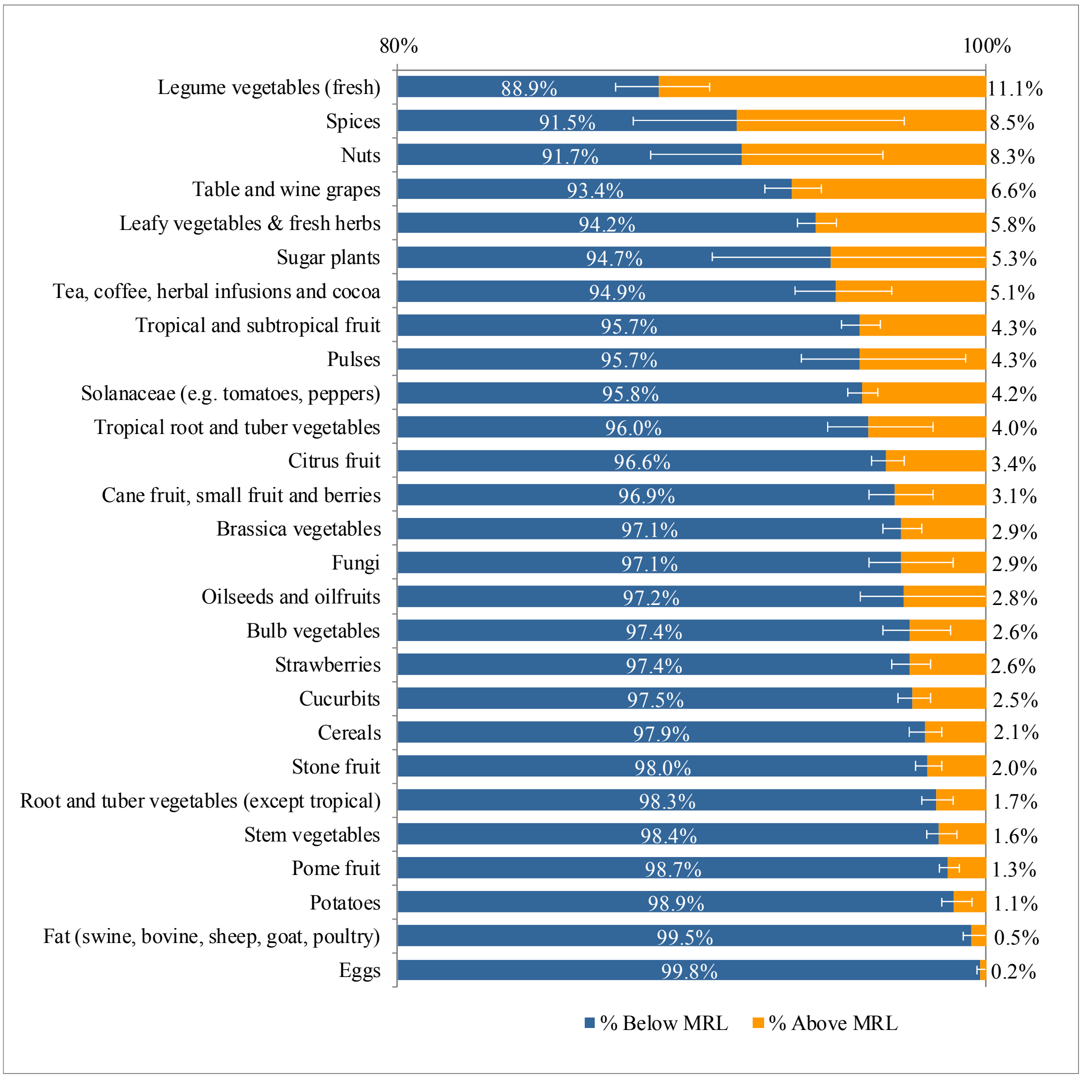


Figure 4-1: EU+NCP – Percentage of compliance with EU MRL for unprocessed commodities (surveillance samples) - 2010[54].

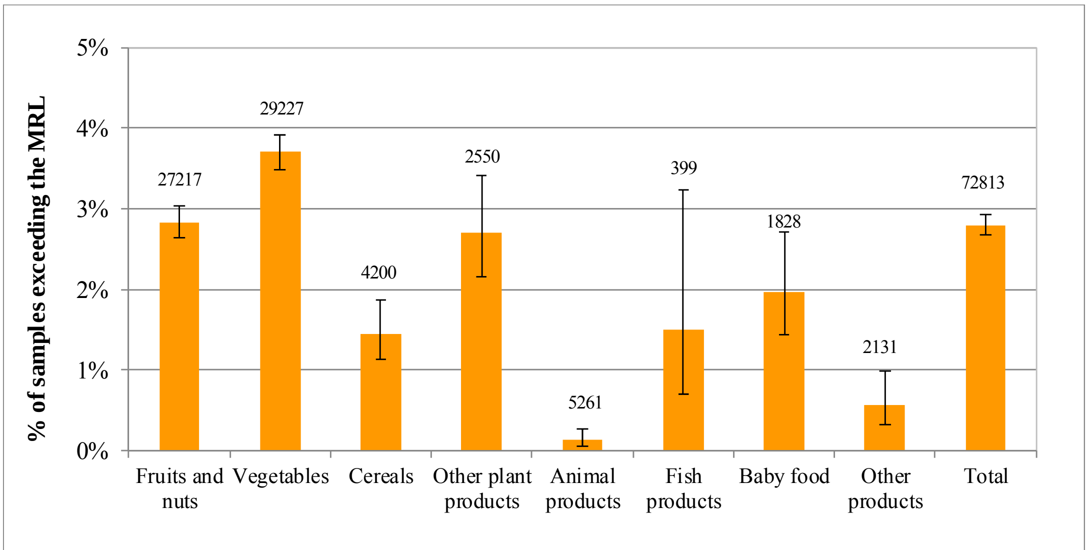


Figure 4-2: EU+NCP – MRL exceedance rates of surveillance samples according to the different food group tested (processed and unprocessed commodities); above each bar the number of samples taken is reported.

[54] Due to the rounding of the single percentages, the summed percent may slightly differ from 100%.

4.6. Results by pesticide/crop combination

The pesticide/crop combinations with the highest MRL exceedance rates are shown in Figure 4-3. The figure includes only those pesticide/crop combinations for which at least 20 samples were analysed and for which more than 15% of the samples were found exceeding the MRL.

The figure shows that there are specific pesticide/crop combinations, such as acetamiprid in Chinese cabbage (most of them from Hong Kong, China and Thailand), acetamiprid in broccoli (most of them from China and Hong Kong), dimethomorph in Chinese cabbage (most of them from Hong Kong, China and Thailand) with high frequencies of MRL exceedances. If not already analysed, these pesticide/crop combinations could be considered in future control programmes at national level.

The full list of pesticides found in surveillance samples of animal products, cereals, fruit and vegetables can be found in Appendix III, Table A. Results of surveillance sampling per reporting country are listed in Appendix III, Table B (cereals, fruit and nuts, vegetables, other plant products, animal products, and baby food). Results of enforcement sampling per reporting country are tabulated in Appendix III, Table G.

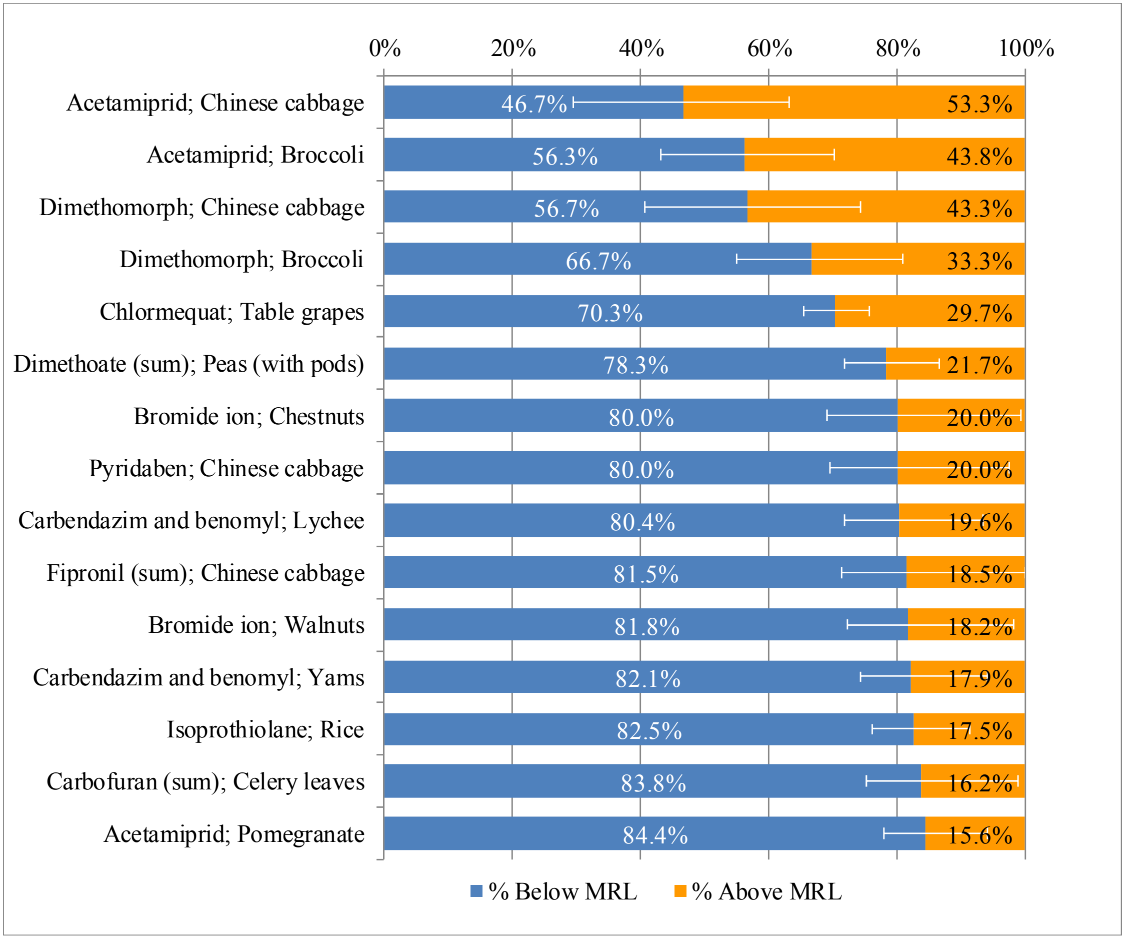


Figure 4-3: EU+NCP – Pesticide/crop combinations with MRL exceedance rates >15% and at least 20 samples (surveillance samples), including confidence intervals for percentages- 2010[54].

4.6.1. Baby Food/Infant Formulae

A general default EU MRL for baby food/infant formulae of 0.01 mg/kg is applicable to all pesticides unless specific MRLs lower than 0.01 mg/kg were established in EU legislation[55] for this food type. In 2010, 28 countries reported data on analyses of baby food. Overall, 1,828 surveillance samples were analysed. Residues above the LOQ were found in 154 samples (8.4% of the samples). In total, 66 different pesticides were measured at quantifiable levels. In 41 samples multiple residues (two or more residues) were measured above the LOQ in the same sample; in one sample six different pesticides (chlordane, cyfluthrin, cypermethrin, deltamethrin, lambda-cyhalothrin and pirimiphos-methyl) were present in measurable quantities. Five out of the six substances measured in the concerned sample are approved for use in Europe; one residue (pirimphos-methyl, 0.10 mg/kg) exceeded the default MRL of 0.01 mg/kg.

The MRL applicable for baby food was exceeded in 36 samples (2.0%) of the baby food surveillance samples. 26 of the MRL exceedances were related to captan residues; other MRL exceedances in baby food were due to residues of anthraquinone, cypermethrin (sum), chlorpyrifos, imazalil and pirimiphos-methyl. The baby food found violating the EU MRLs originated from Germany, Hungary, Portugal, Slovakia and Spain.

The results of the surveillance samples for baby food for each reporting country are listed in Appendix III, Table B. The analysis of the results revealed that in many cases reporting countries did not apply analytical methods which were sensitive enough to analyse residues below or at the MRL. In particular, all the samples analysed for the following six substances were analysed with analytical methods not sufficiently sensitive (LOQ higher than the MRL): meptyldinocap (nine samples analysed), bromide ion (six samples), glufosinate-ammonium (72 samples), prohexadione (36 samples), hymexazol (31 samples) and chlorpropham (12 samples). Due to the insufficient performance of the analytical methods, a correct enforcement of the baby food legislation is not always ensured. It is therefore recommended to improve the analytical methods in order to be capable of quantifying residues at the MRL with sufficient accuracy. The European Reference Laboratories are advised to continue providing support to the national laboratories regarding the implementation of adequate analytical methods and including in the EU Proficiency Tests the pesticides for which MRLs lower than the default limit of 0.01 mg/kg are set in the legislation specific for baby food.

4.6.2. Organic food

In 2010, a total of 3,571 organic samples were analysed and provided by 28 reporting countries; the results concerning these samples are summarised in Figure 4-4.

For all food groups in Figure 4-4 – except for 'Animal products' - the conventionally grown products ("Other production" in the Figure) showed a higher MRL exceedance rate than the organic products. For fruit and nuts, a lower rate of MRL exceedances (0.9%) was found in comparison to conventionally grown fruit and nuts (2.9%). For vegetables the exceedance rates of the surveillance samples were 1.0% and 3.8% respectively for organic and conventionally grown products. In organic and conventional animal products, one and seven samples respectively were found exceeding the legal limit. Overall, the MRL exceedance rate for organic food was 0.8%.

Comparison of results regarding organic and other production types per reporting country can be found in Appendix III, Table H. Table I, in Appendix III shows more detailed results on different production types by commodity.

[55] Commission Directive 2006/141/EC for infant formulae and follow-on formulae and in Commission Directive 2006/125/EC for processed cereal-based foods and baby foods for infants and young children.

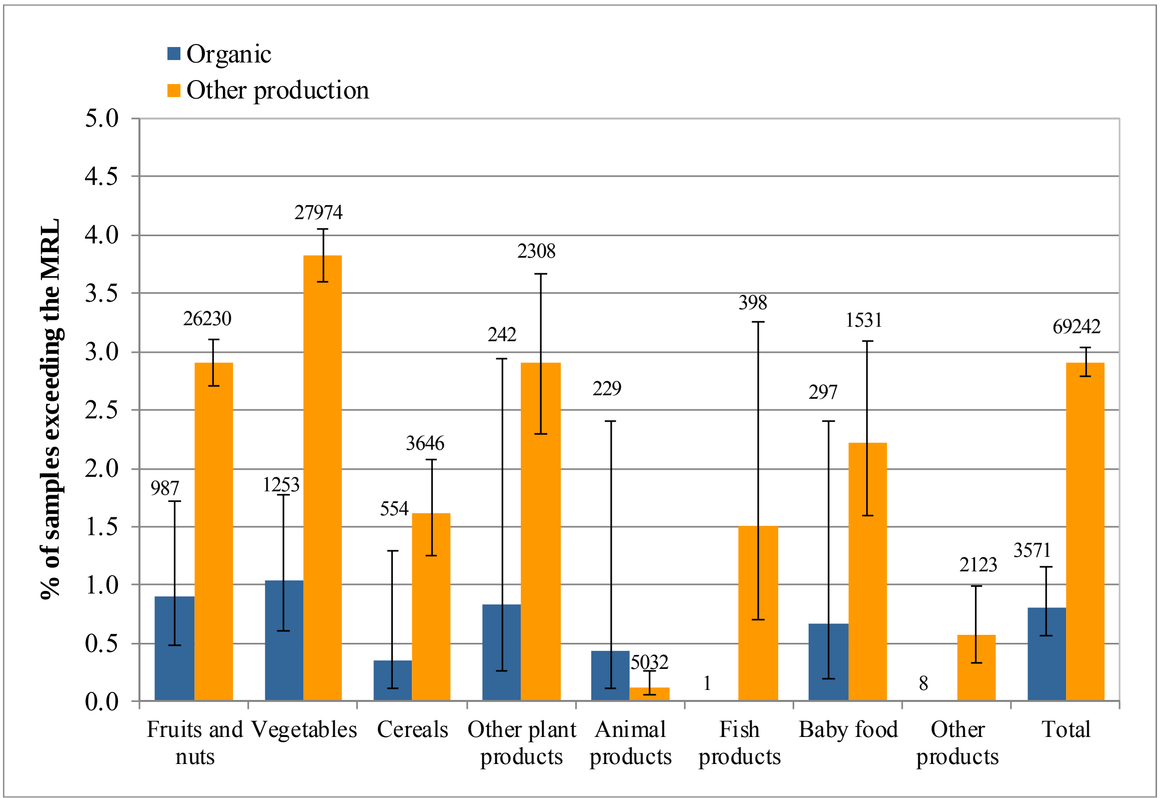


Figure 4-4: Comparison of the results for organic and conventional products: percentages of surveillance samples exceeding the MRL (total number of samples analysed for each food group is displayed on top of the chart bars together with their confidence intervals) - 2010.

In total, 131 different substances were found in organic samples. Table 4-4 lists the pesticides found in measurable levels in at least five organic samples. It is noted that out of these 26 pesticides, one is permitted in organic farming according to Regulation (EC) No 834/2007 and Regulation (EC) No 889/2008; several other pesticides are related to environmental contamination (e.g. hexachlorebenzene and DDT), to naturally occurring substances (e.g. bromide ion, dithiocarbamates measured as carbondisulfide) or to pesticides not allowed in organic production in Europe.

Table 4-4: EU+NCP – Pesticides found in organic food (only pesticides which were detected in at least five surveillance samples) - 2010.

Pesticide	Product	Range of measured residue levels (mg/kg)	Number of detections	Note
Hexachlorobenzene	Baby food, cattle, bovine meat and poultry	0.062-0.000013	45	Banned. Persistent Organic Pollutant (POP)[56]
DDT (sum)	Baby food, cattle, carrots, tea, bovine meat, poultry and chicken eggs	0.160-0.00006	34	Banned. POP
Bromide ion	Lettuce, tomatoes, peppers, coconuts, wheat, lentils, rucola, rye and asparagus	50.0-0.06	25	Pesticide use of methylbromide not allowed in organic production. In some of these food products

[56] POP: substances considered as Persistent Organic Pollutants according to Council Decision of 14 October 2004, (2006/507/EC).

Pesticide	Product	Range of measured residue levels (mg/kg)	Number of detections	Note
				inorganic bromide ion occurs naturally
Spinosad (sum)	Rucola, tomatoes, strawberries, apricots, table grapes, mandarins, peppers, apricots, pears and cucumbers	0.153-0.006	22	
Carbendazim and benomyl	Apples, peaches, apricot, tomatoes, raspberries, papaya, beans, mint and honey	0.106-0.004	18	Pesticide use not allowed in organic production
Chlorpyrifos	Tomatoes, oranges, rye, citrus, pears, peaches, peppers, barley and wheat	0.27-0.003	17	Pesticide use not allowed in organic production
Cypermethrin (sum)	Baby food, maize, wheat, apricots, tomatoes, oranges, lychees, lettuce and tea	1.10-0.003	17	Pesticide use not allowed in organic production
Boscalid	Mint, apples, table grapes, carrots, tomatoes, peppers and lettuce	0.110-0.003	14	Pesticide use not allowed in organic production
Chlormequat	Rye, oats, wheat and pears	0.127-0.0011	13	Pesticide use not allowed in organic production
Imidacloprid	Papaya, tomatoes, peppers, cucumbers, maize and rice	0.09-0.005	12	Pesticide use not allowed in organic production
Endosulfan (sum)	Baby food, soya bean, pumpkin seeds and tea leaves	0.03-0.000054	12	Pesticide use not allowed in organic production. Persistent pesticide in the soil. No longer authorised in EU
Orthophenylphenol	Lemons, apples, pears, bananas, potatoes, carrots, onions and maize	0.1-0.04	11	Pesticide use not allowed in organic production
Thiabendazole	Mandarins, bananas, apples, cucumbers, potatoes, oranges, mandarins and fennel	1.78-0.007	11	Pesticide use not allowed in organic production
Imazalil	Mandarins, bananas, lemons, limes, grapefruit, oranges and potatoes	2.50-0.003	10	Pesticide use not allowed in organic production
Dithiocarbamates	Tomatoes, courgettes, head cabbage, lettuce, beans and leek	0.490-0.014	10	Pesticide use not allowed in organic production. Possible false positive results in brassica crops and in leeks
Pirimiphos-methyl	Wheat, maize, linseed and rye	0.040-0.003	8	Pesticide use not allowed in organic production
Acetamiprid	tomatoes, table grapes and apricots	0.620-0.004	8	Pesticide use not allowed in organic production
Chlorpropham (sum)	Potatoes, ginger and onions	0.050-0.006	8	Pesticide use not allowed in organic production
Cyprodinil	Kiwi, table grapes, carrots and raspberries	0.040-0.002	7	Pesticide use not allowed in organic production
Iprodione	Lettuce, apples, peaches, raspberries and cauliflower	10.8-0.007	6	Pesticide use not allowed in organic production
Fenpropimorph	Barley and bananas	0.005-0.003	6	Pesticide use not allowed in organic production

Pesticide	Product	Range of measured residue levels (mg/kg)	Number of detections	Note
Lambda-cyhalothrin	Baby food, chard, tomatoes and tea leaves	0.130-0.004	6	Pesticide use not allowed in organic production
Fludioxonil	Potatoes, carrots and raspberries	0.023-0.002	5	Pesticide use not allowed in organic production
Metalaxyl (sum)	Lychee, mandarins, cauliflower and carrots	0.130-0.008	5	Pesticide use not allowed in organic production
Epoxiconazole	Barley	0.029-0.009	5	Pesticide use not allowed in organic production
Esfenvalerate (sum)	Tomatoes and wheat	0.056-0.005	5	Pesticide use not allowed in organic production

4.6.3. Processed food

The MRLs applicable to processed commodities are based on the MRLs established for raw agricultural commodities, taking into account processing factors which reflect the changes in levels of pesticide residues caused by processing or mixing[57]. Harmonised processing factors however are not yet established at EU level.

In 2010, 28 countries reported data on analysis of processed products. A total of 11,571 surveillance samples were analysed. Residues above the MRL were reported for 125 samples (1.1%) of processed products, including plant products, animal products and baby food.

Figure 4-5 compares the MRL exceedance rates (surveillance samples only) for the main food categories[58] between processed and unprocessed food. In all product categories, except animal commodities, the MRL exceedance rate was lower for processed commodities than for unprocessed products.

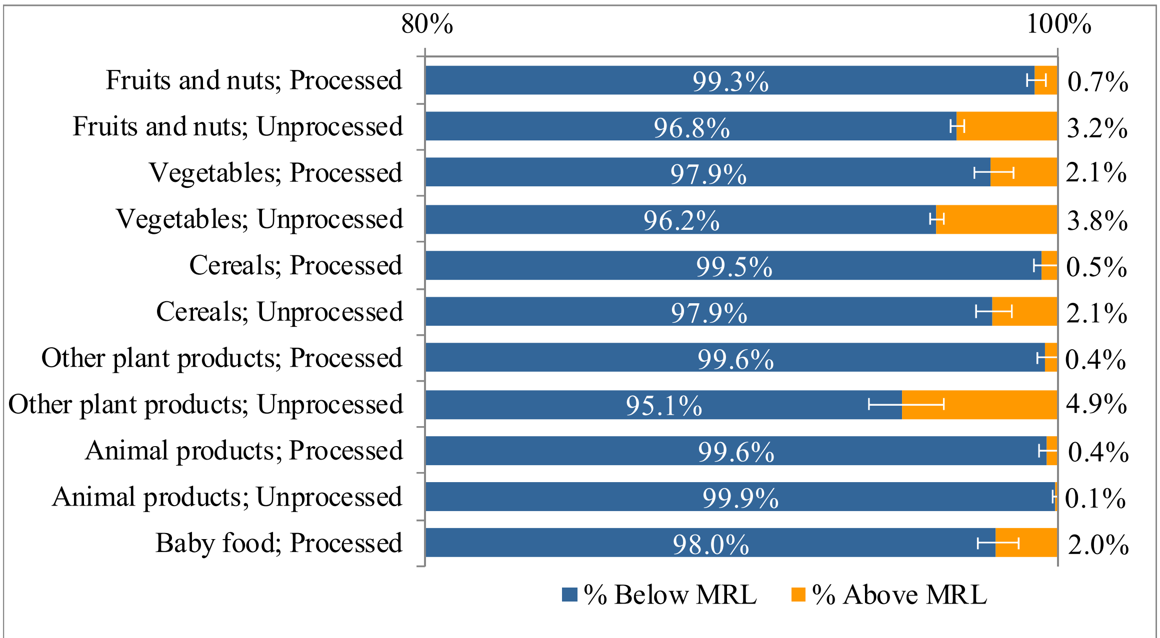


Figure 4-5: EU+NCP – MRL compliance rate of surveillance samples 2010.

Detailed results for surveillance samples at commodity level are shown in Appendix III, Table J.

[57] See "MRL" in the Glossary.
[58] See "Food commodities" in the Glossary.

The lack of processing factors in Annex VI of Regulation (EC) No 396/2005 hampers the enforcement of MRLs at national level for those food items requiring conversion. Therefore, EFSA recommends that efforts should be made to establish a harmonised list of processing factors applicable throughout Europe.

4.6.4. Enforcement and surveillance samples

Figure 4-6 shows a comparison of the percentage of samples above the MRL reported for the total of surveillance and enforcement samples for the main food categories.

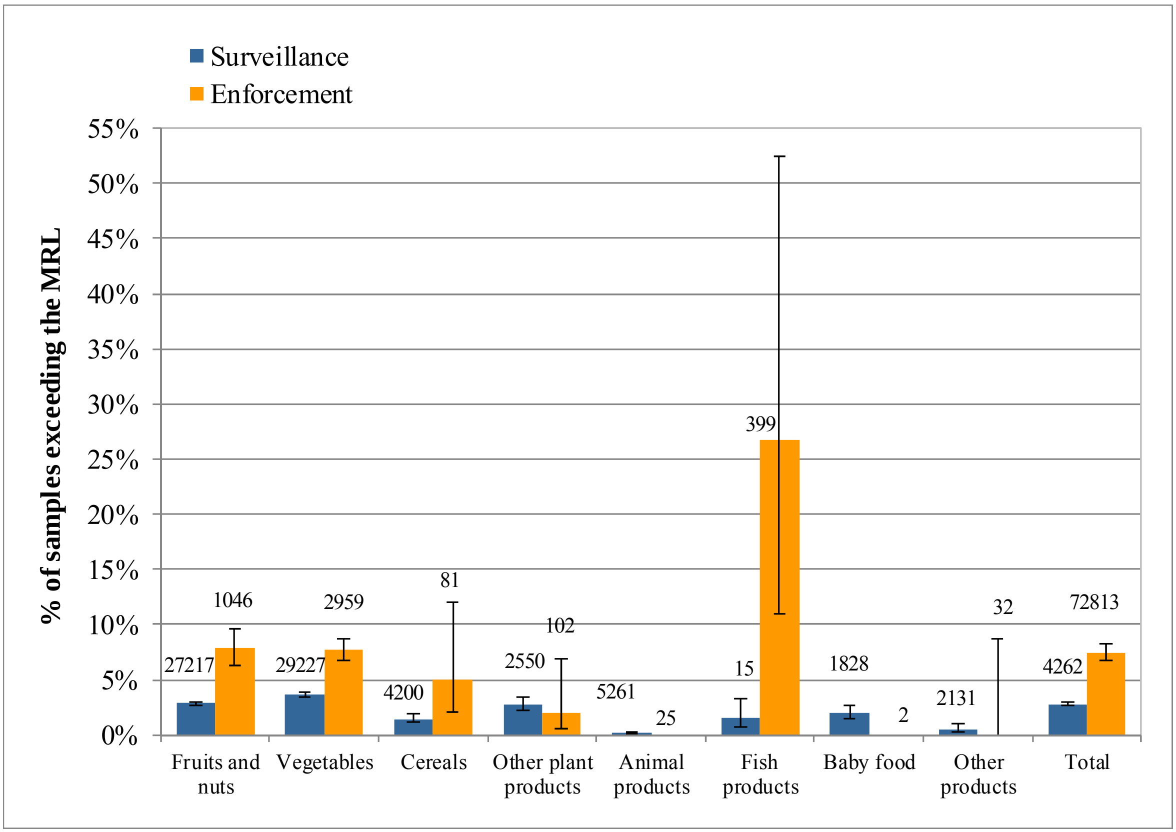


Figure 4-6: EU+NCP – Percentage of samples (surveillance and enforcement) exceeding the MRL (total number of samples analysed for each food group is displayed on top of the chart bars) - 2010.

In enforcement samples, the MRL exceedance rate was generally higher than in surveillance samples. In total, 315 samples, corresponding to 7.5% of all enforcement samples, exceeded the MRL. No exceedance of the MRL was observed for enforcement samples of baby food and animal products.

4.6.5. Multiple residues in the same sample

Considering the results of both the national and the EU-coordinated programmes in 2010, residues of two or more pesticides were found in 19,382 samples, corresponding to 26.6% of the surveillance samples analysed (Figure 4-7).

Multiple residues findings were observed by all reporting countries.

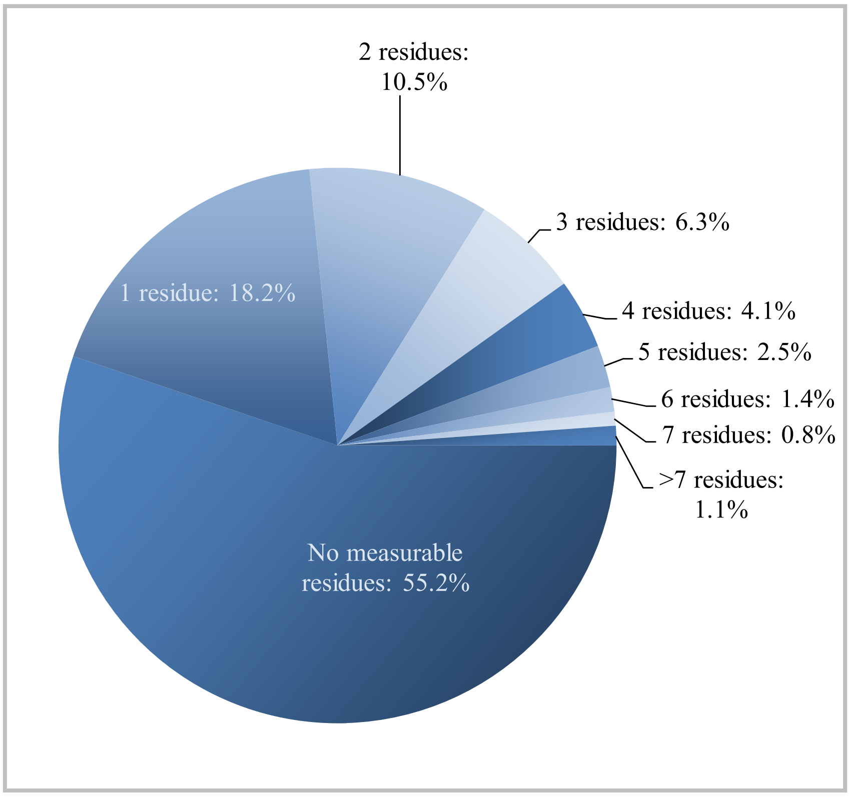


Figure 4-7: EU+NCP – Percentage of samples according to the number of different residues found in individual surveillance samples in 2010.

Important commodities for human consumption with high frequencies of multiple residues were liver (95.7% of 23 liver samples), citrus fruits (62.8% of 4,363 citrus fruit samples) and strawberries (60.5% of 2,479 strawberries samples). Additional unprocessed commodities with multiple residues, sorted according to the percentage of multiple residues, are listed in Table 4-5.

According to the current EU legislation, the presence of multiple residues in one sample as such is not a reason for considering a sample as not compliant with the MRL legislation as long as the individual residues do not exceed the single MRLs. Legal actions have to be imposed by the Member States in cases where one or more MRLs are exceeded.

In 2010, 338 (0.5% out of the 72,813 surveillance samples) unprocessed samples were found to exceed two or more EU MRLs (Table 4-6). The highest number of multiple MRL exceedances in one sample was 11, measured in vine leaves (processed grape leaves). The commodity with the highest number of samples with multiple MRL exceedances was peppers (46 out of 1,633 unprocessed surveillance samples; 2.8% of the samples).

The number of samples with multiple residues per reporting country can be found in Appendix III, Table C.

Table 4-5: EU+NCP – Percentage of unprocessed surveillance samples with multiple residues by commodity groups (only results for commodity groups with more than five samples with multiple residues) – 2010[54].

Product (Number of samples analysed)	Number of different residues (n) in the same sample									Overall >1
	0	1	2	3	4	5	6	7	>7	
	Percentage of samples according to the number of different residues in the same sample									
Liver (swine, bovine, sheep, goat, poultry) (23)	4.3		34.8	30.4	17.4	4.3	8.7			95.7
Citrus fruit (4363)	19.8	17.4	21.3	17.8	11.5	6.6	2.8	1.3	1.5	62.8
Strawberries (2479)	24.5	14.9	12.8	13.1	12.7	8.7	6	3.5	3.8	60.5
Table and wine grapes (2710)	23.9	18.4	13.5	10.9	11.4	7.5	5.7	3.4	5.3	57.7
Cane fruit, small fruit and berries (1140)	28.9	15	14.1	11.8	10.3	7.5	6.1	2.2	4.1	56.1
Pome fruit (5060)	29.6	20.4	17.6	13.1	8.3	4.7	2.5	1.7	2	50
Stone fruit (3706)	33.4	25.6	16.3	10	5.9	4	2.2	1.5	1.2	41
Leafy vegetables & fresh herbs (5179)	47.1	19.2	11.4	7.5	5	3.8	2.3	1.5	2.3	33.7
Tea, coffee, herbal infusions and cocoa (707)	58.3	14.6	9.1	8.1	4.8	1.8	1.1	1.3	1	27.2
Solanaceae (e.g. tomatoes, peppers) (6315)	52.9	20.5	10.7	6.3	4.1	2.2	1.3	0.6	1.4	26.6
Tropical and subtropical fruit (3662)	48.9	24.5	17	5.4	2.6	1	0.3	0.1	0.2	26.5
Legume vegetables (fresh) (1530)	57.6	21	12.7	4.8	2.2	0.7	0.5	0.1	0.5	21.4
Cucurbits (3091)	62.5	19.1	9.4	4.2	1.9	1.4	0.6	0.4	0.5	18.4
Stem vegetables (2316)	67.4	16.5	7.8	3.4	1.9	1.3	0.7	0.5	0.5	16.1
Root and tuber vegetables (except tropical) (2144)	67.6	17.4	9	3.4	1.4	0.7	0.4	0.1		15
Cereals (2551)	69.4	18.8	8.5	2.4	0.6	0.3	0.0			11.8
Brassica vegetables (2870)	68.5	20.7	5.6	2.6	1.3	0.9	0.3	0.1	0.1	10.9
Spices (142)	68.3	21.8	4.2	4.2	0.7	0.7				9.9
Eggs (509)	81.7	8.8	6.1	2.8	0.4	0.2				9.4
Fungi (524)	70.4	20.2	7.1	1.3	0.6	0.4				9.4
Meat (swine, bovine, sheep, goat, poultry) (1142)	85.8	6.7	4.5	1.8	0.7	0.4	0.1			7.4
Bulb vegetables (801)	79.3	13.4	2.6	2.5	1	0.4	0.5	0.2	0.1	7.4
Potatoes (1832)	68.6	24.6	5.4	1.1	0.2	0.1				6.8
Pulses (211)	79.1	14.2	4.3	1.4	0.9					6.6
Sugar plants (19)	89.5	5.3		5.3						5.3
Oilseeds and oilfruits (217)	75.6	19.4	1.8	1.4			0.5	0.9	0.5	5.1
Milk and milk products (1239)	90.2	5.6	3.4	0.6	0.2					4.2
Tropical root and tuber vegetables (453)	92.1	3.8	4.2							4.2
Nuts (193)	73.1	26.4		0.5						0.5

Table 4-6: EU+NCP – Summary of results of unprocessed samples with multiple EU MRL exceedances by commodity (surveillance samples only, data on commodities considered not relevant are not presented) – 2010[54].

Product (Number of samples analysed)	**Number of residues exceeding the MRL in the same sample**						**Overall >1**
	0	**1**	**2**	**3**	**4**	**>4**	
	Percentage of samples						
Camomille flowers (1)						100	100
Chicory roots (1)			100				100
Cumin seed (1)				100			100
Rosemary (1)			100				100
Asparagus (6)	50		33.3	16.7			50
Dewberries (2)		50	50				50
Pepper, black and white (5)	40	20	40				40
Vine leaves (24)	58.3	4.2	16.7		4.2	16.7	37.5
Caraway (5)	60	20	20				20
Lychee (28)	50	32.1	7.1	3.6		7.1	17.9
Chives (12)	66.7	16.7	16.7				16.7
Celery leaves (61)	47.5	36.1	9.8	1.6	1.6	3.3	16.4
Okra (107)	65.4	20.6	11.2	0.9	0.9	0.9	14
Passion fruit (51)	74.5	11.8	9.8	3.9			13.7
Chinese cabbage (108)	77.8	9.3	2.8	3.7	4.6	1.9	13
Basil (102)	76.5	11.8	9.8	1	1		11.8
Cassava (21)	81	9.5	9.5				9.5
Spring onions (25)	72	20	8				8
Broccoli (240)	87.5	4.6	5.4	0.8	1.3	0.4	7.9
Flowering brassica (13)	61.5	30.8		7.7			7.7
Kumquats (13)	46.2	46.2	7.7				7.7
Pomegranate (72)	69.4	23.6	2.8	2.8		1.4	6.9
Beans, dry (16)	56.3	37.5	6.3				6.3
Globe artichokes (17)	82.4	11.8	5.9				5.9
Yams (51)	78.4	15.7	5.9				5.9
Guava (38)	68.4	26.3	5.3				5.3
Beans (with pods) (840)	85.2	11	2.9	0.6	0.4		3.8
Chard (98)	87.8	9.2	2	1			3.1
Parsley (165)	84.8	12.1	3				3
Peppers (1633)	90.4	6.8	1.9	0.5	0.2	0.2	2.8
Witloof (36)	94.4	2.8	2.8				2.8
Peas (with pods) (123)	69.9	27.6	0.8	0.8	0.8		2.4
Kale (150)	91.3	6.7	2				2
Fennel (54)	96.3	1.9		1.9			1.9
Rocket, Rucola (56)	91.1	7.1	1.8				1.8
Papaya (119)	79.8	18.5	1.7				1.7
Avocados (60)	93.3	5	1.7				1.7
Figs (62)	93.5	4.8	1.6				1.6
Tea leaves (458)	93.7	4.8	1.3			0.2	1.5
Brussels sprouts (76)	98.7		1.3				1.3
Onions (88)	90.9	8	1.1				1.1
Spinach (550)	94.9	4.4	0.5	0.2			0.7
Aubergines (590)	93.7	5.6	0.5	0.2			0.7
Cherries (470)	94.7	4.7	0.6				0.6

Product (Number of samples analysed)	Number of residues exceeding the MRL in the same sample						Overall >1
	0	1	2	3	4	>4	
	Percentage of samples						
Head cabbage (368)	97	2.4	0.5				0.5
Celery (185)	91.4	8.1	0.5				0.5
Apricots (404)	96.3	3.2	0.5				0.5
Carrots (412)	95.9	3.6	0.5				0.5
Table grapes (2080)	92.4	7.1	0.4	0			0.5
Wine grapes (209)	90.9	8.6		0.5			0.5
Mangoes (428)	97.9	1.6	0.2	0.2			0.5
Lettuce (2214)	96.6	2.9	0.3	0.1			0.5
Lamb's lettuce (240)	97.1	2.5	0.4				0.4
Currants (red, black and white) (243)	94.7	4.9	0.4				0.4
Peaches (1406)	98.3	1.4	0.3	0.1			0.4
Lemons (578)	95.7	4	0.3				0.3
Raspberries (305)	95.1	4.6	0.3				0.3
Kiwi (618)	97.7	1.9	0.3				0.3
Melons (313)	96.2	3.5	0.3				0.3
Leek (660)	98.3	1.4	0.3				0.3
Cucumbers (1047)	96.5	3.2	0.3				0.3
Strawberries (2033)	97	2.8	0.2	0			0.2
Oranges (1314)	95.2	4.6	0.2	0.1			0.2
Potatoes (518)	96.1	3.7	0.2				0.2
Mandarins (938)	97.4	2.5	0.1				0.1
Pears (1174)	98	2	0.1				0.1
Apples (2603)	98.6	1.3	0.1				0.1
Tomatoes (1990)	98.3	1.7	0.1				0.1

Multiple residues in one sample can result from the application of different types of pesticides used to protect the crop against different pests or diseases, e.g. insecticides, fungicides and herbicides. Pesticide formulations often contain a number of pesticides which have different modes of action. The use of pesticides with different modes of action is often recommended by national authorities in integrated pest management strategies in order to minimise the development of pest resistance to pesticides. In addition to the agricultural practices mentioned above (that may be different in the Member States due to e.g. different climate conditions) other possible reasons for the occurrence of multiple residues are:

- mixing of lots which were treated with different pesticides, either during the sampling or in the course of the sorting of the commodities (e.g. sorting for quality classes);
- residues resulting from soil uptake in cases where pesticides have high persistence in the soil;
- residues resulting from spray drift from neighbouring plots or cross-contamination in the processing of the crops (e.g. by washing practices);
- contamination during handling, packing and storage.

Further analysis of samples containing multiple residues could help to better understand the reasons for the presence of multiple residues and to derive recommendations and, if needed, to take measures to follow up on this. Considering the total number of data on the commodities of concern, a more detailed data analysis was performed for a single crop (lettuce), for which repeatedly multiple residues were observed.

4.6.5.1. Case study on lettuce

Lettuce was chosen for the case study due to the high percentage of multiple residues and MRL exceedances and the importance of lettuce for the human consumption.

The total number of surveillance samples for unprocessed lettuce was 2,559. 41.1% (1,051 samples) of these samples had no measurable residues, and 18.1% (462 samples) had one pesticide residue; the remaining samples (1,046 samples – 40.9%) contained multiple residues (Figure 4-8).

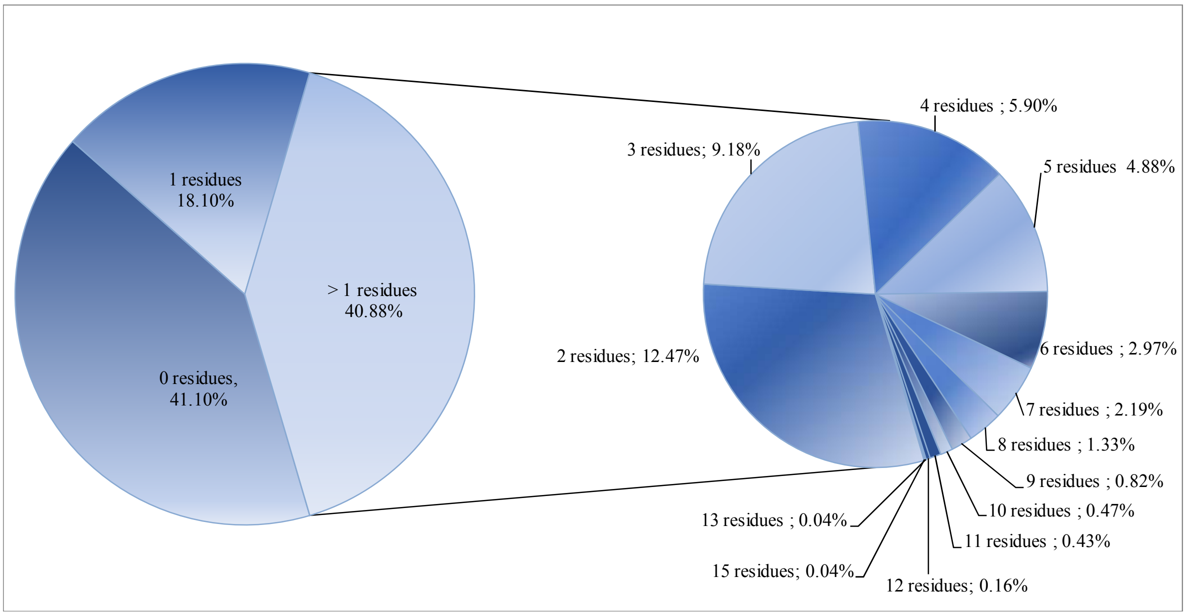


Figure 4-8: EU+NCP – Percentage of lettuce samples according to the number of different pesticides found in the same sample - 2010 (surveillance samples only).

In Table 4-7 the results for the multiple residue samples are reported according to the sample origin (only those samples, for which the country of origin was reported and could clearly be identified are included). Some countries have few samples (less than 10) taken so uncertainty is associated with it to conclude any facts. On the contrary, for those countries with higher number of samples taken, the analysis shows that the percentage of samples with none or only one pesticide was the highest for samples originating from Malta and Denmark. Samples from Belgium, Ireland, France, Germany and Hungary had the highest occurrence rates of samples containing more than one pesticide.

Table 4-7: EU+NCP – Numbers of lettuce samples with 0, 1 or >1 residue by country of origin - 2010[54].

Country of origin (total number of samples analysed)	Number of residues						
	0	1	2	3	4	5	>5
	Percentage of samples						
Albania (4)	100						
Argentina (1)							100
Austria (56)	75	10.7	8.9	1.8	1.8	1.8	
Belgium (224)	10.3	3.6	7.1	10.3	10.3	14.7	43.8
Bulgaria (37)	59.5	24.3	10.8	2.7	.	2.7	
Croatia (2)					50.0		50.0
Cyprus (29)	72.4	10.3	13.8	3.4			
Czech Republic (21)	33.3	33.3	19.0	14.3			
Denmark (23)	87.0	13.0					
Estonia (14)	64.3	35.7					

Country of origin (total number of samples analysed)	Number of residues						
	0	1	2	3	4	5	>5
	Percentage of samples						
Finland (19)	84.2	10.5		5.3			
France (348)	35.6	12.1	14.4	14.9	8.9	7.2	6.9
Germany (358)	28.5	20.1	15.4	12.6	6.1	5.9	11.5
Greece (127)	70.1	17.3	4.7	4.7	0.8		2.4
Hungary (117)	32.5	27.4	22.2	13.7	1.7	2.6	
Iceland (3)	100						
Ireland (28)	17.7	21.4	25.0	14.3	10.7	7.1	3.6
Italy (155)	31.0	20.6	10.3	8.4	6.5	10.3	12.9
Latvia (10)	70.0		30.0				
Lebanon (4)	75.0	25.0					
Lithuania (5)	80.0		20				
Luxembourg (9)	88.9		11.1				
Macedonia, (The Former Yugoslav Republic of) (1)		100					
Malta (15)	93.3		6.7				
Netherlands (122)	32.8	18.0	18.0	12.3	10.7	3.3	4.9
Norway (50)	72.0	26.0	2.0				
Poland (27)	74.1	14.8	11.1				
Portugal (39)	53.9	35.9	5.1	2.6	2.6		
Romania (59)	76.3	17	5.1		1.7		
Senegal (1)							100
Slovakia (2)			100				
Slovenia (43)	60.5	20.9	9.3	2.3	4.7		2.3
South Africa (1)							100
Spain (488)	37.5	23.8	15.6	9.4	7.6	3.5	2.7
Sweden (26)	65.4	19.2	7.7	3.9	3.9		
Turkey (1)	100						
United Kingdom (54)	68.5	22.2	1.9	1.9	1.9	1.9	1.9
United States (1)	100						

The maximum number of residues found in the same sample was 15, found in one sample originating from Belgium. The detected compounds were: boscalid, cyprodinil, dimethomorph, dithiocarbamates, fludioxonil, iprodione, mandipropamid, metalaxyl (sum), oxadixyl, promecarb, propyzamide, pyraclostrobin, spinosad (sum), thiacloprid and tolclofos-methyl.

In total, 108 different pesticides were found in lettuce samples with multiple residues. The 49 pesticides, most frequently found in combination with one or more other residues, are reported in Figure 4-9. The most relevant pesticides were iprodione (398 determinations), boscalid (388 determinations), cyprodinil (293 determinations), propamocarb (sum) and the dithiocarbamates (243 and 240 determinations, respectively).

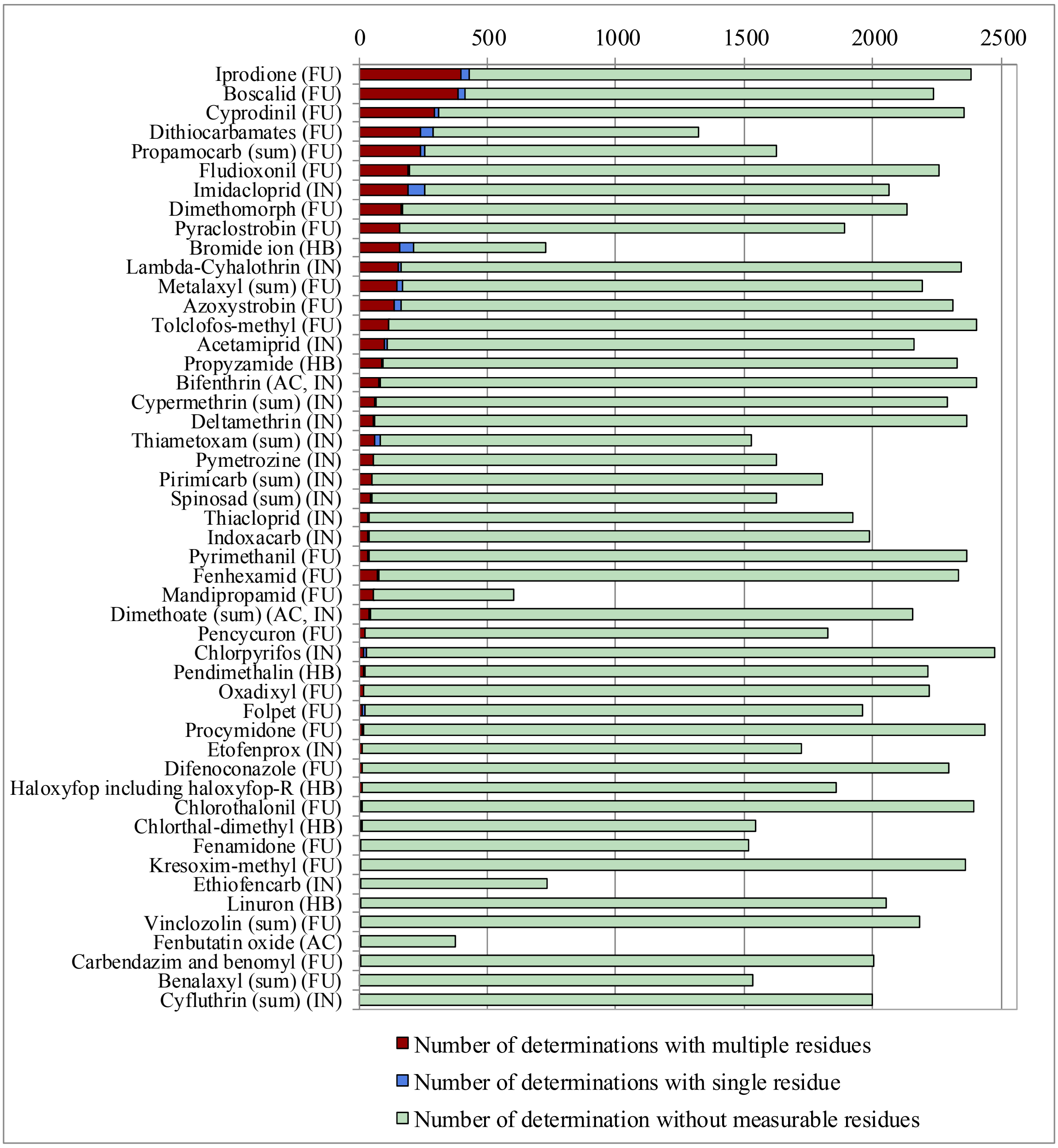


Figure 4-9: EU+NCP – Pesticides most frequently found on lettuce (pesticides with multiple residues only). AC: acaricide; FU: fungicide; HB: herbicide; IN: insecticide; NE: nematicide

The most frequent combinations of two pesticides measured in the same sample were boscalid/iprodione (196 samples, 4.7% of the lettuce samples), cyprodinil/fludioxonil (190 samples, 4.6%) and boscalid/pyraclostrobin (149 samples, 3.6%).

When assessing multiple residues in food, apart from the total number of different pesticides, the concentration of the individual pesticides found on the samples needs to be taken into account. In Figure 4-10 residue concentrations for the most frequent pesticides found in measurable concentrations (>LOQ) on lettuce samples with multiple residues, compared with the MRL for the pertinent pesticide are presented by means of a box plots.

For each pesticide plotted, the following information is presented:

- the left edge of the box (25%-quantile) denotes the residue concentration (expressed in percent of the MRL), that was exceeded in 75% of the samples;

- the median (vertical line within the box) corresponds to the residue concentration (expressed as % of the MRL) exceeded by 50% of the samples;
- the 75%-quantile (upper edge of the box) represents the residue concentration (expressed in % of the MRL) that was exceeded in 25% of the samples;
- the left whisker (lines with margin) represents the lowest measurable residue (expressed in % of the MRL);
- the right whisker represents the highest measured residue value (expressed as % of the MRL).

For example, the results for iprodione are explained: the MRL for iprodione/lettuce is 10 mg/kg. 2,400 samples (see also Figure 4-9) were analysed for iprodione; in 398 samples multiple measurable residues were found. The highest residue found (right whisker) was 25 mg/kg (corresponding to 250% of the MRL). 25% of the samples contained more than 2 mg/kg (20% of the MRL) (75^{th} percentile, right edge of the box), in 50% of the samples the residue concentration was below 1 mg/kg (10% of the MRL), represented by the line within the box (median). The LOQ for iprodione is 0.01 mg/kg. This corresponds to 0.1% of the MRL. The 25^{th} percentile and the lowest residue (left whisker) are close to 8.3% and 0.1% of the MRL, respectively

From Figure 4-10 it is concluded that all median residue concentrations for the most frequently found pesticides in lettuce were below 10% of the MRL, the 75%-quartiles for all but three cases lay below 15% of the MRL.

As a result of the above, this analysis shows that in most cases with multiple residues on lettuce, the measured residues occur in concentrations below the MRL. Individual samples contained residues in concentrations close to or even above the MRL (please note that for reasons of readability not all extreme values for azoxystrobin, boscalid, bromide ion, dithiocarbamates, fludioxonil, iprodione and lambda-cyhalothrin exceeding 100% of the MRL could be presented).

However, even if the individual MRLs for pesticides are not exceeded, a food item may be of concern if the occurrence of the individual substances causes the same toxicological effect in humans and if the cumulated concentration exceeds the toxicological threshold concentration, taking into account the different toxicological potencies of the individual substances. Thus, if compounds belonging to a group of chemicals which have a common mode/mechanism of action are present in the same sample, a cumulative exposure assessment should be performed. In chapter 5 of the present report the results of an indicative estimate of the cumulative exposure for pesticides found on lettuce are reported.

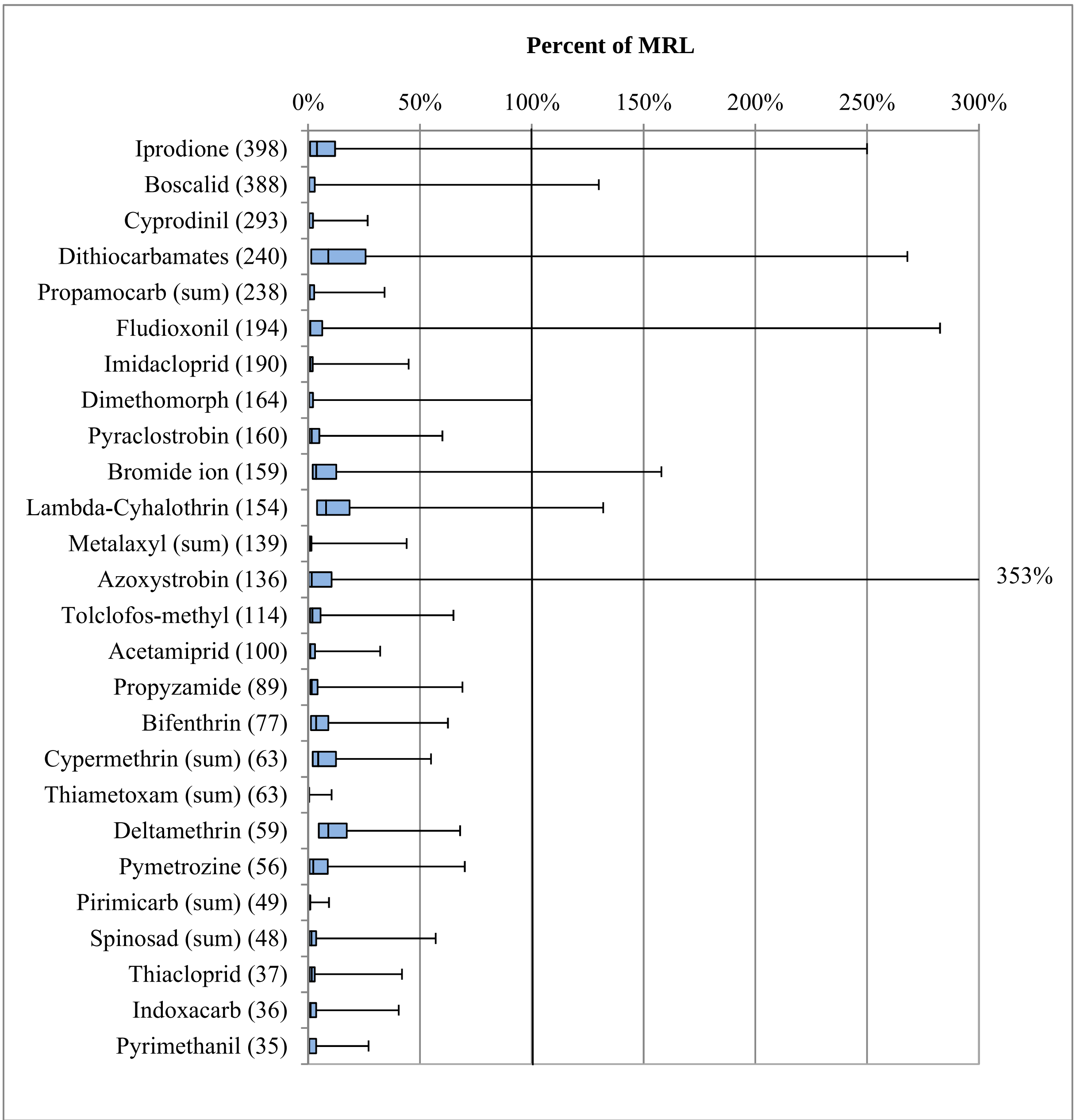


Figure 4-10: EU+NCP – Box plots for the multiple residues in lettuce (unprocessed) 2010, expressed in percentage of the MRL (top 25 results).

4.6.5.2. Results on import control according to Commission Regulation (EC) No 669/2009

According to Commission Regulation (EC) No 669/2009, which applies from 25th of January 2010 onwards, the Member States were requested to control certain products at the point of entry into the European market[59]. The regulation foresees the reinforced control (sampling and analysis) of food from specific countries of origin to be carried out at the point of entry into the EU and to be analysed for specific substances, including some pesticide (or group of pesticides) residues.

The total number of samples analysed for the commodity/pesticide/country combinations indicated in the Regulation was 4,448 (Figure 4-11). Most of these samples were taken as border or import control samples (3,553). As the sampling strategy was targeted for specific combinations of countries/commodities/pesticides for which a high non-compliance rate was expected, the percentage

[59] Regulation (EC) No 669/2209 and its amendments do no specify the absolute number of samples to be analysed, but indicate the percentages of samples to be controlled out of the actual number of samples entering in the EU territory.

of samples not compliant with the European legal limits is generally higher than for the food typically available on the EU market.

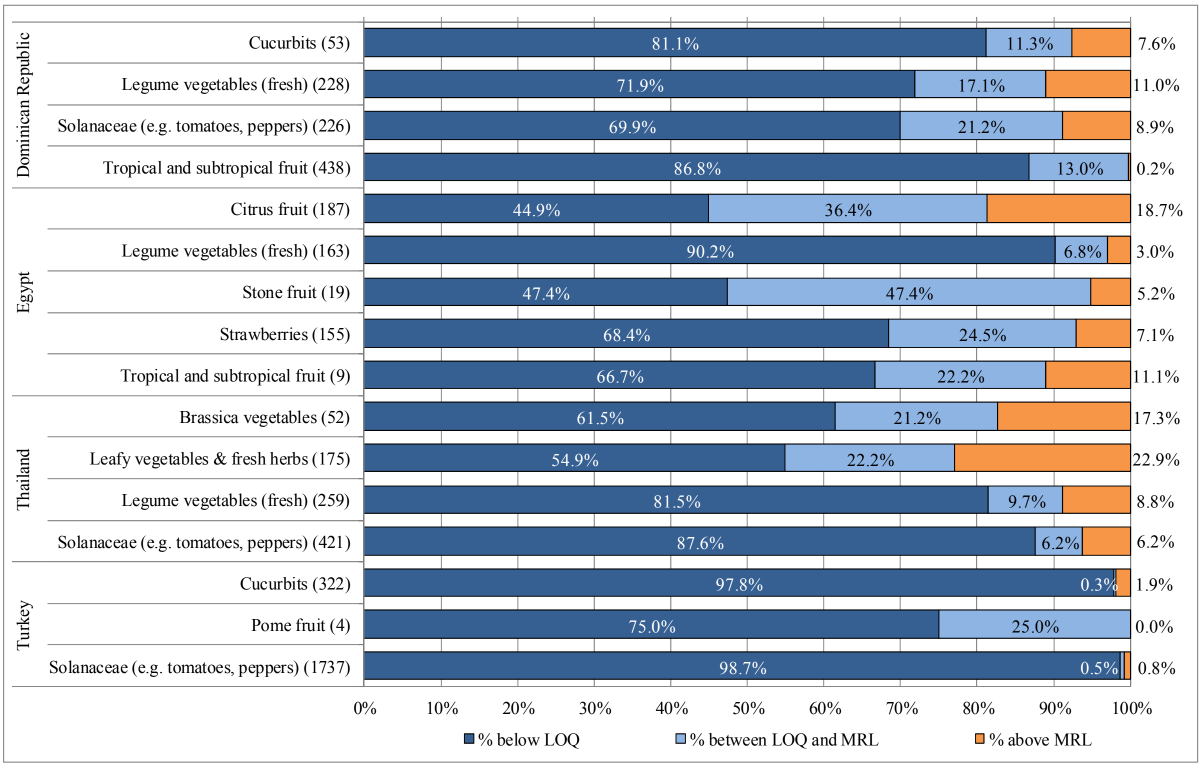


Figure 4-11: Results of the control activities for the imported food according to the country of origin, the food items and the pesticides listed in Regulation (EC) No 669/2009[54].

4.6.6. Food of animal origin

In total, 5,261 surveillance samples of animal origin were analysed in 2010, covering meat, fat and liver of bovine, swine, poultry, sheep, goats and horses, milk and milk products, eggs and honey. The majority of the samples were free from detectable residues (87.3% of the samples were reported below the LOQ). In 0.1% of the samples the MRLs were exceeded.

In total, 43 different pesticides were found in products of animal origin; the most frequently found pesticides were DDT (sum), HCH and thiacloprid, which were detected in 13.4%, 11.6% and 10.2% of the samples analysed for these substances, respectively. The 20 pesticides most frequently found in animal products are reported in Table 4-8 (only the pesticides analysed in at least 10 samples are tabulated).

Table 4-8: EU+NCP – 20 most frequently detected pesticides in animal product samples (only pesticides for which at least 10 samples were analysed) - 2010.

Compound	No of samples with measurable residues	% of sample with measurable residues	Note
DDT (sum)	421	13.4%	POP(*)
HCH (sum)	36	11.6%	POP
Thiacloprid	42	10.2%	Residues detected only in honey
Hexachlorobenzene	319	7.9%	POP
Carbendazim (sum animal products)	13	4.3%	Residues detected only in honey
Thiabendazole (sum animal products)	3	2.0%	Residues in poultry meat and honey
Flusilazole (sum animal products)	2	2.0%	Residues detected only in honey
Boscalid (sum animal products)	6	1.9%	Residues detected only in honey
Lindane	72	1.8%	POP
Dimoxystrobin	2	1.4%	Residues detected only in honey
Iprodione	3	1.0%	Residues detected only in butter
Acetamiprid (sum animal products)	2	1.0%	Residues detected only in honey
HCH alpha	33	0.9%	POP
Pirimicarb (sum)	3	0.9%	Residues detected only in honey
HCH beta	30	0.9%	POP
Spinosad (sum)	1	0.9%	Residue detected in eggs
Amitraz (sum)	1	0.8%	Residue detected only in honey
Nicotine	1	0.8%	Residue detected in eggs
Aldrin and Dieldrin	22	0.8%	POP
Fenhexamid	2	0.7%	Residue detected in butter

(*)POP = Persistent Organic Pollutants under the Stockholm Convention[60].

DDT (sum) was most frequently found in measurable amounts in bovine liver (23 samples; 100% detection rate), in processed samples of sheep milk (detected in 11 samples; 47.5% of the tested samples) and in swine and poultry meat (detected in 13 and 70 samples; detection rates 40.9% and 39.7%). HCH (sum) was mainly detected in milk products and eggs.

Residues of thiacloprid, carbendazim/benomyl, flusilazole, boscalid, dimoxystrobin, acetamiprid, pirimicarb and amitraz were only found in honey samples. Since amitraz is also used in veterinary medicine for the treatment of bee hives, the residues found in honey are not necessarily related to the pesticide use of amitraz. For the remaining pesticides found in honey samples the residues might be linked to their use as pesticide on areas used by bees for foraging.

Among the most frequently detected residues in samples of animal origin, several are considered as POPs under the Stockholm Convention (Council Decision, 2004). Most of these substances have been

[60] Council Decision of 14 October 2004 concerning the conclusion, on behalf of the European Community, of the Stockholm Convention on Persistent Organic Pollutants; OJ L 209, 31.7.2006, p. 1–2 and Regulation (EC) No 850/2004 of the European parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC; OJ L158, 30.4.2004, p. 7-48.

banned in Europe for more than 30 years[61]. Once released into the environment, these chemicals remain intact for exceptionally long periods of time. They become widely distributed throughout the environment accumulating in the fatty tissue of living organisms including humans.

14 of the POP substances under the Stockholm Convention were used as pesticides in the past until they were banned for use in the European Union and are now covered by the MRL legislation. The Convention encourages the monitoring of these substances at national and/or international level; these pesticide residues are already being analysed by the reporting countries.

The existing MRLs for the POPs are based on residue levels reported in monitoring programmes. These values should be regularly revised in view of the possibility of lowering the MRLs, taking into account the declining concentrations found in the more recent monitoring programmes. An analysis of the findings concerning samples taken in Europe may allow the revision the MRLs currently in place. However, EFSA noticed that some reporting countries did not report the results in compliance with the MRL regulation which requires that the results measured in meat should be expressed on fat basis. Due to the difficulties in comparing the reported results, EFSA could not derive sound conclusions and recommendations on the MRL revision. In order to improve the situation, however, EFSA recommends giving clear guidance to reporting countries on how to report the results for food of animal origin for pesticide residues which are considered as fat soluble and giving practical examples of how the provisions explained in the footnotes of Regulation (EC) No 178/2006[62] and Regulation (EU) No 600/2010[63] are to be applied in practice.

The surveillance sampling results for food of animal origin per reporting country, are listed in Appendix III, Table B.

4.6.7. Reasons for MRL exceedances

In 2010, 2,361 samples (including enforcement samples) were found to exceed the MRLs. Only a limited number of possible reasons explaining the breaches were reported. Therefore EFSA can not derive general conclusions on the reasons for MRL exceedances[64] or propose risk management options to avoid MRL exceedances in the future. It is therefore recommended that national authorities improve the reporting of this information. This may require improvement of the collaboration with national authorities involved in pesticide use and control and in the traceability of samples.

[61] Council Directive 79/117/EEC of 21 December 1978 prohibiting the placing on the market and use of plant protection products containing certain active substances. OJ L 33, 08.02.1979, p. 36–40.

[62] Commission Regulation (EC) No 178/2006 of 1 February 2006 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council to establish Annex I listing the food and feed products to which maximum levels for pesticide residues apply. OJ L 29, 2.2.2006, p. 3–25.

[63] Commission Regulation (EU) No 600/2010 of 8 July 2010 amending Annex I to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards additions and modification of the examples of related varieties or other products to which the same MRL applies. OJ L 174, 09.07.2010, p. 18-39.

[64] See also “MRL exceedances” in the Glossary.

SUMMARY CHAPTER 4

97.2% of the analysed surveillance samples (national and EU-coordinated multiannual programme) were below or at the legal MRLs. In 2.8% of the samples (surveillance only), the legal limits were exceeded for one or more pesticides.

MRLs were more often exceeded for samples from third countries (7.9% of the surveillance samples) than for samples from the EU and EFTA countries (1.5% of the surveillance samples). For food originating from Cambodia (50.0%), Mongolia (50.0%), Hong Kong (47.8%), Bangladesh (44.4%), Bolivia (33.3%), India (28.3%), Uganda (23.6%), Burundi (22.2%), Jordan (21.7%), Iran (21.4%), Thailand (20.9%) and Mauritius (20.0%) the highest MRL exceedance rates were observed; however,, due to the low number of samples originating from these countries, the results are affected by a high statistical uncertainty. For the EEA area, the highest percentage of samples exceeding the MRLs was identified for products originating from Slovakia, Cyprus and Malta.

In terms of commodity groups, most of the MRL exceedances (11.1%) were found in unprocessed surveillance samples of legume vegetables (e.g. beans with pods), spices (8.5%) and nuts (8.3%). High MRL exceedance rates were also observed in table and wine grapes and leafy vegetables (e.g. lettuce) and fresh herbs.

The pesticide/crop combinations which most frequently exceeded the MRLs were acetamiprid in Chinese cabbage and broccoli and dimethomorph in Chinese cabbage.

In total, residues of 328 distinct pesticides were found in measurable quantities in vegetables, 301 in fruit and nuts, while in cereals residues of 88 different pesticides were observed (surveillance samples only).

Overall, 1,828 surveillance samples of baby food/infant formulae were analysed. Residues above the reporting level were found in 154 samples (8.4%), while the MRL was exceeded in 36 samples (2.0%). It was noted that the analytical methods used to analyse baby food were often not sensitive enough to quantify residues at the legal limits.

Data on organic food were provided by 28 reporting countries (3,571 samples). For fruit and nuts, a lower rate of MRL exceedances (0.9%) was found in comparison to conventionally grown fruit and nuts (2.9%). For vegetables the exceedance rates of the surveillance samples were 1.0% and 3.8% respectively for organic and conventionally grown products. Overall, the MRL exceedance rate for organic food was 0.8%. In total, 131 different pesticides were found in organic products; of those, 26 pesticides were found in at least five samples. It is noted that 25 out of these 26 substances are not allowed in organic farming.

A total of 11,571 surveillance samples of processed products were analysed. Residues above the MRL were found in 125 samples (1.1%). It is not reported which processing factors were applied to check the compliance of these samples with the legal limits.

The majority of food of animal origin was free of detectable residues (87.3% of samples were reported below the quantification limits). In total, 43 different pesticides were found in animal products; the most frequently found pesticides were DDT and HCH which were detected in 13.4% and 11.6% of the samples analysed for these pesticides, respectively. These substances are considered as persistent organic pollutants which have a tendency to bio accumulate in fat matrices. In the EU the use of these pesticides is banned.

In 2010, multiple residues of two or more pesticides were found in 26.6% of the analysed surveillance samples. The highest frequency of multiple residues was found in processed peppers (46 surveillance samples; 2.8%). Important commodities with high frequencies of multiple residues were liver (95.7%), citrus fruit (62.8%) and strawberries (60.5%). 338 unprocessed surveillance samples were found to exceed two or more EU MRLs.

A specific analysis regarding multiple residues in lettuce showed that 41.1% (1,051 samples) of surveillance samples for lettuce contained no residues, while 18.1% (462 samples) contained one pesticide residue only. 40.9% of the samples (1,046 samples) had multiple residues. Samples from Belgium, Ireland, France, Germany and Hungary had the highest occurrence rates of samples containing more than one pesticide. The most frequently found pesticides in multiple residue samples were iprodione, boscalid, cyprodinil, dithiocarbamates and propamocarb (sum).

Residues of two or more pesticides were found in 19,382 samples, corresponding to 26.6% of the surveillance samples analysed. Important commodities for human consumption with high frequencies of multiple residues were liver (95.7% of 23 liver samples), citrus fruits (62.8% of 4,363 citrus fruit samples) and strawberries (60.5% of 2,479 strawberries samples).

Recommendations

It is recommended to improve the analytical methods in order to be capable of quantifying residues at the MRL with sufficient accuracy. Therefore, it is considered necessary to continue the collaboration between the European Reference Laboratories and the national laboratories on the development and implementation of adequate analytical methods (in particular for the baby food analysis). It is also recommended to continue including EU Proficiency Tests for pesticides for which MRLs lower than the default limit of 0.01 mg/kg are set in the legislation specific for baby food. Furthermore, the European Commission is recommended to align the residue definitions set in the legislation specific for baby food and in the pesticide MRL legislation in food and feed.

Some data analyses were hampered because relevant information was not reported by the reporting countries. Therefore, it is recommended to the Member Sates to make efforts, in particular when reporting the following information:

- possible reasons for MRL exceedances and

- production methods for samples analysed (e.g. conventionally or organically produced food)

Member States are encouraged to conduct possible follow-up investigations at farm level for samples of domestic products where exceedances were reported. This would help to better understand the reasons for MRL exceedances and devise strategies for reducing the number of MRL breaches.

EFSA also recommends collecting and publishing processing factors which can be used for enforcement of the legal values in processed commodities in line with the provision of Regulation (EC) No. 396/2005 on the establishment of Annex VI of the processing factors.

EFSA recommends giving clear guidance to reporting countries on how to report the results for food of animal origin for pesticide residues which are labelled as fat soluble in the pesticide legislation and giving practical examples on how the provisions explained in the footnotes of Regulation (EC) No 178/2006 and Regulation (EU) No 600/2010 are to be applied in practice.

5. Dietary exposure and dietary risk assessment

According to Article 32 of Regulation (EC) No 396/2005, EFSA is required to assess the consumer dietary exposure to pesticide residues and to provide an analysis of the chronic and acute consumer health risks resulting from pesticide residues in and on food. EFSA should also consider other relevant information to perform these assessments, in particular the reports submitted under Directive 96/23/EC[65].

Dietary exposure is basically calculated according to the simplified equation:

$$\text{Dietary exposure} = \frac{\Sigma(\textit{residue concentration} \times \textit{food consumption})}{\text{body weight}}$$

In the chronic (long-term) and acute (short-term) risk assessment, the estimated dietary exposure for a certain pesticide is compared with its toxicological reference values, i.e. the Acceptable Daily Intake (ADI) and the Acute Reference Dose (ARfD), respectively. The toxicological reference values are derived following a full hazard characterisation of a pesticide.

As long as the dietary exposure is lower than or equal to the toxicological reference values (exposure ≤100% of the ADI or ARfD) a consumer health risk can be excluded with a degree of certainty. However, if the calculated dietary exposure exceeds the ADI or the ARfD, effects on the consumer health might occur and consequently appropriate risk management options should be considered, e.g. the withdrawal of products from the market which were identified as posing a possible health risk or restrictions regarding the use of certain pesticides to avoid future problems.

Usually a tiered approach is recommended for performing exposure assessments, where the lower tier calculations should be based on conservative assumptions which are likely to overestimate the actual consumer exposure (risk screening). The calculation models used for the first tier calculations are typically of lower complexity requiring fewer resources, meaning that the selection of input values and the calculation algorithms are based on simplistic assumptions. Refined calculations (higher tier calculations) usually require more detailed data for both the residue concentrations on the food products consumed and the food consumption, and would involve more sophisticated calculation methodologies.

Currently no agreed international or European methodology for estimating the actual chronic and acute exposure to pesticide residues measured in monitoring programmes is available. EFSA decided to adapt the risk assessment methodology developed for the risk assessment in the context of pesticide authorisations (EFSA PRIMo) for this purpose (EFSA, 2007). The model implements the principles of the WHO methodologies for short-term and long-term risk assessment (FAO, 2009), taking into account the food consumption data available for the European population. The EFSA PRIMo is a risk screening tool which allows the performance of lower tier risk assessments. As long as the results obtained with the EFSA PRIMo standard settings do not raise concerns regarding consumer safety, no further refined calculations are considered necessary.

The assumptions and considerations relevant for the short-term and long-term exposure assessment are outlined in sections 5.1 and 5.3, respectively.

According to the WHO methodology and the risk assessment approach used at EU level in the framework of pesticide authorisations and MRL setting, the dietary exposure to pesticide residues is calculated for each individual active substance separately. However, Regulation (EC) No 396/2005

[65] The report for 2010 on the results from monitoring of veterinary medicinal product residues and other substances in live animals and animal products (EFSA, 2012a) highlighted the limitations of the available monitoring data for veterinary drugs residues. Since the results are reported only in a highly aggregated form, without providing detailed information on the residue concentrations found in the individual samples, the data can not be used for dietary exposure calculations.

acknowledges that consumers are expected to be exposed to multiple residues present on food eaten with one meal, during one day or over a longer period which may lead to cumulative (additive or synergistic) effects on human health. EFSA has therefore initiated the development of a methodology to assess such effects (EFSA, 2008; EFSA, 2009; EFSA, 2012b) and the work is still ongoing on this project. Pending the availability of the final EU methodology, EFSA performed an indicative estimation of the cumulative long-term exposure for one group of pesticides (see section 5.5) and an indicative short-term assessment for one crop which was considered of relevance (lettuce, see section 4.6.5.1). The calculations performed in this context are intended to provide practical examples how cumulative assessments for pesticide residues could be performed in future. However, the calculations are made without any prejudice on the final methodology to be used in the context of post-authorisation risk assessment. Thus, the results have to be taken as indicative.

5.1. Model assumptions for the short-term (acute) exposure assessment

For the calculation of the short-term intake, EFSA calculated the International Estimation of Short Term Intake (IESTI) following the methodology described by JMPR (FAO, 2009). However, in some aspects (see below), the methodology was modified. Basically, the IESTI methodology implies the coincidence of the following events:

A consumer who eats a **large portion size** of the food item under consideration (normally 97.5th percentile of the daily food consumption reported in food surveys, considering only persons who have consumed the pertinent food item during the reference period) consumes a food item belonging to the **lot which contains the highest residue measured** (HRM) in the framework of the EU-coordinated or any of the national surveillance control programmes. Possible reduction of residues on the food commodity eaten (e.g. via washing, storage etc.) were not considered in the calculations. Finally, it was assumed that the samples containing the HRH originated from lots/consignments placed on the market and therefore were available for consumption.

The HRM is multiplied by a factor (variability factor) which accommodates for potential **inhomogeneous residue distribution** among the individual units in the same lot/sample analysed. The variability factors depend on the unit size of the food item: for food commodities with a unit weight between 25 and 250 g, a factor of 7 is applied (e.g. aubergines, bananas and peppers). The underlying assumption is that the consumer may pick out a highly contaminated unit which contains a residue that is seven-fold higher than that in the composite which was analysed in a monitoring programme. For food commodities with a unit weight of more than 250 g (e.g. cauliflower), a variability factor of 5 is applied. No variability factor is used for commodities with unit weights less than 25 g (e.g. peas without pods and wheat)[66].

It should be stressed that the co-occurrence of the above events (i.e. large portion size, highest residue measured and inhomogeneous residue distribution) is rather unlikely. In case the estimated consumer exposure based on these very conservative assumptions leads to an exceedance of the toxicological reference values, the degree of exceedance (expressed in percent of the ARfD) and the probability of such an event occurring have to be considered.

The short-term assessment is carried out separately for each pesticide/crop combination as it is considered unlikely that a consumer will eat two or more different commodities in large portions within a short period of time and that all of these commodities contain residues of the same pesticide at the highest level observed during the reporting year.

[66] In 2007, JMPR recommends to use a variability factor of 3 for all commodities with unit weight greater than 25 g instead of the variability factors of 5, 7 and 10 as recommended in the previous guidelines (FAO, 2009). At European level the choice of the most appropriate variability factor to be used for the acute risk assessment is still under discussion. However, so far Member States did not agree to reduce the variability factor. Thus, at EU level the calculations are performed with the more conservative variability factors of 5 and 7. The variability factor of 10 which was recommended by JMPR to be used for leafy vegetables was found to be overly conservative and was therefore not included in the EFSA PRIMo as default variability factor (EFSA, 2007).

The short-term exposure assessments were performed for the active substances covered by the 2010 EU-coordinated programme (Table 2-2), considering the 11 food commodities for which the reporting countries had to submit data (i.e. apples, head cabbage, leek, lettuce, milk, oats, peaches, rye, strawberries, swine meat and tomatoes) (Table 2-1). In addition, the short-term exposure was calculated for amitraz residues measured in pears, a pesticide/crop combination which was also included in the EU-coordinated programme.

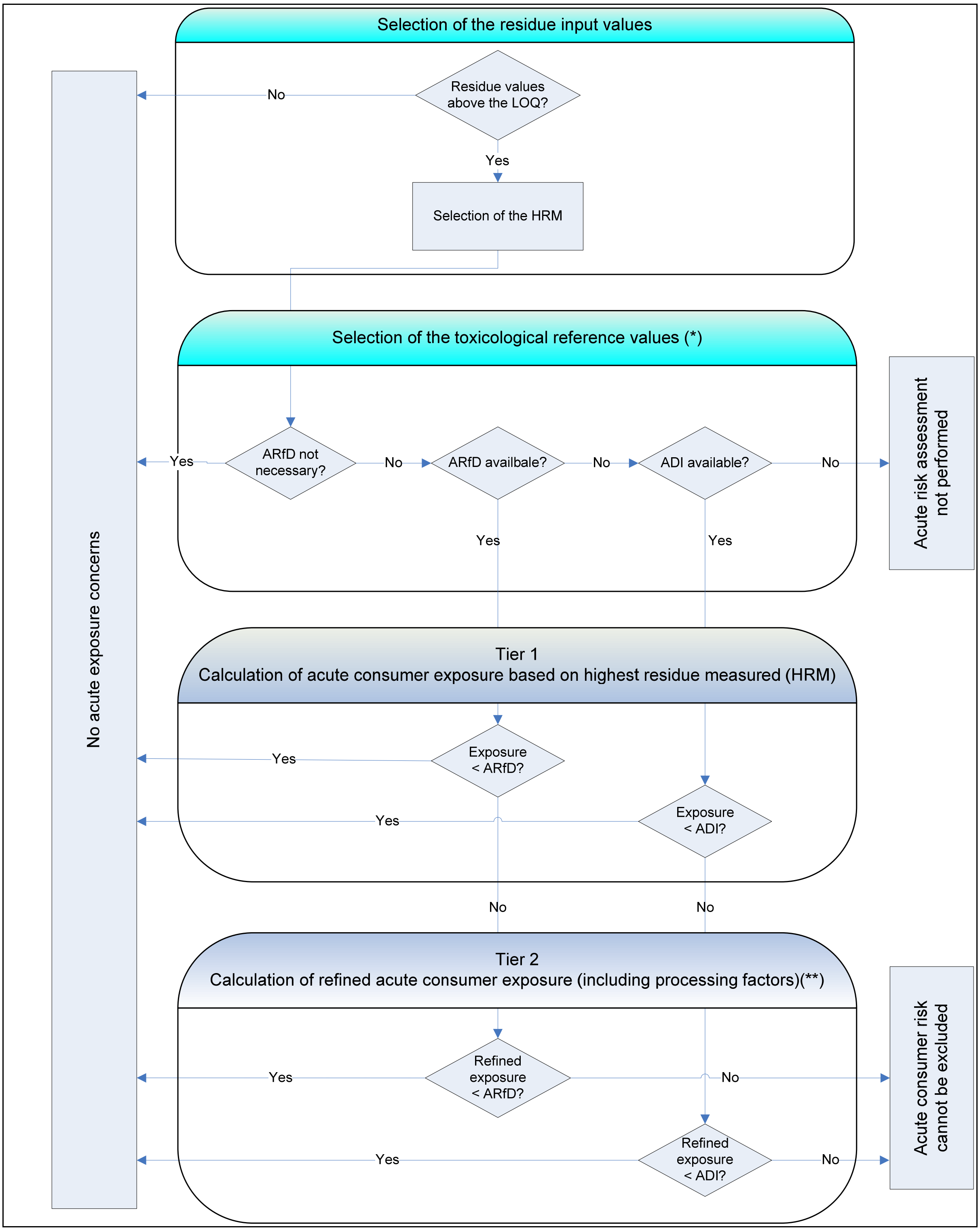
The short-term (acute) consumer exposure is calculated using the following input parameters:

- For each pesticide/crop combination the HRM identified considering all the results reported in the framework of the 2010 EU-coordinated and national programmes (surveillance samples only) and reported above the LOQ. In total, 18,243 samples were considered for this exercise. The following results transmitted by the reporting countries were excluded from the HRM identification:
  - Analytical determinations for which the limit of quantification (LOQ) was not reported;
  - Results not compliant with the legal residue definition.

  For deriving the HRM, all results submitted by reporting countries are considered as described. However, it would be desirable to receive more information from reporting countries whether lots which were exceeding the MRL were actually placed on the market and are therefore relevant for deriving the HRM to be used for the acute consumer risk assessment or whether these lots were destroyed/rejected before they actually reached the consumers.
- For swine meat samples, where the residue levels reported were expressed on a fat basis, the residue concentrations have been recalculated taking into account the fat content of the samples as reported.
- Large portion food consumption data retrieved from the EFSA PRIMo (EFSA, 2007)
- Unit weight for the individual food commodities (retrieved from the EFSA PRIMo, EFSA, 2007)

The general approach used in assessing the acute risk is represented in Figure 5-1.

The ARfD values selected for the risk assessment can be found in section 5.1.1.



(*) In case the residue definition for a given pesticide/crop combination contains more components (each of them having a different ARfD) the ARfD selected for the acute exposure calculation is indicated in Table 5-1.

(**) The processing/peeling factors are applied only to food commodities normally not consumed raw or without processing (i.e. rye, oats and swine meat).

Figure 5-1: Flow chart for the tiered approach used in assessing the potential acute consumer health risk for each pesticide/crop combination included in the 2010 EU-coordinated programme.

5.1.1. Toxicological reference values for the acute exposure

In order to perform the risk assessment, the calculated exposure for a certain pesticide/crop combination was compared with the ARfD value established for the concerned pesticide. In Table Table 5-1 the ARfD values used for the acute risk assessment are listed. It should be mentioned that some of the ARfD values were derived recently and were not in place in 2010 when the monitoring results were generated. For 35 substances with low acute toxicity the toxicological assessments concluded that the setting of an ARfD is not necessary. These substances are therefore not relevant for acute exposure assessment.

For a total of 16 substances the short-term risk assessment has been performed with the ADI instead of the ARfD because these have not been evaluated with regard to the setting of the ARfD and/or the setting of the ARfD was not finalised. The list of ADI values can be found in Table 5-1. For seven substances for which neither and ARfD nor an ADI was available (azinphos-ethyl, camphechlor, HCH (alpha isomer), HCH (beta isomer), hexachlorobenzene, propargite and trichlorfon), no acute risk assessment could be performed[67].

Table 5-1: ARfD values used for the short-term risk assessment.

Pesticide	ARfD[(1)] (mg/kg bw)	ARfD evaluation year	ARfD source
2,4-D	ARfD not necessary	2011	COM
Abamectin	0.005	2008	COM
Acephate	0.1	2005	JMPR
Acetamiprid	0.1	1999	COM
Acrinathrin	0.01	2010	EFSA
Aldicarb	0.003	2001	JMPR
Amitraz	0.01	2003	COM
Amitrole	ARfD not necessary	2001	COM
Azinphos-ethyl	No ARfD and no ADI allocated		
Azinphos-methyl	0.01	2006	COM
Azoxystrobin	ARfD not necessary	2011	COM
Benfuracarb	0.02	2009	EFSA
Bifenthrin	0.03	2011	EFSA
Bitertanol	0.01	2011	COM
Boscalid	ARfD not necessary	2008	COM
Bromide ion	No ARfD available; no acute risk assessment is performed		
Bromopropylate	No ARfD available; acute risk assessment performed with ADI (0.03 mg/kg bw per d; 1993 JMPR)		
Bromuconazole	0.1	2010	COM
Bupirimate	ARfD not necessary	2011	COM
Buprofezin	0.5	2010	COM
Cadusafos (aka ebufos)	0.003	2009	EFSA
Camphechlor	No ARfD and no ADI allocated		
Captan	0.3	2008	COM
Carbaryl	0.01	2006	EFSA
Carbendazim	0.02[(2)]	2010	COM
Carbofuran	0.00015	2009	EFSA
Carbosulfan	0.005	2009	EFSA
Chlordane	No ARfD available; acute risk assessment performed with ADI (0.0005 mg/kg bw per d; 1994 JMPR)		

[67] For some pesticides the toxicological reference values (ADI/ARfD) are not available because the national/EU/international toxicological assessment was not finalised or carried out due to e.g. the incomplete toxicological dossier.

Pesticide	ARfD[1] (mg/kg bw)	ARfD evaluation year	ARfD source
Chlorfenapyr	0.015	1999	ECCO
Chlorfenvinphos	No ARfD available; acute risk assessment performed with ADI (0.0005 mg/kg bw per d; 1994 JMPR)		
Chlormequat	0.07[3]	2009	COM
Chlorobenzilate	No ARfD available; acute risk assessment performed with ADI (0.02 mg/kg bw per d; 1980 JMPR)		
Chlorothalonil	0.6	2006	COM
Chlorpropham	0.5	2004	COM
Chlorpyrifos	0.1	2005	COM
Chlorpyrifos-methyl	0.1	2005	COM
Clofentezine	ARfD not necessary	2010	COM
Clothianidin	0.1	2006	COM
Cyfluthrin	0.02	2003	COM
Cypermethrin	0.2[4]	2005	COM
Cyproconazole	0.02	2011	COM
Cyprodinil	ARfD not necessary	2006	COM
DDT	ARfD not necessary	2000	JMPR
Deltamethrin	0.01	2003	COM
Diazinon	0.025	2006	EFSA
Dichlofluanid	No ARfD available; acute risk assessment performed with ADI (0.3 mg/kg bw per d; 1983 JMPR)		
Dichlorvos	0.002 (tentative value)	2006	EFSA
Dicloran	0.025	2010	EFSA
Dicofol	0.2	2011	JMPR
Dieldrin	0.003	2007	EFSA
Difenoconazole	0.2	2008	COM
Dimethoate	0.01[5]	2007	COM
Dimethomorph	0.6	2007	COM
Dinocap	0.004	2007	COM
Diphenylamine	ARfD not necessary	2008	EFSA
Dithiocarbamates: Mancozeb	0.34[6]	2005	COM
Dithiocarbamates: Ziram	0.04[6]	2004	COM
Endosulfan	0.015	2001	ECCO
Endrin	No ARfD available; acute risk assessment performed with ADI (0.0002 mg/kg bw per d; 1994 JMPR)		
Epoxiconazole	0.023	2008	COM
Esfenvalerate, Fenvalerate	0.05	2000	COM
Ethephon	0.05	2008	COM
Ethion (aka diethion)	No ARfD available; acute risk assessment performed with ADI (0.002 mg/kg bw per d; 1990 JMPR)		
Ethoprophos	0.01	2006	EFSA
Etofenprox	1	2009	COM
Fenamiphos (aka phenamiphos)	0.0025	2006	COM
Fenarimol	0.02	2006	COM
Fenazaquin	0.1	2011	COM
Fenbuconazole	0.3	2010	COM
Fenbutatin oxide	0.1	2011	COM

Pesticide	ARfD[1] (mg/kg bw)	ARfD evaluation year	ARfD source
Fenhexamid	ARfD not necessary	2001	COM
Fenitrothion	0.013	2006	EFSA
Fenoxycarb	2	2011	COM
Fenpropathrin	No ARfD available; acute risk assessment performed with ADI (0.03 mg/kg bw per d; 1993 JMPR)		
Fenpropimorph	0.03	2008	COM
Fenthion	0.01	2000	JMPR
Fipronil	0.009	2007	COM
Fluazifop-P-butyl	0.017	2011	COM
Fludioxonil	ARfD not necessary	2007	COM
Flufenoxuron	ARfD not necessary	2011	EFSA
Fluquinconazole	0.02	2011	COM
Flusilazole	0.005[7]	2007	COM
Flutriafol	0.05	2011	COM
Folpet	0.2	2008	COM
Formetanate	0.005	2007	COM
Fosthiazate	0.005	2003	COM
Glyphosate	ARfD not necessary	2001	COM
Haloxyfop	0.075	2006	EFSA
HCH (Hexachlorcyclohexane), Alpha-isomer	No ADI and no ARfD allocated		
HCH (Hexachlorcyclohexane), Beta-isomer	No ADI and no ARfD allocated		
Heptachlor	No ARfD available; acute risk assessment performed with ADI (0.0001 mg/kg bw per d; 1994 JMPR)		
Hexachlorobenzene	No ADI and no ARfD allocated		
Hexaconazole	No ARfD available; acute risk assessment performed with ADI (0.005 mg/kg bw per d; 1990 JMPR)		
Hexythiazox	ARfD not necessary	2011	COM
Imazalil	0.05	2011	COM
Imidacloprid	0.08	2008	COM
Indoxacarb	0.125	2005	COM
Iprodione	ARfD not necessary	2002	COM
Iprovalicarb	ARfD not necessary	2002	COM
Kresoxim-methyl	ARfD not necessary	2011	COM
lambda-Cyhalothrin	0.0075	2001	COM
Lindane (HCH, Gamma isomer)	0.06	2000	COM
Linuron	0.03	2002	COM
Lufenuron	ARfD not necessary	2009	COM
Malathion	0.3	2010	COM
Mepanipyrim	ARfD not necessary	2004	COM
Mepiquat	0.23[8]	2008	COM
Metalaxyl-M, metalaxyl	0.5	2002	COM
Metconazole	0.01	2006	COM
Methamidophos	0.003	2007	COM
Methidathion	0.01	1997	JMPR
Methiocarb	0.013	2007	COM
Methomyl	0.0025[9]	2009	COM
Methoxychlor	No ARfD available; acute risk assessment performed with ADI (0.1 mg/kg bw per d; 1977 JMPR)		

Pesticide	ARfD[1] (mg/kg bw)	ARfD evaluation year	ARfD source
Methoxyfenozide	0.2	2005	COM
Monocrotophos	0.002	1995	JMPR
Myclobutanil	0.31	2010	COM
Omethoate	0.002[5]	2007	COM
Oxadixyl	No ARfD available; acute risk assessment performed with ADI (0.01 mg/kg bw per d; 1984 FR)		
Oxamyl	0.001	2006	COM
Oxydemeton-methyl	0.0015	2006	COM
Paclobutrazol	0.1	2011	COM
Parathion	0.005	2001	ECCO 100
Parathion-methyl	0.03	1995	JMPR
Penconazole	0.5	2009	COM
Pencycuron	ARfD not necessary	2011	COM
Pendimethalin	ARfD not necessary	2003	COM
Permethrin	1.5	2000	COM
Phenthoate	No ARfD available; acute risk assessment performed with ADI (0.003 mg/kg bw per d; 1984 JMPR)		
Phosalone	0.1	2006	EFSA
Phosmet	0.045	2007	COM
Phoxim	No ARfD available; acute risk assessment performed with ADI (0.00375 mg/kg bw per d; 2000 EMEA)		
Pirimicarb	0.1	2006	COM
Pirimiphos-methyl	0.15	2007	COM
Prochloraz	0.025	2011	COM
Procymidone	0.012	2007	DAR FR
Profenofos	1	2007	JMPR
Propamocarb	0.84[10]	2007	COM
Propargite	No ADI and no ARfD allocated	2011	EFSA
Propiconazole	0.3	2003	COM
Propyzamide	ARfD not necessary	2003	COM
Prothioconazole	0.01	2008	COM
Pyraclostrobin	0.03	2004	COM
Pyrazophos	0.001	1998	DE
Pyrethrins	0.2	2008	COM
Pyridaben	0.05	2010	COM
Pyrimethanil	ARfD not necessary	2006	EFSA
Pyriproxyfen	10	2008	COM
Quinoxyfen	ARfD not necessary	2003	COM
Quintozene	ARfD not necessary	2000	COM
Resmethrin	No ARfD available; acute risk assessment performed with ADI (0.03 mg/kg bw per d; 1991 JMPR)		
Spinosad	ARfD not necessary	2006	COM
Spiroxamine	0.1	2011	COM
Tau-Fluvalinate	0.05	2010	COM
Tebuconazole	0.03	2008	COM
Tebufenozide	ARfD not necessary	2011	COM
Tebufenpyrad	0.02	2009	COM
Tecnazene	No ARfD available; acute risk assessment performed with ADI (0.02 mg/kg bw per d; 1994 JMPR)		

Pesticide	ARfD[(1)] (mg/kg bw)	ARfD evaluation year	ARfD source
Teflubenzuron	ARfD not necessary	2008	COM
Tefluthrin	0.005	2010	COM
Tetraconazole	0.05	2008	COM
Tetradifon	ARfD not necessary	2002	DE
Thiabendazole	ARfD not necessary	2001	COM
Thiacloprid	0.03	2004	COM
Thiametoxam	0.5	2007	COM
Thiophanate-methyl	0.2	2005	COM
Tolclofos-methyl	ARfD not necessary	2006	COM
Tolylfluanid	0.25	2006	COM
Triadimenol	0.05[(11)]	2008	COM
Triazophos	0.001	2002	JMPR
Trichlorfon	No ADI and no ARfD allocated		
Trifloxystrobin	ARfD not necessary	2003	COM
Triflumuron	ARfD not necessary	2011	COM
Trifluralin	ARfD not necessary	2005	EFSA
Triticonazole	0.05	2006	COM
Vinclozolin	0.06	2006	COM
Zoxamide	ARfD not necessary	2003	COM

(1) For the short-term risk assessment, the most recent ARfDs available were used. It should be mentioned that some of the ARfD values were derived recently and were not in place in 2010 when the monitoring results were generated. For active substances for which no ARfD was available, the acute risk assessment was performed with the ADI (see Table 5-4).

(2) Carbendazim and benomyl: the legal residue definition refers to the sum of these two substances. For the acute risk assessment the ARfD set for carbendazim (0.02 mg/kg bw) was applied because the use of benomyl is not authorised in the EU and therefore it is most likely that the measured residues refer to carbendazim.

(3) Chlormequat: the ARfD derived in the peer review for chlormequat chloride (0.09 mg/kg) was recalculated to chlormequat by applying a molecular weight conversion factor to match with the residue definition which is expressed as chlormequat (ion).

(4) Cypermethrin: the legal residue definition is set to cypermethrin, including other mixtures of constituent isomers. For the acute risk assessment the ARfD derived for the isomeric mixture is used (0.2 mg/kg bw). For alpha-cypermethrin and zeta-cypermethrin different ARfD values are derived: 0.04 mg/kg bw and 0.125 mg/kg bw respectively.

(5) Dimethoate: the residue definition (sum of dimethoate and omethoate) comprises compounds for which different ARfD values were set. Therefore two scenarios were calculated, the first with the ARfD of dimethoate (0.01 mg/kg bw), the second with the ARfD of omethoate (0.002 mg/kg bw), assuming that the reported residues (sum of dimethoate and omethoate) comprise only dimethoate (scenario 1) or omethoate (scenario 2).

(6) Dithiocarbamates: the residue definition covers compounds for which different ARfD values were set. Therefore two scenarios were calculated, the first with the ARfD of mancozeb (highest), the second with the ARfD of ziram (lowest) as both substances are authorised. The ARfDs for mancozeb and ziram derived in the peer review (0.6 mg/kg bw and 0.08 mg/kg bw, respectively) were recalculated to CS_2 by multiplying with a molecular weight correction factor. The following conversion factors were applied: mancozeb: 0.56; ziram: 0.5. For other dithiocarbamates the following ARfD values are available: maneb: 0.2 mg/kg bw, propineb: 0.1 mg/kg bw, thiram: 0.6 mg/kg bw, metiram: no ARfD necessary.

(7) Flusilazole: according to Review Report of the European Commission the ARfD refers to women of child bearing age (6850/VI/97, 5 January 2007, http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail) .

(8) Mepiquat: the ARfD derived in the peer review for mepiquat chloride (0.03 mg/kg bw) by recalculated to mepiquat multiplying with a molecular weight correction factor to match with the residue definition which is expressed as mepiquat (ion).

(9) Methomyl: the legal residue definition is set to the sum of methomyl and thiodicarb. For the acute risk assessment, the methomyl ARfD (0.0025 mg/kg bw) was used, as the use of methomyl is authorised at EU level (the use of thiodicarb is not authorised) and therefore the summed residues reported are most likely due to methomyl rather than thiodicarb residues.

(10) Propamocarb: the ARfD derived by the peer review for propamocarb hydrochloride (1 mg/kg bw) was recalculated to propamocarb by multiplying with a molecular weight correction factor to match with the residue definition which is expressed as propamocarb.

(11) Triadimenol: the residue definition is set to the sum of triadimenol and triadimefon. For the acute risk assessment, the triadimenol ARfD (0.05 mg/kg bw) was used as its use is authorised at EU level, while the use of triadimefon is not authorised. As a result, the summed residues are most likely due to the residues of triadimenol.

5.1.2. Residue levels

The first tier IESTI calculations were performed with the residue levels reported in Table 5-2. The table does not contain data concerning pesticides for which no ARfD was deemed necessary or where no toxicological reference value is available (see Table 5-1). Shaded cells in the table refer to pesticide/crops which were not covered by the 2010 EU-coordinated programme. White empty cells refer to pesticide/crop combinations for which samples were analysed, but none of the samples contained measurable residues (i.e. all results were reported below the LOQ).

The monitoring results were reported according to the enforcement residue definition as defined in Regulation (EC) No 396/2005. A re-calculation to the risk assessment residue definition was not possible because the conversion factors are currently not available.

Table 5-2: Highest residue measured (HRM) in mg/kg used as input values for the short-term dietary exposure calculations (tier 1).

Pesticide (residue definition for the concerned food commodities)	**Apples**	**Head cabbage**	**Leek**	**Lettuce**	**Milk**	**Oats**	**Peaches**	**Rye**	**Strawberries**	**Swine meat**	**Tomatoes**
Abamectin (sum of avermectin B1a, avermectin B1b and delta-8,9 isomer of avermectin B1a)				0.055					0.052		
Acephate	0.010						0.029				
Acetamiprid	0.099	0.008		1.61			0.092		0.070		0.670
Acrinathrin			0.160	0.080			0.110		0.240		0.079
Aldicarb (sum of aldicarb, its sulfoxide and its sulfone, expressed as aldicarb)		0.003									
Aldrin and dieldrin (aldrin and dieldrin combined expressed as dieldrin)											
Azinphos-methyl	0.068		0.011				0.047		0.020		
Benfuracarb											
Bifenthrin	0.157		0.010	1.25		0.012	0.250		0.150		0.300
Bitertanol	0.077			0.012			0.320				0.573
Bromopropylate			0.470			0.020		0.009			0.016
Bromuconazole (sum of diasteroisomers)											
Buprofezin	0.010	0.040		0.028			0.060				0.480
Cadusafos											
Captan			0.440	0.020			3.20				
Captan/Folpet (sum of captan and folpet)	2.72								3.70		
Carbaryl	0.021						0.032		0.015		0.016
Carbendazim and benomyl (sum of benomyl and carbendazim expressed as carbendazim)	0.440	0.011	0.010	0.190		0.078	0.640	0.082	0.287		0.200
Carbofuran (sum of carbofuran and 3-hydroxycarbofuran expressed as carbofuran)				0.018							
Carbosulfan											
Chlordane (sum of cis- and trans-isomers and oxychlordane expressed as chlordane)											
Chlorfenapyr	0.032								0.170		0.034
Chlorfenvinphos	0.010			0.002							
Chlormequat						15.0		2.41			
Chlorobenzilate											
Chlorothalonil	0.260	0.600	0.930	3.28			0.906		2.10		1.81
Chlorpropham (chlorpropham and 3-chloroaniline expressed as chlorpropham)	0.021						0.002		0.047		0.010
Chlorpyrifos	0.500	0.290	0.099	1.04	0.001	0.040	0.680	0.020	0.160		0.410
Chlorpyrifos-methyl	0.270		0.010	0.034		1.13	0.500	0.071	0.138		0.400
Clothianidin	0.012			0.023			0.012				0.030
Cyfluthrin (cyfluthrin incl. other mixtures of constituent isomers (sum of isomers))	0.030	0.040		0.116			0.190				0.040

Pesticide (residue definition for the concerned food commodities)	**Apples**	**Head cabbage**	**Leek**	**Lettuce**	**Milk**	**Oats**	**Peaches**	**Rye**	**Strawberries**	**Swine meat**	**Tomatoes**
Cypermethrin (cypermethrin incl. other mixtures of constituent isomers (sum of isomers))	0.390	0.590	1.00	1.30			0.600		0.140	0.030	0.460
Cyproconazole	0.014	0.110				0.020	0.098		0.062		0.049
Deltamethrin (cis-deltamethrin)	0.036	0.020	0.020	0.340		0.410	0.120		0.076		0.220
Diazinon	0.200	0.012		0.017		0.015			0.012	0.011	
Dichlofluanid	0.160										0.003
Dichlorvos	0.080						0.030		0.029		0.010
Dicloran		0.017		0.440							0.180
Dicofol (sum of p,p′ and o,p′ isomers)	0.156										0.050
Difenoconazole	0.080	0.380	0.090	0.180			0.070		0.024		0.770
Dimethoate (sum of dimethoate and omethoate expressed as dimethoate)	1.20	0.089		0.700			1.27		0.033		0.045
Dimethoate	1.20	0.015		0.580					0.033		0.030
Omethoate	0.120	0.056		0.120							0.018
Dimethomorph	0.050	1.60	0.031	10.0			0.010		0.064		0.270
Dinocap (sum of dinocap isomers and their corresponding phenols expressed as dinocap)											
Dithiocarbamates (dithiocarbamates expressed as CS_2, including maneb, mancozeb, metiram, propineb, thiram and ziram)	1.90	3.00	2.01	13.4		0.050	1.29	0.900	7.00		1.11
Endosulfan (sum of alpha- and beta-isomers and endosulfan-sulphate expressed as endosulfan)	0.054			0.140			0.071		0.080		0.300
Endrin					0.00008						
Epoxiconazole						0.060		0.018	0.060		0.050
Ethephon	0.043							0.010			3.80
Ethion		0.018							0.320		
Ethoprophos							0.011				
Etofenprox	0.051	0.600		0.780			0.200		0.059		0.210
Fenamiphos (sum of fenamiphos and its sulfoxide and sulfone expressed as fenamiphos)		0.009									0.030
Fenarimol	0.030			0.020					0.078		0.016
Fenazaquin	0.050						0.077		0.210		0.041
Fenbuconazole	0.022						0.140		0.019		
Fenbutatin oxide	0.199			0.014			0.022	0.004	0.011		0.051
Fenitrothion	0.021										
Fenoxycarb	0.123						0.094				
Fenpropathrin	0.100						0.087		0.070		
Fenpropimorph	0.030		0.087	0.005					0.049		
Fenthion (sum of fenthion and its oxygen analogue, their sulfoxides and sulfone expressed as parent)	0.110						0.056				
Fenvalerate and Esfenvalerate (sum of RS/SR and RR/SS isomers)							0.026				
Fipronil (sum of fipronil and sulfone metabolite (MB46136) expressed as fipronil)											
Fluazifop (fluazifop-P-butyl (fluazifop acid (free and conjugate)))		0.255	0.038	0.004					0.011		
Fluquinconazole	0.020										
Flusilazole	0.015					0.030	0.006		0.004		0.010
Flutriafol	0.030								0.454		0.055
Folpet				17.0							
Formetanate (sum of formetanate and its salts expressed as formetanate (hydrochloride))									0.260		
Fosthiazate											
Haloxyfop including Haloxyfop-R (Haloxyfop-R methyl ester, haloxyfop-R and conjugates of haloxyfop-R expressed as haloxyfop-R)			0.055	0.024					0.003		
Heptachlor (sum of heptachlor and										0.0007	

Pesticide (residue definition for the concerned food commodities)	**Apples**	**Head cabbage**	**Leek**	**Lettuce**	**Milk**	**Oats**	**Peaches**	**Rye**	**Strawberries**	**Swine meat**	**Tomatoes**
heptachlor epoxide expressed as heptachlor)											
Hexaconazole	0.050						0.024		0.053		
Imazalil	1.13	0.014		0.020			0.066		0.023		1.40
Imidacloprid	0.070	0.120	0.001	0.900		0.029	0.170		0.120		0.550
Indoxacarb (indoxacarb as sum of the isomers S and R)	0.174	0.160	0.058	0.810			0.130		0.010		0.150
Lambda-Cyhalothrin	0.087	0.064	0.035	0.660			0.200		0.300		0.064
Lindane (gamma-isomer of hexachlorocyclohexane (HCH))					0.00008					0.0002	
Linuron		0.017	0.084	0.018				0.020			
Malathion (sum of malathion and malaoxon expressed as malathion)						0.012	0.029	0.060			
Mepiquat						0.250		1.74			
Metalaxyl and metalaxyl-M (metalaxyl incl. other mixtures of constituent isomers incl. Metalaxyl-M (sum of isomers))	0.032	0.024	0.012	0.882			0.040		0.077		0.110
Metconazole											
Methamidophos	0.060								1.50		0.026
Methidathion	0.012	0.026					0.030				
Methiocarb (sum of methiocarb and methiocarb sulfoxide and sulfone, expressed as methiocarb)		0.025	0.042	0.030			0.410		0.310		
Methomyl and Thiodicarb (sum of methomyl and thiodicarb expressed as methomyl)		0.055		0.024					0.435		
Methoxychlor											
Methoxyfenozide	0.176	0.130					0.160				0.390
Monocrotophos									0.028		
Myclobutanil	0.106			0.076			0.079		0.390		0.050
Oxadixyl				0.210							0.046
Oxamyl		0.250							0.100		0.380
Oxydemeton-methyl (sum of oxydemeton-methyl and demeton-S-methylsulfone expressed as oxydemeton-methyl)	0.026										
Paclobutrazole	0.010										
Parathion											
Parathion-methyl (sum of parathion-methyl and paraoxon-methyl expressed as parathion-methyl)									0.020		
Penconazole	0.042	0.020					0.100		0.424		0.100
Permethrin (sum of isomers)										0.001	
Phentoate											
Phosalone	0.470										0.016
Phosmet (phosmet and phosmet-oxon expressed as phosmet)	0.160		0.016				0.240				0.014
Phoxim											
Pirimicarb (sum of pirimicarb and desmethyl pirimicarb expressed as pirimicarb)	0.222	0.080		0.468			0.086	0.035	0.460		0.099
Pirimiphos-methyl		0.023		0.029		4.10		3.20		0.001	0.500
Prochloraz (sum of prochloraz and its metabolites containing the 2,4,6-trichlorophenol moiety expressed as prochloraz)	0.027			0.020							0.020
Procymidone	0.020	0.021		0.700			0.088		0.590		0.470
Profenofos									0.090		
Propamocarb (sum of propamocarb and its salt expressed as propamocarb)		0.660	0.800	17.1			0.033		0.069		0.800
Propiconazole							0.035				0.011
Prothioconazole (prothioconazole (prothioconazole-desthio))											
Pyraclostrobin	0.200	0.070	0.069	1.20		0.012	0.180		0.470		0.360
Pyrazophos											
Pyrethrins	0.023			0.370					0.020		0.072

Pesticide (residue definition for the concerned food commodities)	**Apples**	**Head cabbage**	**Leek**	**Lettuce**	**Milk**	**Oats**	**Peaches**	**Rye**	**Strawberries**	**Swine meat**	**Tomatoes**
Pyridaben	0.030						0.130		0.050		0.055
Pyriproxyfen				0.017							0.150
Resmethrin (resmethrin including other mixtures of constituent isomers (sum of isomers))											
Spiroxamine	0.001			0.003							0.056
Tau-fluvalinate	0.034			2.80			0.010		0.022		0.010
Tebuconazole	1.00	0.300	0.167	0.035		0.100	0.600	0.029	0.061		0.290
Tebufenpyrad	0.090	0.014					0.050		0.429		0.110
Tecnazene											
Tefluthrin											0.029
Tetraconazole	0.110			0.013			0.090		0.150		0.057
Thiacloprid	0.860	0.076	0.012	0.840			0.080		1.09		0.170
Thiamethoxam (sum of thiamethoxam and clothianidin expressed as thiamethoxam)	0.240	0.018		0.524			0.190		0.200		0.080
Thiophanate-methyl	0.470	0.087		0.006		0.022	4.40		1.50		0.470
Tolylfluanid (sum of tolylfluanid and dimethylaminosulfotoluidide expressed as tolylfluanid)	0.140			0.020					0.160		0.047
Triadimefon and Triadimenol (sum of triadimefon and triadimenol)	0.040		0.109	0.050					1.30		0.130
Triazophos			0.007								
Triticonazole											
Vinclozolin (sum of vinclozolin and all metabolites cont. the 3,5-dichloraniniline moiety, expressed as vinclozolin)		0.010		0.152					0.261		0.017

In addition to the pesticides and commodities listed in Table 5-2 reporting countries had to analyse for amitraz residues on pears. The HRM for this combination amounted to 0.22 mg/kg.

5.2. Results of the short-term risk (acute) assessment

The results of the short-term risk assessment are presented in Table 5-3[68]. The exposure resulting from the highest residue measured for a certain pesticide/crop combination was calculated according to the model assumptions explained in section 5.1. The results are expressed in percent of the toxicological reference values. Thus, for pesticide/crop combinations where the exposure is below or at 100% no short-term consumer health risk is expected. Blank cells in the table refer to pesticide/crop combinations where the exposure was considered to be negligible because none of the samples analysed contained measurable residues. Results reported in bold font refer to residue findings which exceeded the MRL.

For 20 substances no residues were detected in quantifiable concentrations in any of the samples taken for the food commoditise requested to be analysed: aldrin and dieldrin, benfuracarb, bromuconazole (sum), cadusafos, carbosulfan, chlordane (sum), chlorbenzilate, dinocap (sum), fipronil (sum), fosthiazate, metconazole, methoxychlor, parathion, phenthoate, phoxim, prothioconazole, pyrazophos, resmethrin, tecnazene and triticonazole. These substances appear as completely empty rows in Table 5-3. For 30 pesticides at least one sample was identified which contained residues in concentrations that could pose a potential consumer health risk. The pesticide/crop combinations for which exceedances of the ARfD (or ADI) were identified are highlighted in the Table 5-3 by shading the respective cells in dark orange (exposure between 100% and 1,000% of the toxicological reference value) or dark red (exposure exceeding 1,000% of the ARfD/ADI).

For two compounds included in the EU monitoring programme (i.e. dimethoate/omethoate and dithiocarbamates) the residue definitions contain compounds with significantly different toxicity.

[68] The table does not contain the pesticides for which an ARfD was considered not necessary and substances for which no toxicological reference values for acute risk assessment are available.

Without knowing the nature of the residue found on the samples it is therefore impossible to perform an unambiguous risk assessment. Thus, for these two compounds EFSA calculated two scenarios: scenario 1 is based on the less conservative assumptions[69], whereas in scenario 2 the worst case assumptions – likely to be overly conservative - are implemented[70].

In total, for 79 samples/determinations the short-term consumer health risk could not be excluded. This number of samples/determinations reflects the calculations on the basis of the less conservative scenarios (scenario 1 for dimethoate/omethoate and dithiocarbamates). In scenario 2, calculated for dimethoate/omethoate and dithiocarbamates, for a total of 200 samples/determinations a potential acute risk was identified. The number of samples exceeding the toxicological threshold for a pesticide/crop combination is reported in brackets in Table 5-3.

Under scenario 1, the pesticide/crop combinations for which a potential acute risk could not be excluded amounted to 51.

Amitraz, which had to be analysed only in pears, is not included in Table 5-3. The highest estimated short-term exposure for this pesticide/crop combination accounted for 200.4% of the ARfD; the only sample that was found exceeding the toxicological threshold was also not compliant with the EU MRL.

The detailed results of the acute exposure assessments are reported individually for each pesticide in an exposure assessment summary report in Appendix IV.

Table 5-3: Summarized results of short-term dietary exposure assessment (exposure expressed in % of the ARfD or ADI – tier 1 calculation). The figure in brackets indicates the number of samples exceeding the toxicological threshold level; numbers reported in bold refer to combinations for which an MRL exceedance was reported.

Pesticide(*)	**Apples**	**Head cabbage**	**Leek**	**Lettuce**	**Milk**	**Oats**	**Peaches**	**Rye**	**Strawberries**	**Swine Meat**	**Tomatoes**
Abamectin (sum)				29.6					16.2		
Acephate	1.0						**1.7**				
Acetamiprid	9.7	0.4		43.4			5.5		**1.1**		**39.0**
Acrinathrin			**94.3**	**21.5**			65.3		37.4		45.9
Aldicarb (sum)		5.3									
Aldrin and Dieldrin (sum)											
Azinphos-methyl	**66.6**		6.5				27.9		3.1		
Benfuracarb											
Bifenthrin	51.3		2.0	112.1 (2)		0.2	**49.4**		7.8		**58.1**
Bitertanol	75.4			3.2			189.9 (1)				333.2 (5)
Bromopropylate			**92.4**			0.3		0.2			**3.1**

69 Scenario 1 for dimethoate/omethoate: it is assumed the samples would not contain the more toxic omethoate; the total residue reported as sum of dimethoate and omethoate expressed as dimethoate would only contains dimethoate. Scenario 1 for dithiocarbamates: it is assumed that the samples would contain only the less toxic compound of the dithiocarbamates group (i.e. mancozeb).

70 Scenario 2 for dimethoate/omethoate: it is assumed the samples would contain only the more toxic omethoate. It is noted that omethoate is no longer authorised in the EU. However, it is formed to a certain extent as metabolite from dimethoate. Scenario 2 for dithiocarbamates: it is assumed that the samples would contain only the more toxic ziram. However, it is noted that ziram is not authorised in the EU for the crops under consideration.

Pesticide(*)	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Rye	Strawberries	Swine Meat	Tomatoes
Bromuconazole (sum)											
Buprofezin	0.2	0.4	0.0	0.2			0.7				5.6
Cadusafos							0.0				
Captan[1]	88.8		8.6	0.2			**63.3**		**19.2**		
Carbaryl	20.6						19.0		2.3		9.3
Carbendazim and benomyl	**215.5 (4)**	2.9	2.9	**25.6**		1.6	**189.9 (1)**	2.6	**22.4**		58.1
Carbofuran (sum)				322.8 (1)							
Carbosulfan											
Chlordane (sum)											
Chlorfenapyr	20.9								**17.7**		13.2
Chlorfenvinphos	195.9 (1)			10.8							
Chlormequat						**85.3**		**21.7**			
Chlorobenzilate											
Chlorothalonil	4.2	5.3	9.1	**14.7**			9.0		5.5		17.5
Chlorpropham (sum)	0.4						<0.1		0.1		0.1
Chlorpyrifos	49.0	15.3	5.8	**28.0**	0.1	0.2	**40.3**	0.1	2.5		23.8
Chlorpyrifos-methyl	26.5		0.6	0.9		4.5	29.7	0.4	2.2		23.3
Clothianidin	1.2			0.6			0.7				1.7
Cyfluthrin (sum)	14.7	10.5		15.6			56.4				11.6
Cypermethrin (sum)	19.1	15.5	**29.5**	17.5			17.8		**1.1**	0.1	13.4
Cyproconazole	6.9	**28.9**				0.4	29.1		**4.8**		14.2
Deltamethrin	35.3	10.5	11.8	91.5		16.3	**71.2**		11.8		**127.9 (2)**
Diazinon	**78.4**	2.5		**1.8**		0.2			**0.7**	0.4	
Dichlofluanid	5.2										0.1
Dichlorvos	**391.9 (1)**						**89.0**		**22.6**		29.1
Dicloran		3.6		**47.4**							41.9
Dicofol (sum)	**7.6**										1.5
Difenoconazole	3.9	**10.0**	2.7	**2.4**			2.1		0.2		22.4
Dimethoate (sum)/Dimethoate[2]	**1175.6 (1)**	46.8		**188.3 (2)**			**753.5 (2)**		**5.1**		**25.9**
Dimethoate (sum)/Omethoate[2]	**5877.9 (5)**	234.2 (2)		**941.6 (13)**			**3767.5 (2)**		**25.7**		**129.4 (1)**
Dimethomorph	0.8	**14.0**	0.3	44.8			0.1		**0.2**		2.6
Dinocap (sum)											
Dithiocarbamates/ mancozeb [3]	54.7	46.4	34.8	**106.0 (1)**		0.1	22.5	1.7	32.1		19.0
Dithiocarbamates/ ziram [3]	465.3 (18)	394.7 (10)	296.2 (7)	**901.3 (55)**		0.5	191.3 (3)	14.2	272.8 (1)		161.4 (7)

Pesticide(*)	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Rye	Strawberries	Swine Meat	Tomatoes
Endosulfan (sum)	35.3			**25.1**			**28.1**		**8.3**		116.3 (1)
Endrin					5.0						
Epoxiconazole						1.0		0.5	4.1		12.6
Ethephon	8.4							0.1			**441.9 (5)**
Ethion		**47.4**							**249.5 (1)**		
Ethoprophos							6.5				
Etofenprox	0.5	3.2		2.1			1.2		0.1		1.2
Fenamiphos (sum)		18.9									69.8
Fenarimol	14.7			2.7					6.1		4.7
Fenazaquin	4.9						4.6		3.3		2.4
Fenbuconazole	0.7						2.8		0.1		
Fenbutatin oxide	19.5			0.4			1.3	<0.1	0.2		3.0
Fenitrothion	**15.8**										
Fenoxycarb	0.6						0.3				
Fenpropathrin	**32.7**						**17.2**		3.6		
Fenpropimorph	9.8		17.1	0.4					2.5		
Fenthion (sum)	**107.8 (1)**						**33.2**				
Fenvalerate/ Esfenvalerate (sum)							3.1				
Fipronil (sum)											
Fluazifop-P-butyl (fluazifop acid (free and conjugate))		78.9	13.2	0.6					1.0		
Fluquinconazole	9.8										
Flusilazole	29.4					2.4	7.1		1.2		11.6
Flutriafol	5.9								14.2		6.4
Folpet[4]	133.2 (3)			**228.7 (6)**					28.8		
Formetanate (sum)									81.1		
Fosthiazate											
Haloxyfop including haloxyfop-R (sum)			4.3	0.8					0.1		
Heptachlor										5.7	
Hexaconazole	98.0						**28.5**		16.5		
Imazalil	221.4 (6)	1.5		1.1			**7.8**		0.7		162.8 (1)
Imidacloprid	8.6	7.9	0.1	30.3		0.1	12.6		2.3		**40.0**
Indoxacarb	13.6	6.7	**2.7**	17.4			6.2		0.1		7.0
Lambda-Cyhalothrin	113.6 (1)	44.9	27.5	**236.8 (6)**			158.2 (1)		62.4		49.6
Lindane					<0.1					<0.1	

Pesticide(*)	**Apples**	**Head cabbage**	**Leek**	**Lettuce**	**Milk**	**Oats**	**Peaches**	**Rye**	**Strawberries**	**Swine Meat**	**Tomatoes**
Linuron		3.0	**16.5**	1.6				0.4			
Malathion (sum)						<0.1	0.6	0.1			
Mepiquat						0.4		4.8			
Metalaxyl (sum)	0.6	0.3	0.1	4.7			0.5		0.2		1.3
Metconazole											
Methamidophos	**195.9 (1)**								**779.6 (1)**		**50.4**
Methidathion	11.8	13.7					17.8				
Methiocarb (sum)		10.1	19.1	6.2			**187.1 (1)**		37.2		
Methomyl and Thiodicarb		**115.8 (1)**		25.8					**271.2 (1)**		
Methoxychlor											
Methoxyfenozide	8.6	**3.4**					4.7				11.3
Monocrotophos									**21.8**		
Myclobutanil	3.4			**0.7**			1.5		2.0		0.9
Oxadixyl				**56.5**							**26.7**
Oxamyl		**1315.8 (1)**							**155.9 (1)**		**2209.6 (4)**
Oxydemeton-methyl (sum)	**169.8 (1)**										
Paclobutrazol	1.0										
Parathion											
Parathion-methyl (sum)									**1.0**		
Penconazole	0.8	0.2					1.2		1.3		1.2
Permethrin										<0.1	
Phenthoate											
Phosalone	**46.0**										0.9
Phosmet (sum)	34.8		2.1				**31.6**				1.8
Phoxim											
Pirimicarb (sum)	21.7	4.2		12.6			5.1	0.2	7.2		5.8
Pirimiphos-methyl		0.8		0.5		10.9	0.0	13.5		<0.1	19.4
Prochloraz (sum)	10.6			2.2			0.0				4.7
Procymidone	16.3	**9.2**		156.9 (2)			43.5		76.7		227.7 (3)
Profenofos									**0.1**		
Propamocarb (sum)		3.5	4.7	46.0			0.2		0.1		4.7
Propiconazole							0.7				0.2
Prothioconazole (prothioconazole-desthio)											
Pyraclostrobin	65.3	12.3	13.6	107.6 (1)		0.2	35.6		24.4		**69.8**

Pesticide(*)	Apples	Head cabbage	Leek	Lettuce	Milk	Oats	Peaches	Rye	Strawberries	Swine Meat	Tomatoes
Pyrazophos											
Pyrethrins	1.1			5.0					0.2		2.1
Pyridaben	5.9						15.4		1.6		6.4
Pyriproxyfen				<0.1							0.1
Resmethrin											
Spiroxamine	0.1			0.1							**3.3**
tau-Fluvalinate	6.7			**150.7 (1)**			1.2		0.7		1.2
Tebuconazole	326.6 (2)	52.6	32.8	3.1		1.3	118.7 (1)	0.6	**3.2**		56.2
Tebufenpyrad	44.1	3.7					14.8		33.4		32.0
Tecnazene											
Tefluthrin											33.7
Tetraconazole	21.6			0.7			10.7		4.7		6.6
Thiacloprid	**280.8 (1)**	13.3	2.4	75.3			15.8		**56.6**		32.9
Thiametoxam (sum)	**4.7**	0.2		2.8			2.3		**0.6**		0.9
Thiophanate-methyl	23.0	2.3		0.1		<0.1	**130.5 (1)**		**11.7**		13.7
Tolylfluanid (sum)	5.5			0.2					1.0		1.1
Triadimenol (sum)(5)	7.8		**12.9**	2.7					**40.5**		15.1
Triazophos			40.7								
Trichlorfon									0.0		18.6
Triticonazole											
Vinclozolin (sum)		0.9		6.8					6.8		1.6

Legend: less than 1% of ARfD/ADI; less than 10 % of ARfD/ADI; less than 100% of ARfD/ADI; less than 1000% of ARfD/ADI; more than 1000% of the ARfD/ADI; no sample analysed; no samples above the LOQ - negligible exposure

(*) The cells concerning pesticide/crop combinations shaded and empty refer to combinations were not covered by the 2010 EU-coordinated programme defined in Regulation (EC) No 901/2009.
(1) For apples, strawberries and tomatoes, the results reported for the sum of captan and folpet were used for calculating the exposure, using the ARfD set for captan.
(2) For dimethoate/omethoate, the estimated exposure was assessed twice, once on the basis of the ARfD set for dimethoate and once with the ARfD set for omethoate (see Table 5-1). It is noted that the omethoate scenario (Scenario 2) is rather conservative,
(3) For the dithiocarbamates, the estimated exposure was assessed twice, once on the basis of the ARfD set for mancozeb and once with the ARfD set for ziram (see Table 5-1). It is noted that the ziram-scenario (Scenario 2) is rather unlikely since in the EU ziram is not authorised for any of the crops under consideration.
(4) For apples, strawberries and tomatoes, the results reported for the sum of captan and folpet were used for calculating the exposure, using the ARfD set for folpet.
(5) For triadimenol, the estimated exposure was assessed on the bases of triadimenol ARfD (see Table 5-1).

Considering the 51 pesticide/crop combinations for which a consumer risk could not be excluded, the commodities that most often raised a potential intake concern (scenario 1 and 2) were lettuce (87 and 22 samples) followed by apples and tomatoes (45 and 23; 29 and 21 samples, respectively). It is noted that for milk, oats, rye and swine meat none of the tested samples contained residues in concentrations that may have posed an acute risk. None of the samples posing a potential acute consumer risk concerned organically produced food.

The results of the exposure calculations presented in Table 5-3 refer to the samples with the highest residue measured. For the pesticide/crop combinations where more than one sample contained residues above the toxicological threshold more details con be found in Figure 5-2: there, the estimated acute exposure (expressed in % of the ARfD) is presented individually for each of the samples concerned.

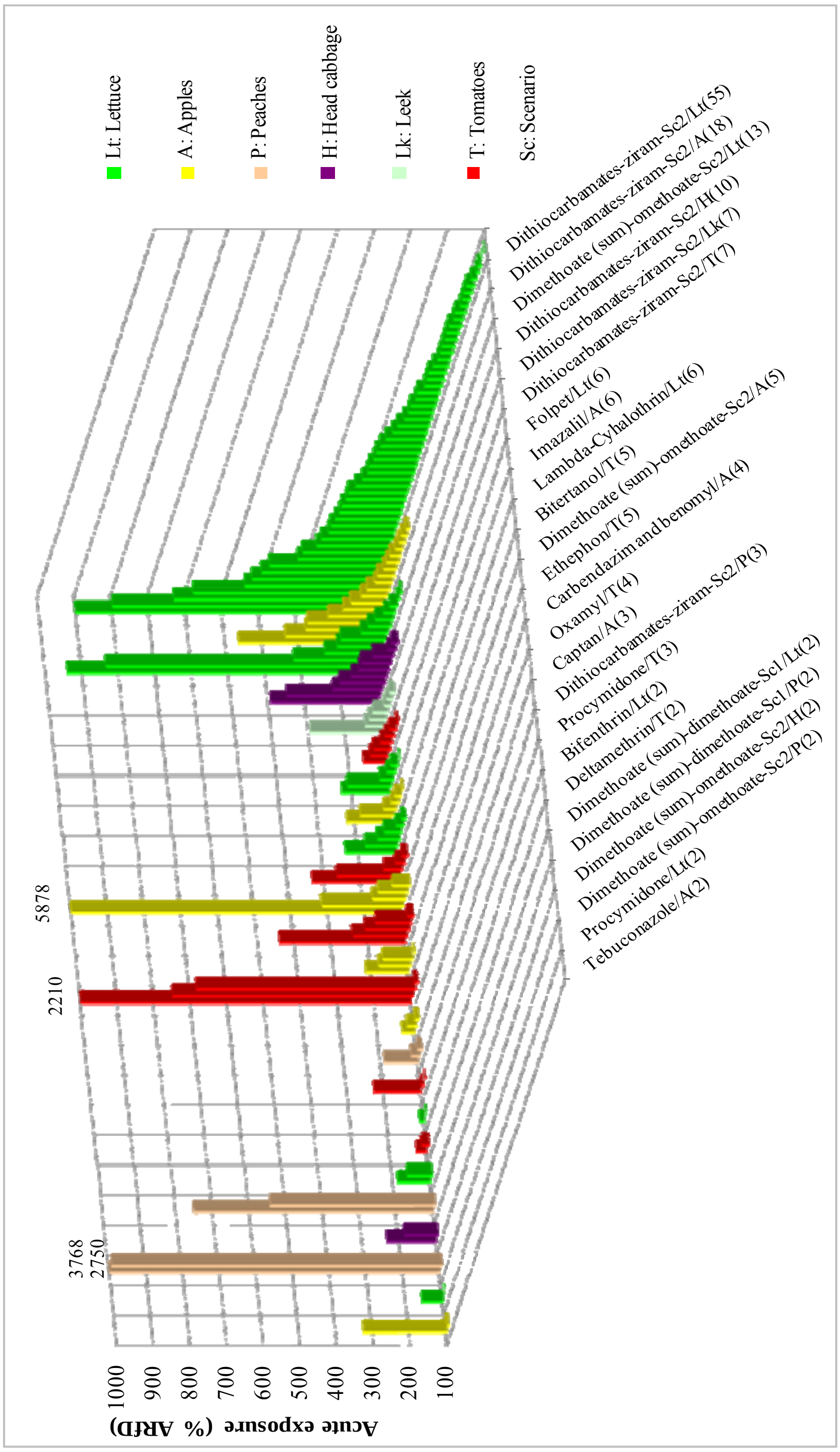


Figure 5-2: Distribution of the acute exposure (expressed in % of the ARfD) for those combinations for which more than one samples were found exceeding the toxicological threshold.

Refinements of the estimated short-term exposure calculations (tier 2, see Figure 5-1) were not performed as all the pesticide/crop combinations for which a potential consumer risk could not be excluded in the first tier calculation concerned food commodities commonly consumed raw and/or unprocessed. Thus, the correction of the estimated exposure by a processing/peeling factor was not considered appropriate. However, usual food handling and household practices (e.g. washing) are expected to lead to a reduction of the residue concentrations on the food item consumed. Thus, the calculated theoretical consumer exposure might have overestimated the real consumer risk.

Table 5-3 contains as an additional piece of information an indication whether the highest residue measured exceeded the MRL for the pertinent pesticide/crop combination (results reported in bold font). As an example, the entry for acephate/peaches, for which the estimated short-term exposure accounted for 1.7% of the ARfD is highlighted in bold font, indicating that the highest residue reported (i.e. 0.03 mg/kg) exceeded the MRL which is set at the LOQ of 0.02 mg/kg.

Most of the samples for which an acute risk could not be excluded referred to samples that exceeded the EU MRLs. However, a potential short-term consumer risk was identified for some samples which were compliant with the MRL. This was for example the case for bifenthrin/lettuce, bitertanol/peaches and tomatoes and imazalil/apples and tomatoes. Similar situations were identified for endosulfan, lambda-cyhalothrin, procymidone, pyraclostrobin and tebuconazole. These findings imply that for some pesticide/crop combinations MRLs were set at a level which was not sufficiently protective for European consumers. However, the overall conservatism of the assumptions for exposure assessment (see 5.1) should be borne in mind.

It is noted that the toxicological reference values for bifenthrin, bitertanol and imazalil were lowered in 2011 on the basis of the most recent scientific knowledge. It is therefore necessary to review the existing MRLs to ensure that the MRLs are safe for European consumers. Also for endosulfan/tomatoes, lambda-cyhalothrin/apples and peaches, pyraclostrobin/lettuce and tebuconazole/apples and peaches the existing MRLs should be reviewed since there are indications that the existing MRLs are set at levels which lead to an exceedance of the toxicological reference values. For procymidone the MRLs in place in 2010 were set at levels for which a consumer risk could not be excluded. However, for this substance a decision on the lowering of the MRLs in place at the beginning of 2010 has been already taken. For carbofuran/lettuce and chlorfenvinphos/apples residues at the LOQ caused an exceedance of the ARfD. The MRLs for substances with extremely low toxicological reference values like carbofuran and chlorfenvinphos should be set at the lowest level achievable from an analytical point of view. Therefore it should be explored if a further lowering of the LOQs for these two substances is feasible.

5.3. Model assumptions for long-term (chronic) risk assessment

The chronic or long-term exposure assessment estimates the expected exposure of an individual over a long period, predicting the lifetime exposure. According to JMPR, the long-term dietary intakes are calculated by multiplying the residue concentration on food by the average daily per capita consumption estimated for each commodity, on the basis of appropriate food consumption data, and summing the intakes for each food (FAO, 2009). Ideally, the long-term exposure assessment should be calculated by means of probabilistic modelling, using the distributions of the individual food consumption reported by the respondents of food surveys and the distribution of the measured residue concentration identified in the monitoring programmes. Since a methodology for probabilistic calculations is not yet available, EFSA calculated the long-term exposure with a deterministic model, analogous to the calculation of the Theoretical Maximum Daily Intake (TMDI). The TMDI is calculated according to the following equation which was developed for the assessment of the long-term dietary intake in the framework of setting MRLs (WHO, 1997):

$$TMDI = \sum (MRL_i * F_i)$$

MRL_i: Maximum residue level for food commodity i

F_i: Food consumption of food commodity i

For the purpose of the risk assessment in the framework of this report, the MRL that is normally used in the TMDI calculation has been replaced with the mean residue concentration found in 2010 monitoring samples. If the calculated exposure, normalised by body weight, is below the toxicological reference value derived for long-term exposure, i.e. the Acceptable Daily Intake (ADI)[71], the consumer is considered as adequately protected.

The following input values are required to calculate the actual chronic exposure:

- Residue concentration to which the consumer is exposed (see section 5.3.2)
- Mean food consumption, taken from the EFSA PRIMo (EFSA, 2007).
- Processing/peeling factors are used to perform more refined intake calculations for those crops that normally are not consumed raw/unprocessed (see section 5.3.2).[72]

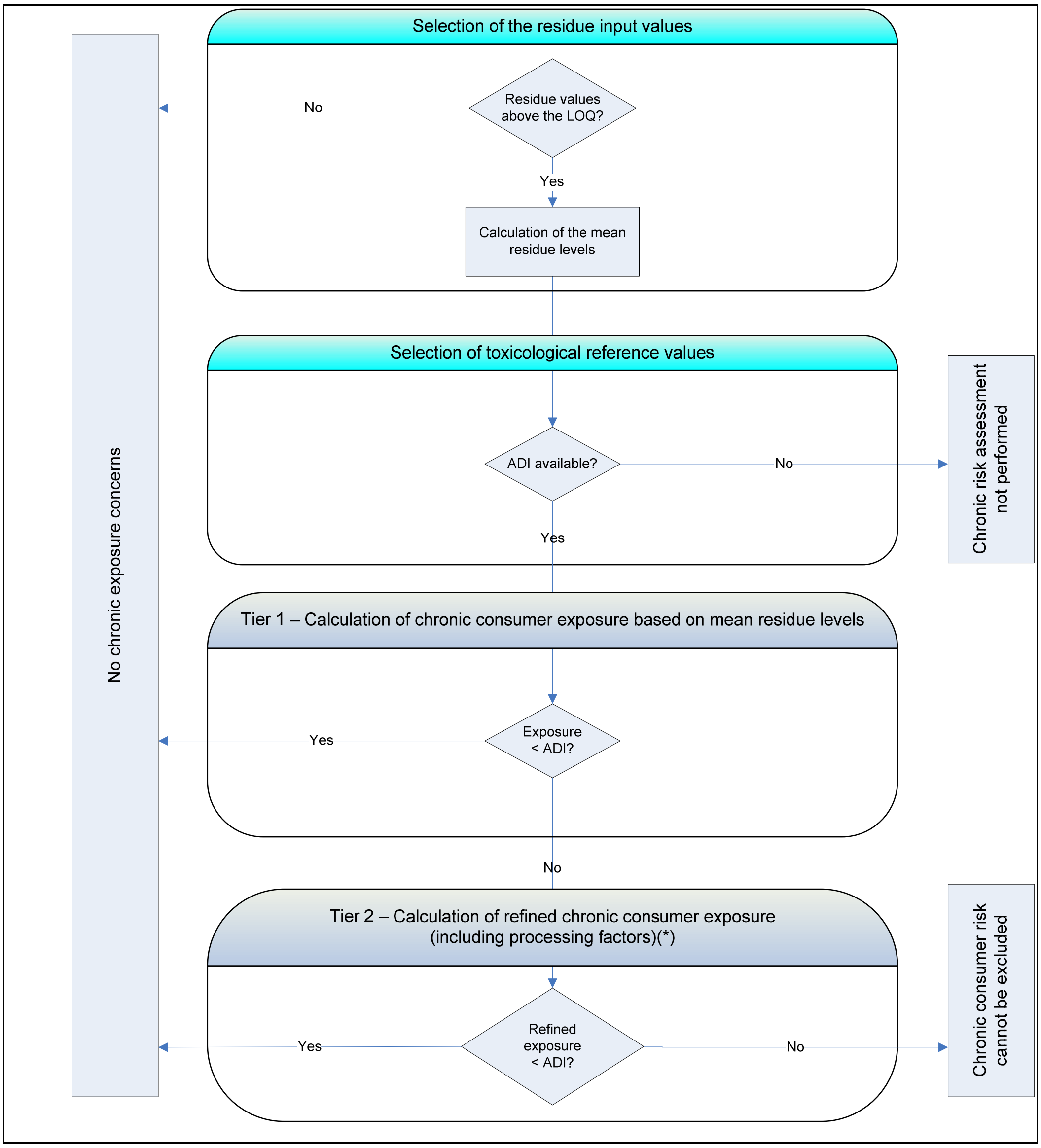
As reported in section 2.1.1, the contribution of the food commodities of plant origin monitored in the 2010 EU-coordinated programme represents 8 to 36% of the total dietary daily intake of the European consumers. In order to be more representative for the total intake, the chronic risk assessment also included the commodities of plant origin which are relevant for 2011 and 2012 monitoring years (see section 2.1.1)[73]. With this approach, 39% to 95% of the total dietary intake of food of plant origin is represented. EFSA took into account also the exposure to swine meat and milk (including milk products).

In Figure 5-3 the tiered approach used in assessing the chronic risk is represented.

[71] See "Acceptable Daily Intake (ADI)" in the Glossary.

[72] The peeling /processing factors are available in a database developed by the Federal Institute for Risk Assessment (BfR), which includes a collection of processing factors from annually published reports and evaluations by the FAO/WHO Joint Meeting on Pesticide Residues (JMPR), from draft assessment reports (DAR) prepared in the European Pesticide Risk Assessment Peer Review Programme (PRAPeR) and from residue data which were submitted within the framework of national authorisation procedures. Additional data concerning pulp/peel distribution were provided for BfR by retailers and have been collected within the framework of national food monitoring programmes. The database is available at: : http://www.bfr.bund.de/cd/579 (BfR compilation of 2011-10-20).

[73] The following food commodities were not considered in the chronic exposure assessment: butter, wheat flour, orange juice, poultry meat, liver, eggs because of limited availability of results and/or processing factors.



(*) If needed, the processing/peeling factors are applied only to food commodities normally not consumed as raw (i.e. oats, rye and swine meat).

Figure 5-3: Flow chart for the tiered approach used in assessing the chronic consumer health risk.

5.3.1. Acceptable Daily Intake values (ADIs)

The list of the ADI values used for the assessment of the chronic exposure is reported in Table 5-4.

Table 5-4: ADI values used as input values for the long-term risk assessment.

Pesticide	ADI (mg/kg bw per d)	ADI evaluation year	ADI [(1)] source
2,4-D	0.05	2001	COM
Abamectin	0.0025	2008	EFSA
Acephate	0.03	2005	JMPR
Acetamiprid	0.07	1999	COM
Acrinathrin	0.01	2010	EFSA
Aldicarb	0.003	2001	JMPR
Amitraz	0.003	2003	COM
Amitrole	0.001	2001	COM
Azinphos-ethyl	No ADI allocated		

Pesticide	ADI (mg/kg bw per d)	ADI evaluation year	ADI [(1)] source
Azinphos-methyl	0.005	2006	COM
Azoxystrobin	0.2	2011	COM
Benfuracarb	0.01	2009	EFSA
Bifenthrin	0.015	2011	EFSA
Bitertanol	0.003	2011	COM
Boscalid	0.04	2008	COM
Bromide ion	1	1988	JMPR
Bromopropylate	0.03	1993	JMPR
Bromuconazole	0.01	2010	COM
Bupirimate	0.05	2011	COM
Buprofezin	0.01	2010	COM
Cadusafos	0.0004	2009	EFSA
Camphechlor	No ADI allocated	1973	JMPR
Captan	0.1	2008	COM
Carbaryl	0.0075	2006	EFSA
Carbendazim	0.02	2010	COM
Carbofuran	0.00015	2009	EFSA
Carbosulfan	0.005	2009	EFSA
Chlordane	0.0005	1994	JMPR
Chlorfenapyr	0.015	1999	ECCO
Chlorfenvinphos	0.0005	1994	JMPR
Chlormequat	0.031[(2)]	2009	COM
Chlorobenzilate	0.02	1980	JMPR
Chlorothalonil	0.015	2006	COM
Chlorpropham	0.05	2004	COM
Chlorpyrifos	0.01	2005	COM
Chlorpyrifos-methyl	0.01	2005	COM
Clofentezine	0.02	2010	COM
Clothianidin	0.097	2006	COM
Cyfluthrin	0.003	2003	COM
Cypermethrin	0.05[(3)]	2005	COM
Cyproconazole	0.02	2011	COM
Cyprodinil	0.03	2006	COM
DDT	0.01	2000	JMPR
Deltamethrin	0.01	2003	COM
Diazinon	0.0002	2006	EFSA
Dichlofluanid	0.3	1983	JMPR
Dichlorvos	0.00008	2006	EFSA
Dicloran	0.005	2010	EFSA
Dicofol	0.002	1992	JMPR
Dieldrin	0.0001	1994	JMPR
Difenoconazole	0.01	2008	COM
Dimethoate	0.001[(4)]	2007	COM
Dimethomorph	0.05	2007	COM
Dinocap	0.004	2007	COM
Diphenylamine	0.075	2008	EFSA
Dithiocarbamates: Mancozeb	0.05[(5)]	2005	COM
Dithiocarbamates: Ziram	0.006[(5)]	2004	COM
Endosulfan	0.006	2006	JMPR
Endrin	0.0002	1994	JMPR
Epoxiconazole	0.008	2008	COM
Esfenvalerate	0.02	2000	COM
Ethephon	0.03	2006	COM

Pesticide	ADI (mg/kg bw per d)	ADI evaluation year	ADI [(1)] source
Ethion (aka diethion)	0.002	1990	JMPR
Ethoprophos	0.0004	2006	EFSA
Etofenprox	0.03	2009	COM
Fenamiphos (aka phenamiphos)	0.0008	2006	COM
Fenarimol	0.01	2006	COM
Fenazaquin	0.005	2011	COM
Fenbuconazole	0.006	2010	COM
Fenbutatin oxide	0.05	2011	COM
Fenhexamid	0.2	2001	COM
Fenitrothion	0.005	2006	EFSA
Fenoxycarb	0.053	2011	COM
Fenpropathrin	0.03	1993	JMPR
Fenpropimorph	0.003	2008	COM
Fenthion	0.007	2000	JMPR
Fipronil	0.0002	2007	COM
Fluazifop-P-butyl	0.01	2011	COM
Fludioxonil	0.37	2007	COM
Flufenoxuron	0.01	2011	EFSA
Fluquinconazole	0.002	2011	COM
Flusilazole	0.002	2007	COM
Flutriafol	0.01	2011	COM
Folpet	0.1	2007	COM
Formetanate	0.004	2007	COM
Fosthiazate	0.004	2003	COM
Glyphosate	0.3	2001	COM
Haloxyfop	0.00065	2006	EFSA
HCH – α isomer	No ADI allocated	1973	JMPR
HCH – β isomer	No ADI allocated	1973	JMPR
Heptachlor	0.0001	1994	JMPR
Hexachlorobenzene	No ADI allocated	1978	JMPR
Hexaconazole	0.005	1990	JMPR
Hexythiazox	0.03	2011	COM
Imazalil	0.025	2011	COM
Imidacloprid	0.06	2008	COM
Indoxacarb	0.006	2005	COM
Iprodione	0.06	2002	COM
Iprovalicarb	0.015	2002	COM
Kresoxim-methyl	0.4	2011	COM
lambda-Cyhalothrin	0.005	2001	COM
Lindane	0.005	2000	COM
Linuron	0.003	2002	COM
Lufenuron	0.015	2009	COM
Malathion	0.03	2010	COM
Mepanipyrim	0.02	2004	COM
Mepiquat	0.154[(6)]	2008	COM
Metalaxyl-M	0.08	2002	COM
Metconazole	0.01	2006	COM
Methamidophos	0.001	2007	COM
Methidathion	0.001	1997	JMPR
Methiocarb (aka mercaptodimethur)	0.013	2007	COM
Methomyl	0.0025	2009	COM
Methoxychlor	0.1	1977	JMPR
Methoxyfenozide	0.1	2005	COM

Pesticide	ADI (mg/kg bw per d)	ADI evaluation year	ADI [(1)] source
Monocrotophos	0.0006	1995	JMPR
Myclobutanil	0.025	2010	COM
Omethoate	0.0003[(4)]	2007	COM
Oxadixyl	0.01	1984	FR
Oxamyl	0.001	2006	COM
Oxydemeton-methyl	0.0003	2006	COM
Paclobutrazol	0.022	2011	COM
Parathion	0.0006	2001	ECCO 100
Parathion-methyl	0.003	2003	JMPR
Penconazole	0.03	2009	COM
Pencycuron	0.2	2011	COM
Pendimethalin	0.125	2003	COM
Permethrin	0.05	2000	COM
Phenthoate	0.003	1984	JMPR
Phosalone	0.01	2006	EFSA
Phosmet	0.01	2011	COM
Phoxim	0.00375	2000	EMEA
Pirimicarb	0.035	2006	COM
Pirimiphos-methyl	0.004	2007	COM
Prochloraz	0.01	2011	COM
Procymidone	0.0028	2007	DAR FR
Profenofos	0.03	2007	JMPR
Propamocarb	0.244[(7)]	2007	COM
Propargite	No ADI allocated	2011	EFSA
Propiconazole	0.04	2003	COM
Propyzamide	0.02	2003	COM
Prothioconazole	0.01	2008	COM
Pyraclostrobin	0.03	2004	COM
Pyrazophos	0.001	1999	ECCO 73
Pyrethrins	0.04	2008	COM
Pyridaben	0.01	2010	COM
Pyrimethanil	0.17	2006	COM
Pyriproxyfen	0.1	2008	COM
Quinoxyfen	0.2	2004	COM
Quintozene	0.01	2000	COM
Resmethrin	0.03	1991	JMPR
Spinosad	0.024	2007	COM
Spiroxamine	0.025	1999	COM
tau-Fluvalinate	0.005	2010	COM
Tebuconazole	0.03	2008	COM
Tebufenozide	0.02	2011	COM
Tebufenpyrad	0.01	2009	COM
Tecnazene	0.02	1994	JMPR
Teflubenzuron	0.01	2008	COM
Tefluthrin	0.005	2010	COM
Tetraconazole	0.004	2008	COM
Tetradifon	0.015	2001	DE
Thiabendazole	0.1	2001	COM
Thiacloprid	0.01	2004	COM
Thiametoxam	0.026	2007	COM
Thiophanate-methyl	0.08	2005	COM
Tolclofos-methyl	0.064	2006	COM
Tolylfluanid	0.1	2006	COM

Pesticide	ADI (mg/kg bw per d)	ADI evaluation year	ADI [(1)] source
Triadimefon	0.03[(8)]	2004	JMPR
Triadimenol	0.05[(8)]	2008	COM
Triazophos	0.001	2002	JMPR
Trichlorfon	No agreed ADI available	2006	EFSA
Trifloxystrobin	0.1	2003	COM
Triflumuron	0.014	2011	COM
Trifluralin	0.015	2005	EFSA
Triticonazole	0.025	2006	COM
Vinclozolin	0.005	2006	COM
Zoxamide	0.5	2003	COM

(1) For the long-term risk assessment, the most recent ADI values available were used. It should be mentioned that some of the ADI values were derived recently and were not in place in 2010 when the monitoring results were generated.
(2) Chlormequat: the ADI derived in the peer review for chlormequat chloride (0.04 mg/kg bw per d) was recalculated to chlormequat by applying a molecular weight conversion factor to match with the residue definition which is expressed as chlormequat (ion).
(3) Cypermethrin: For the chronic risk assessment the ADI derived for the sum of isomers is used. For alpha-cypermethrin and zeta-cypermethrin different ADI values were derived: alpha-cypermethrin: 0.015 mg/kg bw per d, zeta-cypermethrin: 0.04mg/kg bw per d).
(4) Dimethoate: The residue definition (sum of dimethoate and omethoate) comprises compounds for which different ADI values were set. Therefore two scenarios were calculated, the first with the ADI of dimethoate (0.001 mg/kg bw per d), the second with the ADI of omethoate (0.0003 mg/kg bw per d), assuming that the reported residues (sum of dimethoate and omethoate) comprise only dimethoate (scenario 1) or omethoate (scenario 2).
(5) Dithiocarbamates: The residue definition covers compounds for which different ADI values were set. Therefore two scenarios were calculated, the first with the ADI of mancozeb, the second more conservative scenario with the ADI of ziram) The ADIs for mancozeb (0.6 mg/kg bw per d) and ziram (0.006 mg/kg bw per d) derived in the peer review were recalculated to CS_2 by multiplying with a molecular weight correction factor. The following conversion factors were applied: mancozeb: 0.56; ziram: 0.5. For other dithiocarbamates the following ADI values are available: maneb: 05 mg/kg bw per d, propineb: 0.007 mg/kg bw per d, thiram: 0.01 mg/kg bw per d, metiram: 0.03 mg/kg bw per d.
(6) Mepiquat: the ADI derived in the peer review for mepiquat chloride (0.2 mg/kg bw per d) by recalculated to mepiquat multiplying with a molecular weight correction factor to match with the residue definition which is expressed as mepiquat (ion).
(7) Propamocarb: the ADI derived by the peer review for propamocarb hydrochloride (0.29 mg/kg bw per d) was recalculated to propamocarb by multiplying with a molecular weight correction factor to match with the residue definition which is expressed as propamocarb.
(8) Triadimenol/triadimefon: the residue definition is set to the sum of triadimenol and triadimefon. For the chronic risk assessment, the ADI derived for triadimefon was used.

5.3.2. Residue levels

For each pesticide/crop combination, the mean residue levels to be used as input value in the chronic exposure estimations were derived according to the following approach:

- For each pesticide/crop combination an overall mean value was calculated, using the actual values measured in the individual samples, without applying analytical determination uncertainty factors. For samples with residues below the LOQ, EFSA used as a conservative assumption the numerical value of the LOQ to calculate the overall mean.

- For the crops covered by the 2010 EU-coordinated monitoring programme (apples, head cabbage, leek, lettuce, milk, peaches, pears (only for amitraz), oats, rye, strawberries, swine meat and tomatoes) the mean residue concentration was calculated from the results presented in section 3 of this report.

- For the remaining food commodities considered in the long-term exposure assessment, the residue input figures were derived from the results of the 2010 national programmes (surveillance samples only). This applies to aubergines, banana, beans (with pods), carrots, cauliflower, cucumbers, mandarins, oranges, peas (without pods), peppers, potatoes, rice, spinach, table grapes and wheat.

- For swine meat samples, where the residue levels reported were expressed on fat basis, the residue concentrations have been recalculated taking into account the fat content of the samples as reported.

- Results concerning samples analysed with analytical methods for which the LOQ was greater than the corresponding EU MRL were disregarded.

- Results that were not compliant with the residue definition were normally omitted. However, for some pesticides some of the results which were not fully compliant with the residue definitions were included in the calculation of the mean residue concentration (see footnotes to Table 5-5). The pesticides concerned were: captan/folpet, fenvalerate/esfenvalerate, and metalaxyl/metalaxyl-M.

- If for a given pesticide/crop combination no positive findings were reported by any of the reporting countries (i.e. all the results reported below the LOQ), then the contribution of these crops to the total dietary intake was not considered, assuming a "no use/no residue" situation.

The residue values reported according to the residue definition for enforcement (in accordance with the EU MRL legislation) were not recalculated to the residue definition for risk assessment[74] because no agreed conversion factors are available at the moment.

The residue levels used as input values for the calculation of the long-term exposure are reported in Table 5-5. Empty cells in the table concern pesticides/commodity combinations for which none of the samples tested contained quantifiable residues.

[74] See "residue definition" in the Glossary.

Table 5-5: Mean residue concentrations (in mg/kg) used as input values for the long-term dietary exposure calculations.

Pesticide (residue definition) [1]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)		0.0043				0.0060									0.0116			0.0064										
Abamectin (sum of avermectin B1a, avermectin B1b and delta-8,9 isomer of avermectin B1a)		0.0085		0.0086								0.0157	0.0094						0.0141									
Acephate		0.0115		0.0115													0.0111	0.0111				0.0119						
Acetamiprid	0.0112	0.0123		0.0100		0.0091		0.0123		0.0091		0.0170	0.0101		0.0101	0.0111	0.0102	0.0092	0.0093		0.0114	0.0137	0.0114		0.0085			
Acrinathrin			0.0228	0.0146				0.0193			0.0134	0.0163	0.0183			0.0227	0.0240	0.0172	0.0186		0.0189	0.0185						
Aldicarb (sum of aldicarb, its sulfoxide and its sulfone, expressed as aldicarb)										0.0098																		
Aldrin and dieldrin (aldrin and dieldrin combined expressed as dieldrin)									0.0056																			
Amitraz (amitraz including the metabolites containing the 2,4-dimethylaniline moiety expressed as amitraz)																0.0348												
Amitrole																												
Azinphos-methyl	0.0185		0.0177								0.0163					0.0181	0.0192					0.0170			0.0119			
Azoxystrobin	0.0135	0.0139	0.0233	0.0154		0.0152	0.0110	0.0199		0.0157	0.0164	0.0360	0.0170	0.0142	0.0145		0.0137	0.0219	0.0315	0.0129	0.0172	0.0245	0.0196	0.0138	0.0118	0.0114	0.0131	
Bifenthrin	0.0140	0.0129	0.0127	0.0109		0.0117		0.0124			0.0148	0.0182	0.0115	0.0140		0.0138	0.0152	0.0129	0.0133	0.0135	0.0156	0.0124	0.0137				0.0134	
Bitertanol	0.0189		0.0309	0.0179				0.0170				0.0192			0.0127	0.0202	0.0208				0.0167							
Boscalid	0.0203	0.0134	0.0137	0.0126		0.0198		0.0160		0.0128	0.0184	0.0773	0.0113	0.0134	0.0115	0.0371	0.0175	0.0602	0.0541	0.0130	0.0184	0.0200	0.0247	0.0155			0.0137	
Bromide ion								1.7860		3.4163	3.9069	7.3228							5.1094		4.6006				7.5783	2.1113	3.6590	
Bromopropylate		0.0135		0.0091				0.0132			0.0154				0.0093			0.0091				0.0137	0.0201			0.0133		
Bromuconazole (sum of diasteroisomers)																		0.0140										
Bupirimate	0.0117	0.0124				0.0115	0.0115	0.0126			0.0107	0.0110	0.0114		0.0119		0.0117	0.0128	0.0211		0.0132	0.0132						
Buprofezin	0.0168	0.0142	0.0166	0.0123				0.0147		0.0142			0.0148		0.0143	0.0144	0.0141	0.0135			0.0172	0.0157	0.0166		0.0161			
Cadusafos																						0.0129						
Captan [2]	0.0595					0.0166		0.0120			0.0364				0.0121	0.0562	0.0144	0.0122	0.0382			0.0218						
Carbaryl	0.0180		0.0189	0.0131											0.0146		0.0172		0.0165		0.0185	0.0165						
Carbendazim and Benomyl (sum of benomyl and carbendazim	0.0149	0.0130		0.0144				0.0127		0.0110	0.0114	0.0113	0.0119	0.0129	0.0134	0.0131	0.0139	0.0124	0.0143	0.0115	0.0122	0.0146		0.0196	0.0086	0.0173	0.0189	

Pesticide (residue definition) [1]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
expressed as carbendazim)																												
Carbofuran (sum of carbofuran and 3-hydroxycarbofuran expressed as carbofuran)		0.0107		0.0100								0.0109			0.0103							0.0103	0.0128					
Carbosulfan		0.0187																				0.0147						
Chlordane (sum of cis- and trans- isomers and oxychlordane expressed as chlordane)									0.0026																			
Chlorfenapyr	0.0152			0.0108				0.0108					0.0127		0.0125				0.0121			0.0120						
Chlorfenvinphos	0.0119					0.0127												0.0110										
Chlormequat														1.7227		0.0359										0.1268	0.0669	
Chlorothalonil	0.0133	0.0163	0.0170	0.0183		0.0173	0.0128	0.0224		0.0165	0.0178	0.0149			0.0094	0.0177	0.0173	0.0169	0.0206		0.0267	0.0156	0.0098					
Chlorpropham (chlorpropham and 3-chloroaniline expressed as chlorpropham)	0.0174					0.0117							0.0139			0.0198	0.0220		0.0203								0.0102	
Chlorpyrifos	0.0188	0.0124	0.0199	0.0114	0.0044	0.0126	0.0105	0.0122		0.0140	0.0147	0.0131	0.0552	0.0127	0.0301	0.0183	0.0164	0.0219	0.0153	0.0121	0.0152	0.0164	0.0164		0.0136	0.0127	0.0145	
Chlorpyrifos-methyl	0.0134	0.0118				0.0107					0.0139	0.0117	0.0138	0.0340	0.0124	0.0135	0.0135	0.0129	0.0130		0.0159	0.0120			0.0184	0.0141	0.0217	
Clofentezin (sum of all compounds containing the 2-chlorbenzoyl-moiety expressed as clofentezin)	0.0119		0.0119	0.0096				0.0091					0.0124		0.0113		0.0099	0.0095	0.0181		0.0143	0.0099						
Clothianidin	0.0096			0.0098				0.0087							0.0098		0.0098	0.0101			0.0095	0.0112	0.0097					
Cyfluthrin (cyfluthrin incl. other mixtures of constituent isomers (sum of isomers))	0.0292	0.0637	0.0132			0.0121		0.0344		0.0283		0.0354					0.0267	0.0259			0.0194	0.0313					0.0105	
Cypermethrin (cypermethrin incl. other mixtures of constituent isomers (sum of isomers))	0.0303	0.0240	0.0193	0.0366				0.0198		0.0285	0.0364	0.0329	0.0218		0.0217	0.0302	0.0313	0.0309	0.0262		0.0285	0.0313	0.0303		0.0170		0.0264	0.0171
Cyproconazole	0.0148			0.0119		0.0141		0.0146		0.0135				0.0163			0.0146	0.0138	0.0154		0.0141	0.0139						
Cyprodinil	0.0177	0.0138	0.0121	0.0116		0.0108		0.0131			0.0112	0.0531	0.0115		0.0117	0.0313	0.0253	0.0491	0.0518		0.0165	0.0136	0.0122		0.0110		0.0141	
DDT (sum of p,p′-DDT, o,p′-DDT, p-p′-DDE and p,p′-DDD (TDE) expressed as DDT)					0.0056				0.0100																			0.0149
Deltamethrin (cis-deltamethrin)	0.0225	0.0153		0.0142		0.0185				0.0179	0.0193	0.0246		0.0250	0.0182	0.0237	0.0238	0.0222	0.0192		0.0221	0.0198	0.0226		0.0258		0.0230	
Diazinon	0.0097									0.0111		0.0096			0.0096					0.0094		0.0111						0.0084
Dichlorvos				0.0092			0.0087	0.0087								0.0091	0.0092		0.0091						0.0085			
Dicloran		0.0122	0.0155			0.0133						0.0141						0.0141			0.0132							

Pesticide (residue definition) [1]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
Dicofol (sum of p,p′ and o,p′ isomers)	0.0122	0.0109		0.0115		0.0116							0.0245		0.0204			0.0231			0.0229	0.0138						
Difenoconazole	0.0126			0.0107		0.0128		0.0133		0.0135	0.0131	0.0155	0.0125			0.0130	0.0223	0.0132	0.0132		0.0150	0.0149	0.0166		0.0128			
Dimethoate (sum of dimethoate and omethoate expressed as dimethoate)	0.0113	0.0114	0.0105	0.0122		0.0100	0.0100	0.0103		0.0105		0.0123	0.0108		0.0105	0.0104	0.0124	0.0102	0.0100		0.0102	0.0120	0.0112	0.0104				
Dimethomorph		0.0114	0.0136	0.0108		0.0124		0.0137		0.0142	0.0111	0.0219					0.0102	0.0289	0.0111	0.0120	0.0125	0.0142	0.0171					
Dinocap (sum of dinocap isomers and their corresponding phenols expressed as dinocap)																		0.0150										
Diphenylamine	0.0912					0.0131				0.0179			0.0131	0.0160	0.0140	0.0545	0.0198	0.0187				0.0134			0.0120			
Dithiocarbamates (dithiocarbamates expressed as CS_2, including maneb, mancozeb, metiram, propineb, thiram and ziram)	0.0972	0.0935	0.0729	0.0814		0.0488	0.3343	0.1269		0.1423	0.1294	0.3408	0.0974	0.0532	0.0980	0.1504	0.0896	0.1274	0.1041	0.0473	0.1010	0.0806	0.0375			0.0852		
Endosulfan (sum of alpha- and beta-isomers and endosulfan-sulphate expressed as endosulfan)	0.0187	0.0136		0.0131		0.0149		0.0138	0.0129			0.0162	0.0132		0.0144		0.0176	0.0135	0.0163		0.0200	0.0147			0.0142			
Endrin									0.0024																			
Epoxiconazole		0.0113	0.0134											0.0146		0.0127			0.0130	0.0126	0.0131					0.0114	0.0138	
Ethephon	0.0298														0.0411			0.0415			0.0789	0.1187				0.0411		
Ethion				0.0112		0.0087				0.0088					0.0092			0.0090	0.0092			0.0104						
Ethoprophos								0.0101									0.0104					0.0115						
Etofenprox	0.0100	0.0099		0.0095						0.0100		0.0105	0.0123		0.0106	0.0104	0.0149	0.0099	0.0097		0.0110	0.0101	0.0112					
Fenamiphos (sum of fenamiphos and its sulfoxide and sulfone expressed as fenamiphos)																					0.0112	0.0124						
Fenarimol	0.0145												0.0107					0.0122	0.0128			0.0150						
Fenazaquin	0.0111	0.0122	0.0127			0.0092		0.0104					0.0117		0.0111	0.0113	0.0117	0.0109	0.0117		0.0111	0.0114						
Fenbuconazole	0.0131																0.0129	0.0137	0.0111									
Fenbutatin oxide	0.0193			0.0120								0.0131	0.0338		0.0146	0.0207	0.0125	0.0165			0.0153	0.0180	0.0106			0.0146		
Fenhexamid	0.0204	0.0148		0.0124		0.0147	0.0139	0.0334			0.0143	0.0501	0.0141		0.0141	0.0194	0.0247	0.1438	0.0878		0.0220	0.0291			0.0156			
Fenitrothion	0.0093														0.0100							0.0090			0.0150			
Fenoxycarb	0.0146												0.0152			0.0178	0.0140	0.0144					0.0109					
Fenpropathrin	0.0094	0.0099		0.0103											0.0156		0.0094	0.0095	0.0153			0.0095						
Fenpropimorph	0.0119		0.0123			0.0109					0.0105								0.0117	0.0122			0.0123				0.0132	

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Fenthion (sum of fenthion and its oxygen analogue, their sulfoxides and sulfone expressed as parent)	0.0096												0.0106		0.0122		0.0089											
Fenvalerate and Esfenvalerate (sum of RS/SR and RR/SS isomers)[3]	0.0168			0.0127						0.0162						0.0165		0.0156				0.0137					0.0146	
Fipronil (sum of fipronil and sulfone metabolite (MB46136) expressed as fipronil)															0.0039			0.0038		0.0075		0.0042			0.0141			
Fluazifop (fluazifop-P-butyl (fluazifop acid (free and conjugate)))				0.0079		0.0068	0.0028			0.0114	0.0081	0.0084							0.0088	0.0081		0.0073						
Fludioxonil	0.0210	0.0122	0.0147	0.0112		0.0120		0.0147			0.0114	0.1146	0.0140		0.0124	0.0220	0.0161	0.0318	0.0385		0.0159	0.0141	0.0139				0.0141	
Flufenoxuron	0.0116			0.0107								0.0117	0.0110		0.0119	0.0117		0.0134				0.0119						
Fluquinconazole	0.0124																	0.0127										
Flusilazole	0.0100			0.0100													0.0115	0.0109	0.0101		0.0099	0.0105						
Flutriafol	0.0109			0.0103		0.0134		0.0125					0.0123						0.0120		0.0124	0.0157						
Folpet [2]	0.0595					0.0101						0.0444				0.0562		0.0110	0.0382			0.0116	0.0282					
Formetanate (sum of formetanate and its salts expressed as formetanate (hydrochloride))		0.0088						0.0102							0.0118			0.0134		0.0124		0.0151						
Fosthiazate								0.0093												0.0090								
Glyphosate														0.1941												0.1230	0.1357	
Haloxyfop including Haloxyfop-R (Haloxyfop-R methyl ester, haloxyfop-R and conjugates of haloxyfop-R expressed as haloxyfop-R)																						0.0092						
Heptachlor (sum of heptachlor and heptachlor epoxide expressed as heptachlor)																												0.0119
Hexachlorbenzene					0.0033				0.0044																			0.0069
Hexachlorocyclohexane (HCH), alpha-isomer									0.0033																			
Hexachlorocyclohexane (HCH), beta-isomer					0.0017				0.0033																			
Hexaconazole	0.0108			0.0102		0.0101							0.0106				0.0101	0.0104	0.0109			0.0102			0.0100			
Hexythiazox	0.0119	0.0156		0.0145				0.0252					0.0134		0.0118	0.0148	0.0136	0.0172	0.0165		0.0144	0.0201	0.0211					
Imazalil	0.0192	0.0138	0.1062			0.0153		0.0164		0.0133		0.0159	0.9876		0.9316	0.0544	0.0142	0.0132	0.0137	0.0156	0.0154	0.0134	0.0172					

Pesticide (residue definition) [(1)]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
Imidacloprid	0.0116	0.0154	0.0110	0.0111		0.0112	0.0117	0.0123		0.0111	0.0103	0.0168	0.0122	0.0083	0.0127	0.0131	0.0117	0.0277		0.0124	0.0129	0.0163	0.0111		0.0128		0.0128	
Indoxacarb (indoxacarb as sum of the isomers S and R)	0.0115		0.0149	0.0098			0.0111	0.0121		0.0138	0.0096	0.0154	0.0099			0.0125	0.0121	0.0134	0.0095		0.0138	0.0130	0.0238					
Iprodione	0.0985	0.0180		0.0227		0.0290	0.0147	0.0353		0.0248	0.0131	0.2585	0.0235		0.0128	0.0331	0.1061	0.0701	0.0385		0.0253	0.0305	0.0155	0.0181				
Iprovalicarb	0.0103																	0.0124			0.0100	0.0123	0.0127					
Kresoxim-methyl	0.0125	0.0133		0.0107				0.0125			0.0130	0.0119				0.0128		0.0164	0.0149		0.0125	0.0132					0.0123	
Lambda-Cyhalothrin (lambda-cyhalothrin, incl. other mixtures of constituent isomers (sum of isomers))	0.0134	0.0124		0.0126		0.0101		0.0134		0.0118	0.0124	0.0171	0.0132		0.0125	0.0134	0.0160	0.0146	0.0142		0.0142	0.0138	0.0166		0.0113			
Lindane (gamma-isomer of hexachlorocyclohexane (HCH))									0.0044																			0.0053
Linuron						0.0183				0.0119	0.0113	0.0140											0.0141			0.0106		
Lufenuron	0.0130			0.0093				0.0118				0.0141	0.0116			0.0117	0.0134	0.0133	0.0127		0.0130	0.0127						
Malathion (sum of malathion and malaoxon expressed as malathion)				0.0096									0.0107	0.0113	0.0107	0.0107	0.0106	0.0101				0.0098			0.0154		0.0162	
Mepanipyrim (mepanipyrim and its metabolite (2-anilino-4-(2-hydroxypropyl)-6-methylpyrimidine) expressed as mepanipyrim)																		0.0097	0.0159		0.0105							
Mepiquat														0.0235		0.0169										0.0296	0.0168	
Metalaxyl and Metalaxyl-M (metalaxyl incl. mixtures of constituent isomers incl. Metalaxyl-M (sum of isomers))[(4)]	0.0190	0.0138	0.0176	0.0114		0.0118	0.0129	0.0162		0.0163	0.0143	0.0162	0.0149			0.0150	0.0156	0.0177	0.0171	0.0151	0.0182	0.0161	0.0180					
Metconazole													0.0101			0.0097												
Methamidophos				0.0122		0.0092									0.0094				0.0107			0.0100						
Methidathion	0.0128									0.0113			0.0172		0.0191	0.0129	0.0120					0.0115						
Methiocarb (sum of methiocarb and methiocarb-sulfoxide and sulfone, expressed as methiocarb)				0.0102				0.0110		0.0092	0.0095	0.0109	0.0107		0.0102		0.0107	0.0116	0.0098			0.0116	0.0127					
Methomyl and Thiodicarb (sum of methomyl and thiodicarb expressed as methomyl)		0.0124	0.0108	0.0108				0.0179					0.0120			0.0101		0.0108	0.0113			0.0169	0.0097					
Methoxychlor									0.0059																			
Methoxyfenozide	0.0109	0.0097		0.0102						0.0089						0.0182	0.0102	0.0148			0.0111	0.0114						

Pesticide (residue definition) [(1)]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
Monocrotophos		0.0126		0.0112															0.0133			0.0135						
Myclobutanil	0.0128		0.0157	0.0104		0.0126		0.0164				0.0118	0.0146		0.0135	0.0126	0.0128	0.0165	0.0164		0.0152	0.0132						
Oxadixyl												0.0154									0.0096							
Oxamyl				0.0128				0.0093		0.0091											0.0095	0.0096	0.0088					
Oxydemeton-methyl (sum of oxydemeton-methyl and demeton-S-methylsulfone expressed as oxydemeton-methyl)	0.0109																					0.0099						
Paclobutrazole						0.0097										0.0147												
Penconazole	0.0116		0.0111	0.0099		0.0118		0.0128		0.0108						0.0130	0.0124	0.0132	0.0139	0.0111	0.0135	0.0121						
Pencycuron										0.0089		0.0236	0.0105		0.0106					0.0103			0.0092					
Pendimethalin	0.0124	0.0121		0.0113		0.0140		0.0127		0.0117	0.0131	0.0144	0.0115				0.0134		0.0128				0.0139					
Permethrin (sum of isomers)																												0.0142
Phentoate															0.0118							0.0114						
Phosalone	0.0137			0.0116									0.0132		0.0124						0.0145	0.0138			0.0126			
Phosmet (phosmet and phosmet oxon expressed as phosmet)	0.0122										0.0107		0.0129		0.0139	0.0139	0.0126	0.0156			0.0138							
Phoxim													0.0094															
Pirimicarb (sum of pirimicarb and desmethylpirimicarb expressed as pirimicarb)	0.0159	0.0115		0.0095		0.0096		0.0170		0.0094		0.0108	0.0113		0.0110	0.0133			0.0128		0.0094	0.0120	0.0104			0.0102		
Pirimiphos-methyl								0.0137		0.0133			0.0114	0.0517	0.0117						0.0146	0.0122		0.0187	0.0208	0.0362	0.0504	0.0104
Prochloraz (sum of prochloraz and its metabolites containing the 2,4,6-trichlorophenol moiety expressed as prochloraz)	0.0113	0.0138				0.0156							0.0487		0.0394					0.0120	0.0120	0.0181			0.0194		0.0207	
Procymidone	0.0138	0.0161		0.0172		0.0125		0.0148		0.0127		0.0158				0.0142	0.0150	0.0193	0.0165	0.0127	0.0181	0.0156						
Profenofos		0.0122		0.0129									0.0122		0.0121				0.0124			0.0183						
Propamocarb (sum of propamocarb and its salt expressed as propamocarb)		0.0173	0.0132	0.0120		0.0129	0.0160	0.0527		0.0130	0.0172	0.2000				0.0108		0.0128	0.0112	0.0119	0.0205	0.0170	0.0180				0.0122	
Propargite	0.0371	0.0217		0.0098									0.0150		0.0156	0.0191	0.0297	0.0152			0.0255	0.0214						
Propiconazole			0.0128	0.0116		0.0126							0.0127		0.0120	0.0137	0.0119	0.0134				0.0133	0.0129		0.0116			
Propyzamide												0.0138			0.0114	0.0115			0.0114		0.0123							
Pyraclostrobin	0.0184	0.0112				0.0114				0.0138	0.0119	0.0196	0.0116	0.0105	0.0135	0.0200	0.0133	0.0158	0.0204		0.0170	0.0154	0.0192					

Pesticide (residue definition) [(1)]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
Pyrethrins												0.2866							0.2293			0.3111					0.0619	
Pyridaben	0.0131	0.0118	0.0132	0.0100				0.0110					0.0118		0.0119	0.0119	0.0126	0.0111	0.0119		0.0142	0.0119						
Pyrimethanil	0.0481	0.0123	0.0129	0.0116		0.0123	0.0104	0.0152		0.0110	0.0111	0.0242	0.0472		0.0199	0.0452	0.0219	0.0483	0.0288		0.0147	0.0143	0.0142	0.0095				
Pyriproxyfen		0.0134	0.0119			0.0111						0.0111	0.0137		0.0134						0.0120	0.0130						
Quinoxyfen	0.0119															0.0110		0.0125	0.0119			0.0107						
Spinosad (sum of spinosyn A and spinosyn D, expressed as spinosad)	0.0098	0.0103		0.0139				0.0108			0.0094	0.0204	0.0098			0.0101	0.0118	0.0106	0.0153		0.0103	0.0108	0.0114					
Spiroxamine		0.0105		0.0101								0.0115				0.0105		0.0132		0.0107	0.0103	0.0110			0.0145			
Taufluvalinate	0.0122			0.0108								0.0149			0.0125		0.0115		0.0137		0.0121	0.0097						
Tebuconazole	0.0142	0.0132		0.0119		0.0124	0.0116	0.0154		0.0137	0.0168	0.0123	0.0137	0.0164	0.0135	0.0140	0.0217	0.0168	0.0136		0.0157	0.0156	0.0151		0.0422	0.0168	0.0195	
Tebufenozide	0.0106										0.0099	0.0123	0.0113			0.0113	0.0111	0.0113			0.0109	0.0118			0.0098			
Tebufenpyrad	0.0116									0.0108			0.0127		0.0125		0.0107	0.0117	0.0119		0.0115	0.0129	0.0115					
Teflubenzuron	0.0117					0.0123		0.0163								0.0149	0.0127		0.0159		0.0120	0.0144						
Tefluthrin						0.0124														0.0090								
Tetraconazole	0.0116					0.0103		0.0112				0.0109				0.0115	0.0117	0.0114	0.0120		0.0119	0.0111						
Tetradifon	0.0123	0.0152		0.0140				0.0149							0.0145		0.0118				0.0117	0.0126						
Thiabendazole	0.0784	0.0121	0.1006	0.0116				0.0152		0.0138	0.0121		0.2869		0.3009	0.0416	0.0179	0.0156	0.0125	0.0182		0.0137			0.0149		0.0157	
Thiacloprid	0.0127	0.0119		0.0098		0.0097		0.0102		0.0092	0.0092	0.0107			0.0099	0.0158	0.0100		0.0154		0.0105	0.0118						
Thiamethoxam (sum of thiamethoxam and clothianidin expressed as thiamethoxam)	0.0102	0.0111		0.0114		0.0107		0.0126		0.0105		0.0121			0.0108	0.0099	0.0108	0.0114	0.0106	0.0112	0.0101	0.0134	0.0110					
Thiophanate-methyl	0.0130	0.0138		0.0137				0.0124		0.0143		0.0140	0.0116	0.0093	0.0152	0.0130	0.0211	0.0137	0.0136		0.0144	0.0457						
Tolclofos-methyl						0.0122						0.0156								0.0125								
Tolylfluanid (sum of tolylfluanid and dimethylaminosulfotoluidide expressed as tolylfluanid)	0.0149																		0.0171									
Triadimefon and Triadimenol (sum of triadimefon and triadimenol)	0.0195	0.0167	0.0172	0.0146		0.0174		0.0184			0.0169	0.0185			0.0143			0.0218	0.0199		0.0206	0.0210	0.0193					
Triazophos		0.0098		0.0119		0.0087	0.0082				0.0089				0.0092							0.0141			0.0096			
Trichlorfon								0.0122							0.0113						0.0140	0.0134						
Trifloxystrobin	0.0128	0.0107		0.0097				0.0106			0.0112		0.0110		0.0107	0.0126	0.0128	0.0219	0.0154	0.0103	0.0125	0.0118					0.0117	
Triflumuron	0.0108												0.0097		0.0096	0.0118	0.0139			0.0110								
Trifluralin	0.0145					0.0154		0.0157																				

Pesticide (residue definition) [(1)]	Apples	Aubergines	Bananas	Beans (with pods)	Milk	Carrots	Cauliflower	Cucumbers	Eggs	Head cabbage	Leek	Lettuce	Mandarins	Oats	Oranges	Pears	Peaches	Table grapes	Strawberries	Potatoes	Tomatoes	Peppers	Spinach	Peas (without pods)	Rice	Rye	Wheat	Swine meat
Triticonazole																		0.0094										
Vinclozolin (sum of vinclozolin and all metabolites cont. the 3,5-dichloraniniline moiety, expressed as vinclozolin)						0.0134						0.0130	0.0137			0.0116		0.0107			0.0218							
Zoxamide																		0.0142			0.0097							

(1) The residues measured refer to the legal residue definitions reported in the EU legislation.

(2) For folpet and captan, the residue levels reported in the table for the following crops refer to the sum of folpet and captan: apples, beans with pods, pears, strawberries and tomatoes.

(3) For fenvalerate and esfenvalerate, the mean residue concentrations were calculated taking into account the results reported for the two separate residue definitions (i.e. sum of RR & SS isomers and sum of RS & SR isomers.

(4) For metalaxyl/metalaxyl-M the mean residue concentrations were calculated taking into account the results reported for the full residue definition (Metalaxyl including other mixtures of constituent isomers including metalaxyl-M(sum of isomers) and the results reported for metalaxyl or metalaxyl-M alone.

5.4. Results of the long-term (chronic) risk assessment

For each pesticide, the long-term exposure was estimated for all 27 diets included in the EFSA PRIMo model on the basis of the mean residue concentrations for the food commodities covered by the EU-coordinated programme[75]. In Table 5-6 the results of the long-term exposure calculation (maximum exposure among the 27 diets included in the PRIMo model), expressed in percent of the ADI are reported.

The detailed results of the calculations are reported separately for each pesticide in calculation spreadsheets which can be found in Appendix IV of this report.

[75] For each pesticide/crop combination an overall mean value was calculated, using the actual values measured in the individual samples. For samples with residues below the LOQ, the numerical value of the LOQ was used to calculate the overall mean.

Table 5-6: Results of the long-term dietary exposure assessment.

Pesticide	TMDI max (in % ADI)
2,4-D	0.12
Abamectin (sum)	0.83
Acephate	0.07
Acetamiprid	0.35
Acrinathrin	1.32
Aldicarb (sum)	0.20
Aldrin and Dieldrin (sum)	7.52
Amitraz (sum)	0.79
Amitrole	No exposure (*)
Azinphos-ethyl	No ADI available/no exposure (*)
Azinphos-methyl	5.52
Azoxystrobin	0.24
Benfuracarb	No exposure (*)
Bifenthrin	2.43
Bitertanol	12.37
Boscalid	1.51
Bromide ion	5.41
Bromopropylate	0.29
Bromuconazole (sum)	0.18
Bupirimate	0.52
Buprofezin	3.59
Cadusafos (aka ebufos)	1.60
Camphechlor (sum)	No ADI available/no exposure (*)
Captan	0.10
Carbaryl	4.52
Carbendazim and benomyl (sum)	2.13
Carbofuran (sum)	30.75
Carbosulfan	0.26
Chlordane (sum)	0.71
Chlorfenapyr	1.68
Chlorfenvinphos	34.02
Chlormequat	5.27
Chlorobenzilate	No exposure (*)
Chlorothalonil	2.27
Chlorpropham (sum)	0.60
Chlorpyrifos	6.64
Chlorpyrifos-methyl	3.93
Clofentezine (sum)	1.28
Clothianidin	0.19
Cyfluthrin (sum)	17.37
Cypermethrin (sum)	1.50
Cyproconazole	1.27
Cyprodinil	1.68
DDT (sum)	2.38
Deltamethrin (sum)	5.63
Diazinon	93.19
Dichlofluanid	No exposure (*)
Dichlorvos	30.94

Pesticide	TMDI max (in % ADI)
Dicloran	1.38
Dicofol (sum)	15.16
Difenoconazole	2.44
Dimethoate (sum)- dimethoate scenario	26.17
Dimethoate (sum)- omethoate scenario	87.24
Dimethomorph	0.33
Dinocap (sum)	0.48
Diphenylamine	1.66
Dithiocarbamate-mancozeb scenario	9.18
Dithiocarbamate-ziram scenario	85.75
Endosulfan (sum)	6.37
Endrin	1.63
Epoxiconazole	2.58
Esfenvalerate (sum)	1.50
Ethephon	2.37
Ethion	3.23
Ethoprophos	5.04
Etofenprox	0.71
Fenamiphos (sum)	5.10
Fenarimol	2.06
Fenazaquin	5.19
Fenbuconazole	3.08
Fenbutatin oxide	0.75
Fenhexamid	0.31
Fenitrothion	3.15
Fenoxycarb	0.41
Fenpropathrin	0.66
Fenpropimorph	8.92
Fenthion (sum)	2.42
Fipronil (sum)	32.32
Fluazifop-P-butyl (sum)	0.80
Fludioxonil	0.14
Flufenoxuron	2.19
Fluquinconazole	8.29
Flusilazole	7.81
Flutriafol	1.81
Folpet	0.05
Formetanate (sum)	3.09
Fosthiazate	1.38
Glyphosate	0.46
Haloxyfop (sum)	0.71
HCH-alpha	No ADI available
HCH-beta	No ADI available
Heptachlor	18.52
Hexachlorobenzene	No ADI available
Hexaconazole	3.44

Pesticide	TMDI max (in % ADI)
Hexythiazox	0.92
Imazalil	17.99
Imidacloprid	0.65
Indoxacarb (sum)	3.86
Iprodione	2.53
Iprovalicarb	1.04
Kresoxim-methyl	0.07
lambda-Cyhalothrin (sum)	5.99
Lindane (sum)	0.22
Linuron	2.52
Lufenuron	1.47
Malathion (sum)	0.60
Mancozeb	9.19
Mepanipyrim (sum)	0.03
Mepiquat	0.16
Metalaxyl-M (sum)	0.50
Metconazole	0.12
Methamidophos	6.15
Methidathion	25.03
Methiocarb (sum)	0.62
Methomyl and thiodicarb (sum)	2.61
Methoxychlor	0.01
Methoxyfenozide	0.18
Monocrotophos	3.44
Myclobutanil	1.28
Omethoate- see dimethoate	
Oxadixyl	0.35
Oxamyl	4.33
Oxydemeton-methyl (sum)	44.70
Paclobutrazol	0.14
Parathion	No exposure (*)
Parathion-methyl (sum)	No exposure (*)
Penconazole	0.86
Pencycuron	0.06
Pendimethalin	0.15
Permethrin (sum)	0.04
Phenthoate	1.61
Phosalone	2.41
Phosmet (sum)	2.51
Phoxim	0.19
Pirimicarb (sum)	0.85
Pirimiphos-methyl	13.07
Prochloraz (sum)	4.60
Procymidone	10.38

Pesticide	TMDI max (in % ADI)
Profenofos	0.21
Propamocarb (sum)	0.13
Propargite	No ADI available
Propiconazole	0.31
Propyzamide	0.34
Prothioconazole (sum)	No exposure (*)
Pyraclostrobin	1.22
Pyrazophos	No exposure (*)
Pyrethrins	2.01
Pyridaben	2.84
Pyrimethanil	0.50
Pyriproxyfen	0.10
Quinoxyfen	0.09
Quintozene (sum)	No exposure (*)
Resmethrin (sum)	No exposure (*)
Spinosad (sum)	0.74
Spiroxamine	0.38
tau-Fluvalinate	4.42
Tebuconazole	1.43
Tebufenozide	0.88
Tebufenpyrad	2.34
Tecnazene	No exposure (*)
Teflubenzuron	2.00
Tefluthrin	1.52
Tetraconazole	5.07
Tetradifon	1.54
Thiabendazole	2.55
Thiacloprid	2.43
Thiametoxam (sum)	1.00
Thiophanate-methyl	0.37
Tolclofos-methyl	0.15
Tolylfluanid (sum)	0.19
Triadimefon (sum)	1.38
Triadimenol (sum)	0.09
Triazophos	6.60
Trichlorfon	No ADI available
Trifloxystrobin	0.34
Triflumuron	1.50
Trifluralin	1.34
Triticonazole	0.05
Vinclozolin (sum)	1.75
Zoxamide	0.01

(*) No exposure = no quantifiable residues were measured above the LOQ in any of the samples analyzed; a "no residue" or a "no use" situation was assumed.

For 11 pesticides (amitrole, benfuracarb, chlorobenzilate, dichlofluanid, parathion, parathion-methyl, prothioconazole, pyrazophos, quintozene, resmethrin and tecnazene) no quantifiable residues were reported in any of the crops considered in the chronic exposure assessment. Thus, it is concluded that the long-term consumer exposure is considered negligible for these pesticides.

The same is true for two of the seven substances included in the 2010 EU-coordinated control programme for which no ADI values were allocated (azinphos-ethyl and camphechlor). For the remaining pesticides without ADI values (HCH-alpha, HCH-beta, hexachlorobenzene, propargite and trichlorfon) measurable residues at or above the LOQ were found in samples analysed. However, lacking toxicological reference values, no long-term risk assessment could be performed.

Figure 5-4 gives an overview of the results calculated for the 178 pesticides covered by the EU coordinated programme, grouping them in classes according to the percent of the ADI exhaustion.

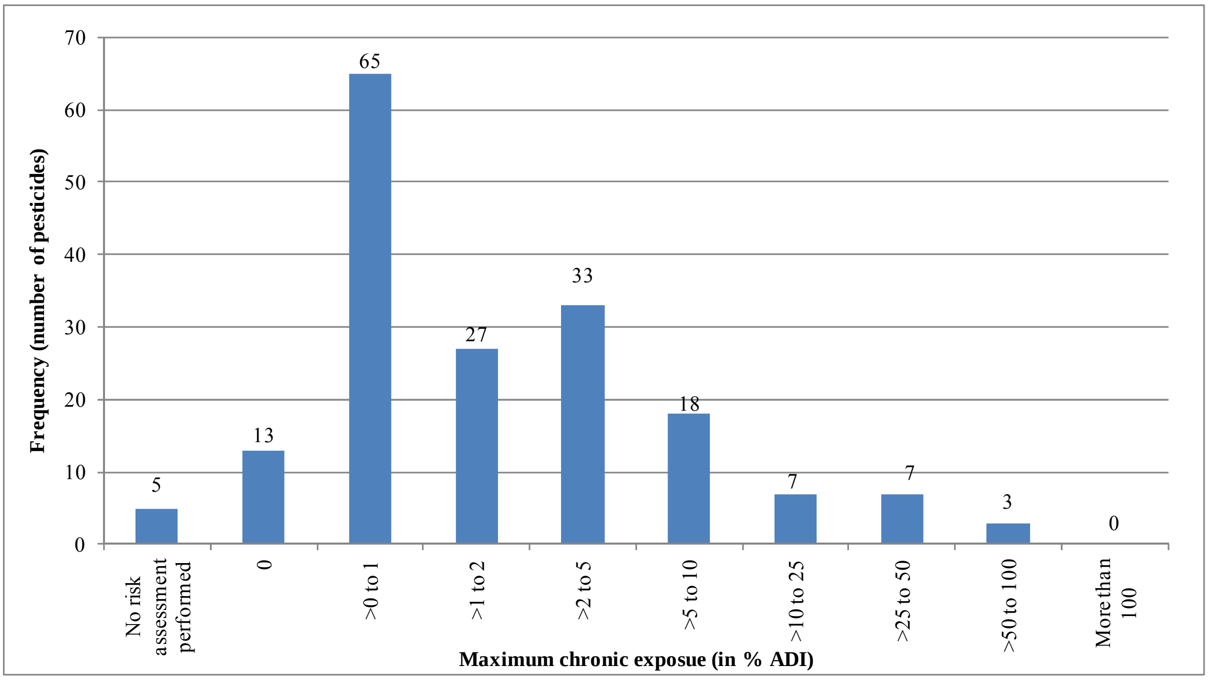

Figure 5-4: Breakdown of the total number of pesticides according to the estimated chronic exposure (expressed in percentage of the ADI) according to scenario 1.

For none of the pesticides covered by the EU-coordinated monitoring programme, the estimated exposure exceeded the ADI value. Therefore, based on the current scientific knowledge, no long-term consumer health risk is expected for these compounds. It is noted that for 105 of the substances (60% of the surveyed substances) the estimated exposure was negligible or accounted for less than 2% of the ADI; only for 3 substances assessed with regard the chronic exposure the estimated TMDI accounted for more than 50% (but less than 100%) of the ADI.

5.5. Indicative cumulative risk assessment

According to the methodologies currently used in consumer risk assessment, the exposure assessment is calculated for each pesticide separately. However, since consumers may be exposed to more than one pesticide either within one meal or over a longer period consuming different food, it is of importance to assess whether the combined exposure to the different pesticides actually present on the food eaten is posing a risk to consumer health.

So far at EU level a lot of work has been done to develop a methodology to assess cumulative exposure (EFSA colloquium in 2006; EFSA, 2008; EFSA, 2009; EFSA, 2012b). However, some work still needs to be completed before a cumulative risk assessment can be implemented in routine pesticide risk assessment (EFSA-Q-2009-00860). In addition to the agreement on a methodology to be used in future, it has to be ensured that monitoring data and food consumption data needed are available at the necessary level of detail and in a format suitable for performing cumulative exposure calculations.

EFSA decided to perform indicative cumulative risk assessments in the framework of this report for both, a chronic and an acute scenario to explore potential deficiencies resulting from the monitoring data generated by the reporting countries and other limitations which may impede the practical implementation of the methodologies currently under development. In case such deficiencies become evident, recommendations should be derived with view on how to modify the monitoring programmes and data reporting formats to be prepared for future cumulative risk assessments.

A second purpose of this assessment is to estimate whether lower tier calculations (e.g. deterministic calculations) as described in the opinions of the PPR Panel of EFSA are suitable screening tools to exclude consumer health risks (EFSA, 2008; EFSA 2012b). Alternatively, the need to use refined exposure calculation methodologies, which are characterised by a higher level of complexity, should be explored. It should be highlighted that the purpose of the exercise was not to obtain accurate exposure estimates. Thus, the results presented in the next sections should be regarded as purely indicative reflecting conservative worst-case assumptions which are likely to overestimate the real consumer exposure.

5.5.1. Methodology for chronic cumulative exposure assessment

In the EFSA Scientific Opinion regarding the suitability of existing methodologies and identification of new approaches to assess cumulative and synergistic risks from pesticides to human health (EFSA, 2008) the framework of cumulative assessments and the selection of the parameters to be considered for the calculations are discussed in detail. In Table 5-7 EFSA describes the modelling approach selected for this specific exercise and the justification for the choices made.

Table 5-7: Description of the modelling approach used for the chronic (long-term) cumulative exposure assessment.

Reference to paragraph in scientific opinion (EFSA, 2008)	Approach used	Justification
1.1. Sources and pathways of exposure	**Exposure via food ingestion**, excluding drinking water, residential or occupational exposure and other routes of exposure (dermal, inhalation)	No data and methodology are available to EFSA regarding other sources/pathways of exposure which could be used for a wider aggregate assessment, than exposure via dietary intake.
1.2. Types of combined action	**Dose addition** of compounds belonging to the chemical class of organophosphates (OP) and N-methyl carbamates (restricted to those **OP pesticides and carbamates which were included in the EU-coordinated monitoring programme**, see Table 5-8).	OP pesticides and N-methyl carbamates cause a common toxic effect by the same sequence of major biochemical events, i.e. inhibition of the cholinesterase. The selection of this subgroup of chemicals based on the chemical class was made for pragmatic reasons without prejudice to the final decision on common assessment groups which is currently under discussion (EFSA-Q-2009-00860)[(*)].
1.3 Types of exposure scenario	Assessment of the **chronic (long-term) actual exposure**	Relevant scenario for this exercise.
2.2. Methods for assessment of the combined risk	**Hazard index** (HI) (expressed in percent of the reference value).	The HI is considered as a transparent and understandable approach (EFSA, 2009) which does not require further toxicological assessments. Thus, as it can be implemented without any further toxicological data analysis it is the approach most suitable for this exercise. The exposure is expressed in percent of the toxicological threshold for long-term exposure; thus, an exposure equal or below 100% of the toxicological threshold, meaning that the exposure is not likely to pose a consumer health risk. This presentation of the results allows a direct comparison with the results derived for the individual pesticides where the exposure is expressed in % of the ADI of the respective pesticide.
2.2.1.Toxicological reference value	**ADI** as reported in Table 5-4 the substances under consideration. It is assumed that parent compound and metabolites included in the residue definition have a comparable toxicity.	Conservative approach which does not require further toxicological evaluations.
3.2. Residues data; 3.2.1.2. Monitoring data	**Results** reported in the framework of the **EU-coordinated monitoring programme** for apples, head cabbage, leek, lettuce, milk, peaches, pears, rye, oats, strawberries, swine meat and tomatoes. For the other commodities considered in the exposure assessment described in section 5.3 the results reported in the framework of the **national programmes** were used. No extrapolation to other food commodities was considered.	The residue results reported in the framework of the EU-coordinated programme are assumed representative with regard to geographical distribution, number of samples and crops. Results are not biased by targeted sampling strategies. To be representative for the whole diet, the residue dataset is completed for the most important food commodities using the results of the national monitoring programmes. Although these data might be more targeted, they are the best data available for the time being to estimate the overall exposure.

Reference to paragraph in scientific opinion (EFSA, 2008)	Approach used	Justification
	Only results which were **compliant with the legal enforcement residue definition** were included. No correction for risk assessment residue definition. **No processing data** are considered.	
3.2.1.3. Using censored data	Scenario 1: Mean residue concentration as reported in Table 5-5 for the relevant pesticide/crop combinations assuming non-detects as containing the full LOQ (residue concentration equivalent to the LOQ).	Scenario 1 is considered as the "worst-case" scenario since the non-detects have a major impact on the outcome of the exposure calculation, EFSA calculated three scenarios. Scenario 1 is the most conservative approach assuming each non-detected substance is present in the sample at the numerical value of the LOQ ("pessimistic scenario").
	Scenario 2: Mean residue concentration was calculated replacing the non-detects with zero in case the MRL is set at the limit of quantification for the respective pesticide/crop combination. For pesticide/commodity combinations with MRL above the LOQ the non-detects were still considered as containing the full LOQ.	Scenario 2 is another possible approach to simulate sample residues between real zero residues and cases where residues might be present in trace concentrations, indirectly taking into account the use pattern of the pesticides. If the MRL is set at the LOQ, this is a strong indication that there is no authorised use for the pesticide/crop combination.
	Scenario 3: The mean residue concentrations used as input values for the cumulative exposure were calculated by replacing all the LOQs for non-detects by zero assuming that these samples do not contain any residue of the pesticide under consideration.	Scenario 3 is the "optimistic scenario" assuming that all samples where no measurable residues were detected (residues below LOQ) were free of the pertinent pesticide.
3.3.3. Food consumption data in chronic intake assessments	**Mean consumption** data for the 27 diets represented in the EFSA **PRIMo revision 2**.	To be consistent with the risk assessment performed for the single substances, the consumption data of the standard risk assessment model were used.
3.4. Determination of the exposure to each pesticide	Deterministic approach (NEDI approach according to WHO methodology as implemented in the EFSA PRIMo).	First tier calculation suitable to get indicative results, sufficiently conservative, less resources needed compared to probabilistic methodology.

(*) EFSA-Q-2009-00860: Mandate on the identification of pesticides to be included in cumulative assessment groups on the basis of their toxicological profile. Further information can be found at http://registerofquestions.efsa.europa.eu/roqFrontend/questionsListLoader?panel=ALL).

Since the non-detects residues are expected to have a major impact on the results of the exposure calculation, the PPR Panel recommended to perform sensitivity analysis, replacing the LOQ partially or completely with zero to quantify the contribution of samples with non-detects to the overall estimated exposure (EFSA, 2008). EFSA therefore calculated three scenarios (see Table 5-7), where scenario 1 is considered to be a rather unrealistic worst case scenario calculating the mean by assuming the samples without detectable residues (<LOQ) contain residue concentrations at the numerical level of the LOQ. Scenario 2 is exploring the possibility to refine the calculations indirectly taking into account the information on authorisations of pesticides for certain uses. The EFSA PPR Panel recommended that for non-detects information on the percentage of the crop treated could be used to replace a certain percentage of the non-detects with zero (EFSA, 2008). To implement this recommendation, statistical data on the use of pesticides in all EU Member States would be required[76]. However, a central repository containing this information currently does not exist. There is also no central register in place on the pesticide authorisations granted at Member State level for each pesticide. This type of information would allow estimating which pesticides are likely to be used on which crops. To overcome this lack of information, EFSA used an alternative approach which takes into account that for a pesticide/crop combination where an authorised use is registered, normally the MRL is set at a level greater than the LOQ. Thus, if the MRL is set at the LOQ[77], this is a strong indicator that no authorisation exists and that therefore samples free of measurable residues (below LOQ) can be considered as real zeros. Infringements which would lead to residues above the LOQ however would still be considered in the exposure calculation. EFSA also calculated a third scenario ("optimistic scenario") where the mean residue concentrations were calculated by replacing the LOQ values reported with a zero. This scenario implies that samples with non-detectable residues are completely free of the pertinent pesticide. In reality, these samples, however, might contain traces of the pesticide and therefore this scenario might underestimate the actual exposure.

In the table below (Table 5-8) the 42 pesticides that have been included in the cumulative risk assessment are listed. The list comprises 32 organophosphates and 10 carbamates. 28 of the pesticides are currently not approved under Regulation (EC) No 1107/2009; in 2010 the situation was comparable.

Table 5-8: Pesticides included in the common assessment group for cumulative chronic exposure assessment.

Pesticide	Chemical class	Approval status[(a)]	Comment
Acephate	organophosphate	Not approved	
Aldicarb	carbamate	Not approved	
Azinphos ethyl	organophosphate	Not approved	No detectable residues in any sample, no ADI allocated.
Azinphos-methyl	organophosphate	Not approved	
Benfuracarb	carbamate	Not approved	No detectable residues in any sample.
Cadusafos	organophosphate	Not approved	
Carbaryl	carbamate	Not approved	
Carbofuran	carbamate	Not approved	
Carbosulfan	carbamate	Not approved	
Chlorfenvinphos	organophosphate	Not approved	
Chlorpyrifos	organophosphate	Approved	
Chlorpyrifos-methyl	organophosphate	Approved	
Diazinon	organophosphate	Not approved	

[76] For imported products such a refinement would not be possible since the use pattern of pesticides in third countries is not available.

[77] The pesticides belonging to the chemical classes of organophosphates and carbamates which are considered in this exercise are used as insecticides and acaricides. The treatment of the crops usually takes place not only in the very early development stages of the crops and therefore residues are rather likely to occur on the harvested crops. Thus, in case a pesticide is authorised in most cases the MRLs are a level higher than the LOQ.

Pesticide	Chemical class	Approval status[(a)]	Comment
Dichlorvos	organophosphate	Not approved	
Dimethoate/Omethoate[(b)]	organophosphate	Approved	ADI of dimethoate was used to calculate exposure.
Ethion	organophosphate	Not approved	
Ethoprophos	organophosphate	Approved	
Fenamiphos	organophosphate	Approved	
Fenitrothion	organophosphate	Not approved	
Fenthion	organophosphate	Not approved	
Formetanate	carbamate	Approved	
Fosthiazate	organophosphate	Approved	
Malathion	organophosphate	Approved	
Methamidophos	organophosphate	Not Approved	
Methidathion	organophosphate	Not approved	
Methiocarb	carbamate	Approved	
Methomyl/Thiodicarb [(c)]	carbamate	Approved	
Monocrotophos	organophosphate	Not approved	
Oxamyl	carbamate	Approved	
Oxydemeton-methyl	organophosphate	Not approved	
Parathion	organophosphate	Not approved	No detectable residues in any sample.
Parathion-methyl	organophosphate	Not approved	No detectable residues in any sample.
Phenthoate	organophosphate	Not approved	
Phosalone	organophosphate	Not approved	
Phosmet	organophosphate	Approved	
Phoxim	organophosphate	Not approved	
Pirimicarb	carbamate	Approved	
Pirimiphos-methyl	organophosphate	Approved	
Profenofos	organophosphate	Not approved	
Pyrazophos	organophosphate	Not approved	
Triazophos	organophosphate	Not approved	
Trichlorfon	organophosphate	Not approved	No ADI allocated

(a) Approved or not approved for use in the EU according to Regulation (EC) No 1107/2009.

(b) The cumulative exposure was calculated assuming the reported residues refer exclusively to the authorised dimethoate with no omethoate present in the sample.

(c) The cumulative exposure was calculated assuming the reported residues refer exclusively to the authorised methomyl with no thiodicarb present in the sample.

5.5.2. Results for chronic cumulative exposure assessment

In Figure 5-5 the results for the cumulative exposure assessment using the methodology described in section 5.5.1 (scenario 1) are presented graphically (only top 10 diets included in the EFSA PRIMo revision 2). The calculations reflect the worst-case scenario, assuming that each individual food commodity has been treated with all 42 pesticides included in the provisional assessment group and contained residues of each of the pesticides at least at the level of quantification. Under this unrealistic worst-case scenario the overall exposure resulting from residues of the organophosphate and carbamate pesticides ranged from 46% to 354% of the toxicological threshold for long-term exposure. As the input data for the long-term cumulative exposure for scenario 1 were derived in the same way as described for the long-term risk assessment performed for the individual compounds, the result of the cumulative exposure assessment is equivalent to the total exposure for the individual substances. For the most critical diet the main contributing pesticides were diazinon, oxydemeton-methyl, chlorfenvinphos and carbofuran; in the other diets, the pattern of the main contributing pesticides was comparable although some variations were observed as regards some individual pesticides. In all diets the non-approved pesticides were calculated to be the major contributors which accounted on average 75% of the overall calculated exposure. In the German diet for children the exposure resulting from non-authorised pesticides was calculated to be 291% of the toxicological threshold for long-term exposure compared to 62% for authorised pesticides. This high contribution of non-authorised pesticides gives an indication that the exposure calculation in scenario 1 is overemphasizing the presence of non-authorised pesticides which are not likely to be used any more at EU level. For most of these non-authorised pesticides the measured residues corresponded to the LOQ. Thus, the use of residue concentrations at the LOQ in the exposure calculation makes the calculation overly conservative.

Figure 5-6 presents the results of scenario 1 describing the contribution of the individual commodities; from this presentation it becomes evident that in the diet representative for German children, apples were the main source of pesticide exposure accounting for 179% of the toxicological reference value. It is noted that the high apple consumption of German children is mainly related to the consumption of apple juice. Also in other diets apples, oranges, potatoes and beans with pods were the major contributing crops. These results also demonstrate that further refined exposure calculations would be possible if processing factors were available (e.g. processing factor for apple juice, peeling of oranges, cooking of potatoes and beans).

The impact of the non-detects was partially assessed in the refined scenario 2 (Figure 5-7 and Figure 5-8). By omitting the non-detects for the pesticide/crop combinations for which the MRLs are set at the LOQ the overall exposure dropped significantly: the highest exposure was again calculated for the German children with an overall exposure of 150% of the toxicological reference value. For all diets the exposure accounted on average for 35% of the exposure calculated in scenario 1. Thus, it is demonstrated that the non-detects were significantly biasing the overall exposure in the unrefined scenario 1. The exposure resulting from approved pesticides dropped from 62% in scenario 1 to 41% (scenario 2). The non-authorised pesticides dropped from 291% to 108% of the total exposure (expressed in percent of the toxicological threshold). As main contributing pesticides in scenario 2, oxydemeton-methyl, carbofuran, methidathion and dimethoate were identified. The non-authorised pesticides with very low toxicological reference values (diazinon, dichlorvos and chlorfenvinphos), which were major contributors in scenario 1, were of minor importance in scenario 2. While the main contributing commodities in scenario 1 and 2 (Figure 5-6 and Figure 5-8) did not change, the number of commodities contributing to more than 2% to the total exposure was lower in scenario 2 for all of the diets (e.g. German diet: in scenario 1, 16 commodities contributed to more than 2% to the exposure respectively whereas in scenario 2 only six commodities exceeded 2% of the exposure).

In scenario 3 EFSA calculated an “optimistic” scenario in which the samples without measurable residues above the LOQ were considered as completely free of the respective pesticide. The results reflecting this assumption are presented in Figure 5-9 and Figure 5-10. In this scenario the maximum exposure accounted for 16% of the toxicological threshold value (German children). Pirimiphos-methyl, methidathion, chlorpyrifos, carbofuran, dimethoate and diazinon were identified as the main contributing pesticides. All other pesticides resulted in an exposure below 1% of the toxicological reference value. Overall, the pesticides authorised in the EU were the main contributors in the most critical diet (10% of the toxicological reference values); among the pesticides not authorised in the EU, methidathion in oranges was the major source of exposure (3% of the toxicological reference value). As regards the major commodities mostly contributing to the exposure, wheat, oranges and apples were identified as the major source of exposure in most of the diets. Further refinements of the exposure calculation leading to a lower overall exposure could be introduced by using appropriate processing factors (e.g. milling/baking for cereals or peeling for citrus fruit).

The calculations presented in scenario 1, 2 and 3 do not allow to draw a clear conclusion whether the exposure to the group of OP pesticides and carbamates represented a potential long-term consumer health risk in 2010. While in scenario 3 the estimated exposure was well below the toxicological reference values, the results of scenario 1 and 2 exceeded the toxicological threshold. The comparison of the results obtained in scenario 3 and the more conservative calculations under scenario 1 and 2 demonstrates that the non-detects (results reported as LOQ) are the main “drivers” for the overall cumulative exposure under the less conservative scenarios.

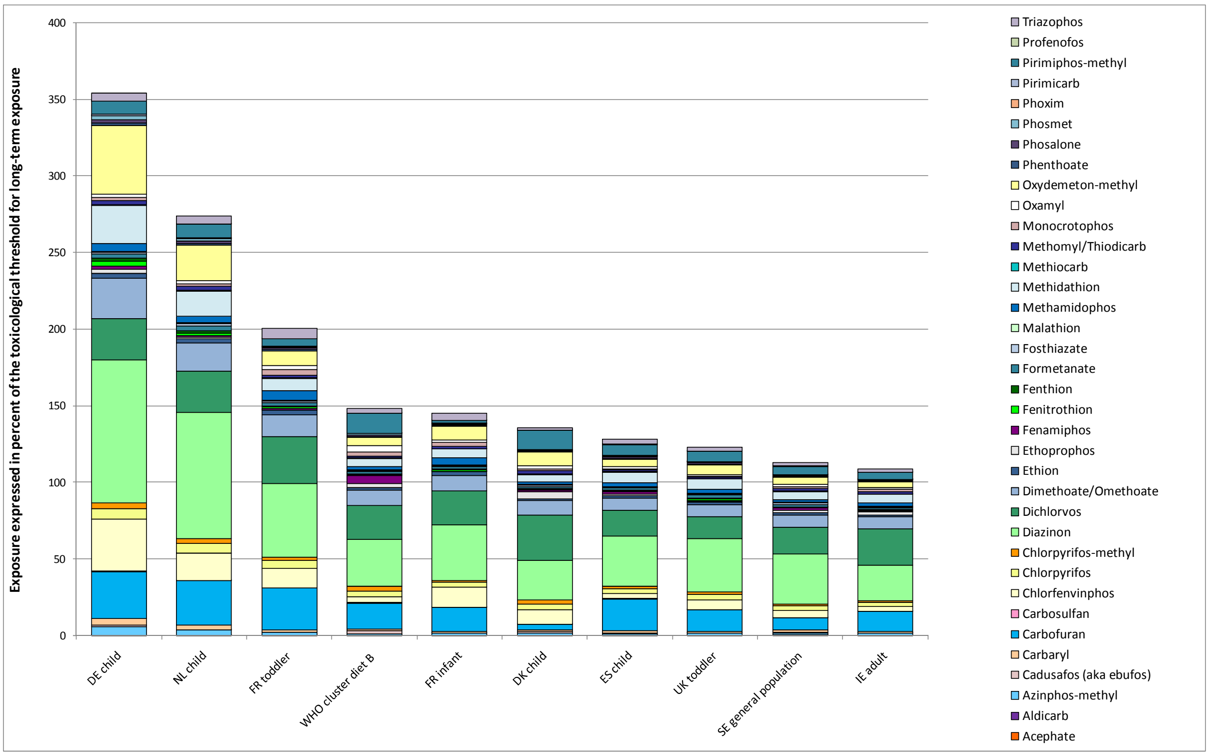

Figure 5-5: Results of chronic cumulative exposure assessment (results broken down by active substances), scenario 1.

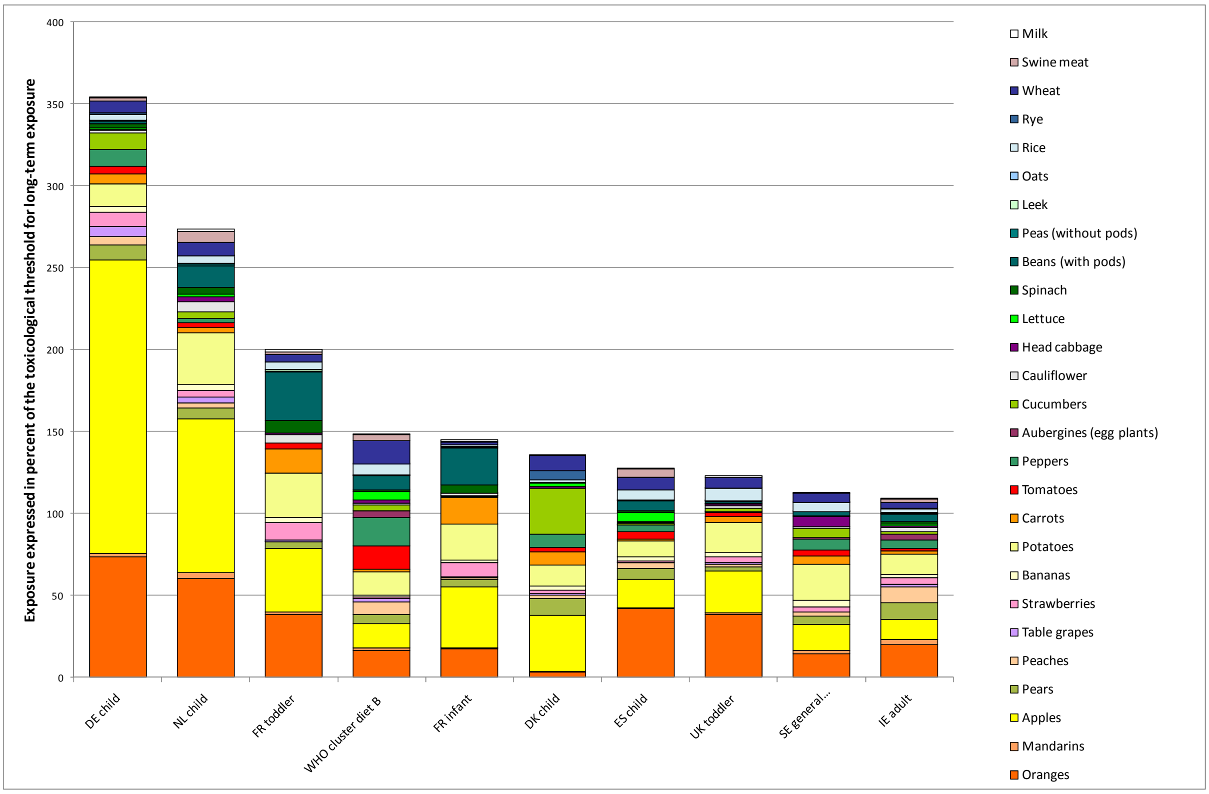

Figure 5-6: Results of chronic cumulative exposure assessment (results broken down by commodities), scenario 1.

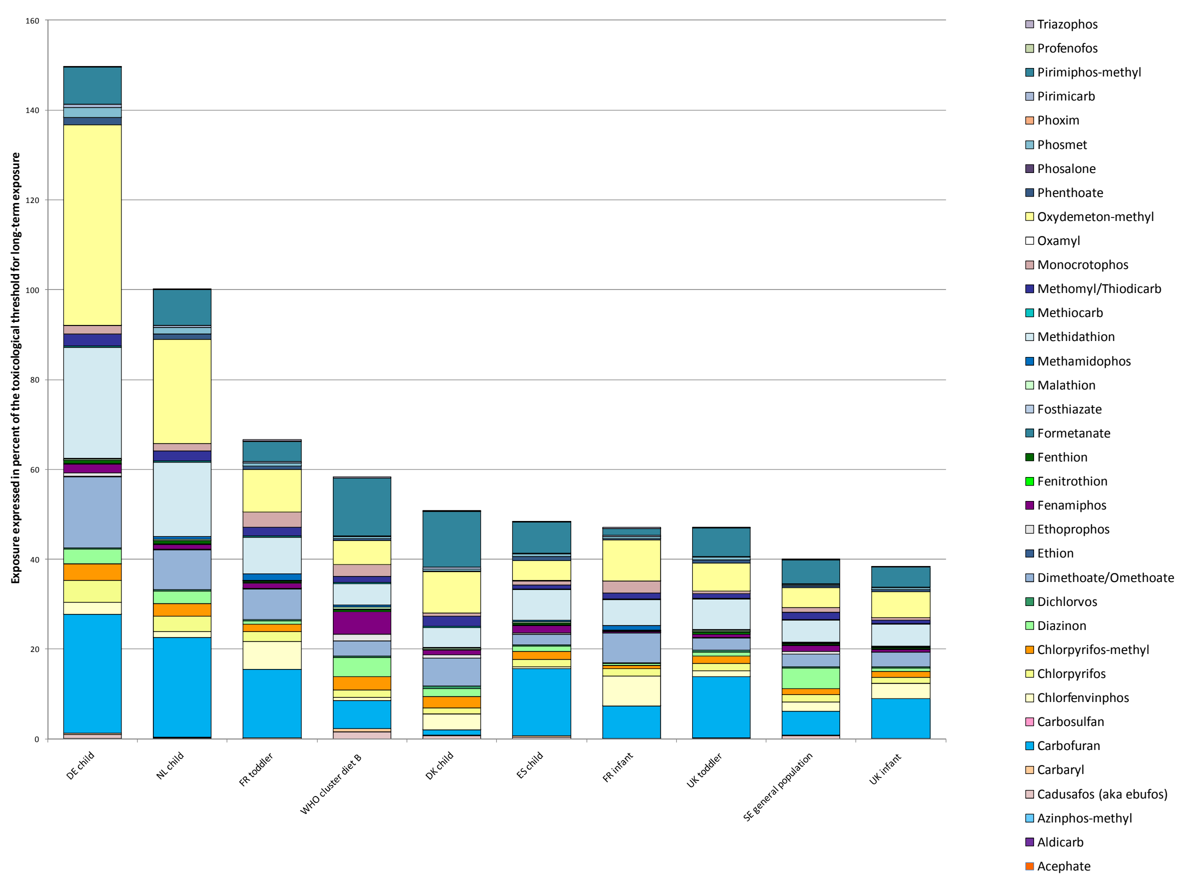

Figure 5-7: Results of chronic cumulative exposure assessment (results broken down by active substances), scenario 2.

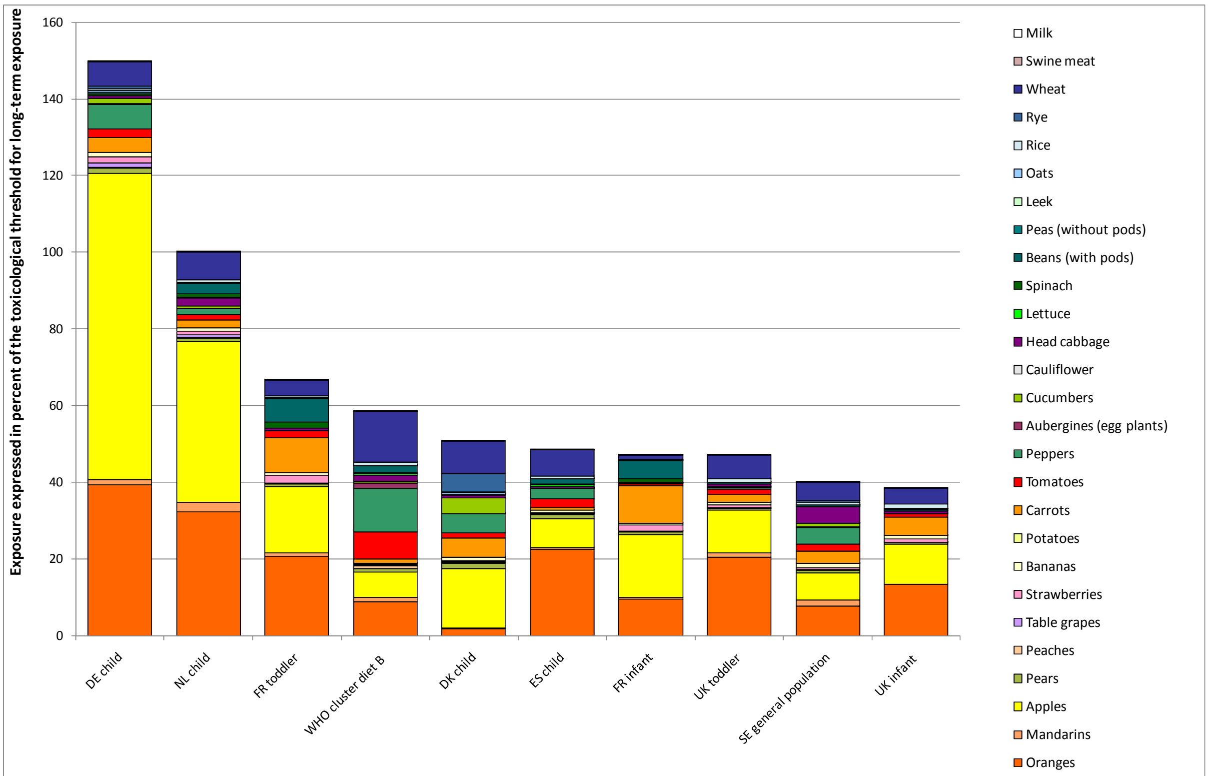

Figure 5-8: Results of chronic cumulative exposure assessment (results broken down by commodities), scenario 2.

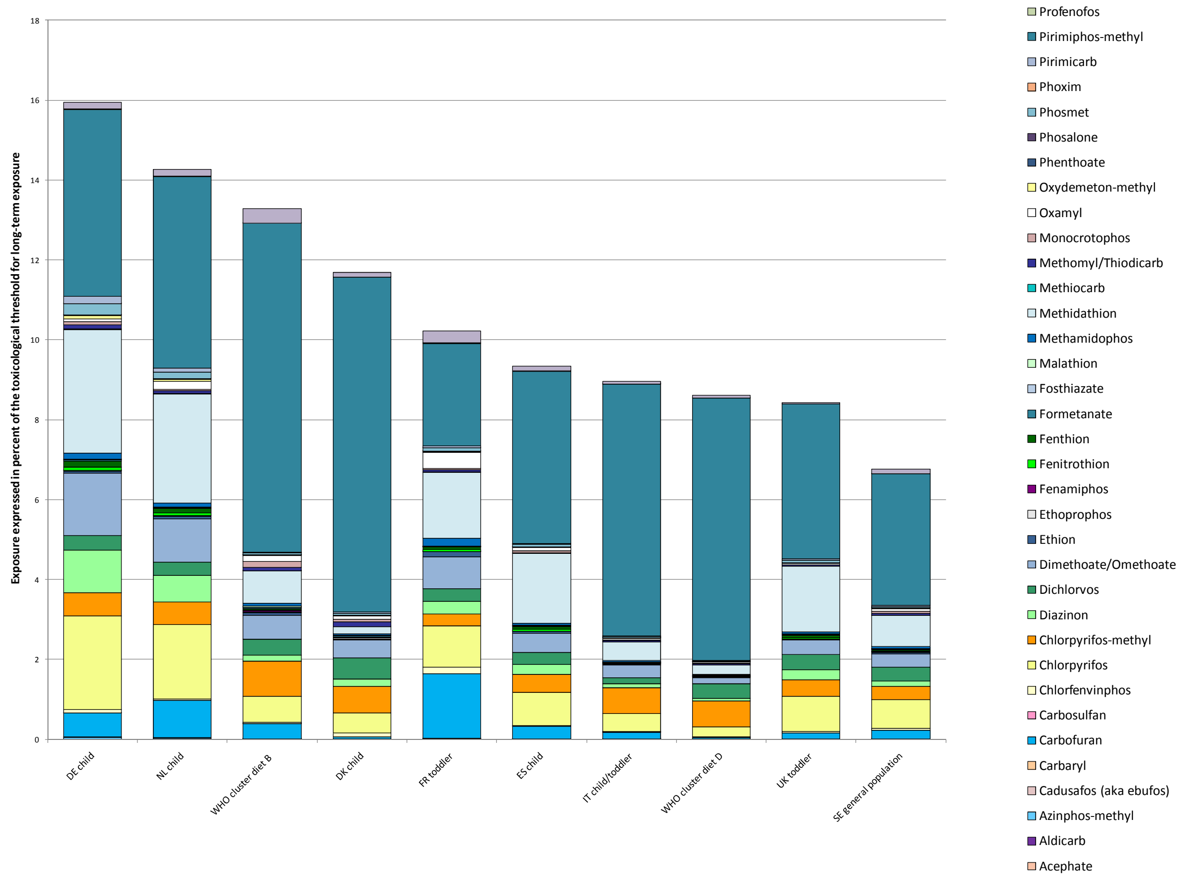

Figure 5-9: Results of chronic cumulative exposure assessment (results broken down by active substances), scenario 3.

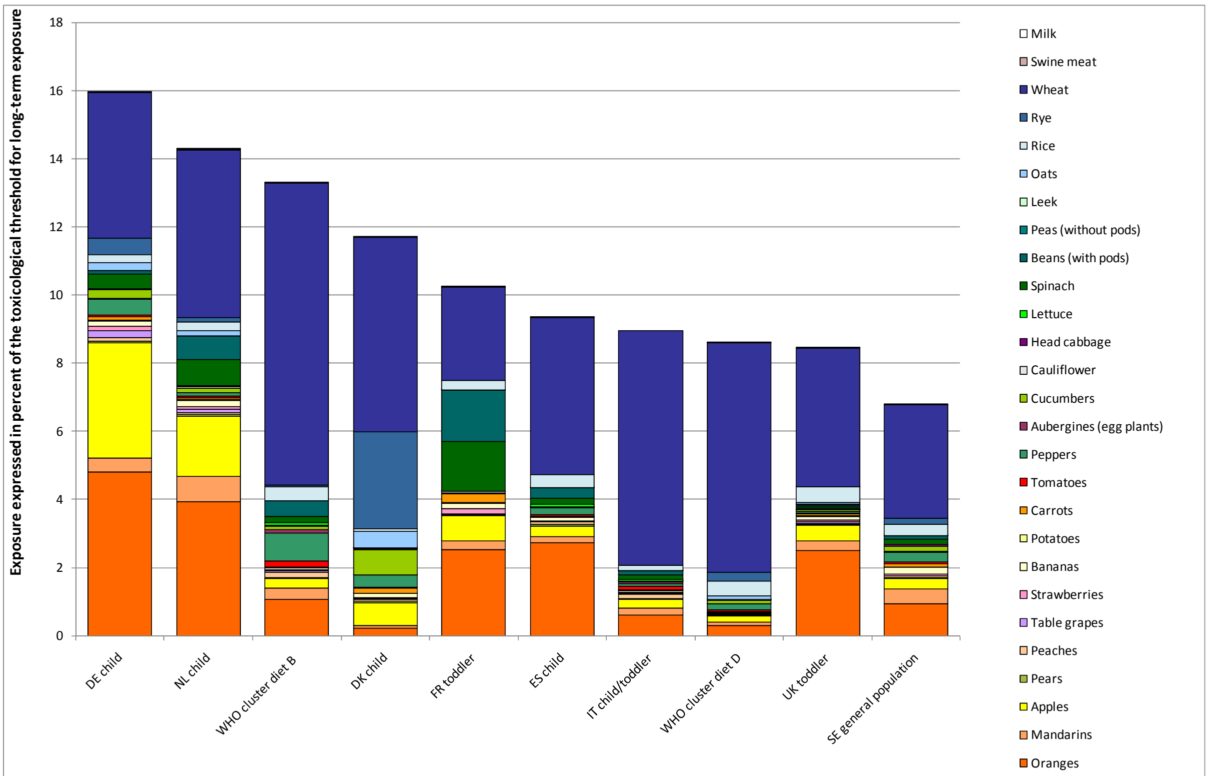

Figure 5-10: Results of chronic cumulative exposure assessment (results broken down by commodities), scenario 3.

The high number of non-detects introduces a high uncertainty in the exposure calculations. The exercise described in this report demonstrated that comparing the provisional results of the "optimistic" and the "pessimistic" scenario differed by a factor of ca. 20. EFSA is of the opinion that it is of importance to find suitable options for refining the calculations and to reduce the uncertainties in the exposure calculations.

In simplified terms, there are different reasons why samples are found to be free of measurable residues[78]:

(a) The pesticide was not used on the crop because the use is not authorised;

(b) The pesticide is authorised for the use on the concerned crop, but was not used on the sample analysed because the crop disease or the pest did not occur or because alternative products were used;

(c) The pesticide was used, but due to its degradation the residue concentration declined to a concentration which could not be quantified with the analytical method used in the control laboratory.

While in case (a) and (b) the sample should be considered as free of the respective residue, in case (c) traces of the pesticide may be present on the crop which should be considered in the consumer risk assessment. In its scientific opinion on risk assessment for the triazole pesticides, the EFSA PPR Panel highlighted that the methods for handling non-detects (ND) can have a great impact on the extent of the estimated exposure, in particular when using deterministic models. The Panel made several proposals how to handle non-detects (assume ND samples as being zero, treat them as containing the full LOQ or treat them as containing a concentration between zero and the LOQ) and recommended to perform sensitivity analysis to assess the impact of the different assumptions. In its guidance on the use of probabilistic methodology for modelling dietary exposure to pesticide residues (EFSA, 2012b), the Panel proposes to treat all samples with residues below the limit of reporting as true zeroes or as containing residues at the level of the limit of reporting in the optimistic and pessimistic runs of the basic assessments respectively. The same assumptions could be considered in the deterministic assessments. A refined approach is to take into account the percentage of crops non-treated as being a true zero. However, as reliable data on the use pattern of the individual chemicals are not available, this option is not easy to be implemented in practice (EFSA, 2009).

In these indicative exposure calculations EFSA followed the recommendations given by the PPR Panel by calculating the pessimistic and the optimistic scenario (scenario 1 and 3). In Scenario 2 EFSA tried to overcome the lack of information on the use patterns by linking the residue results with the MRL database which indirectly provides information on authorisations. However, more suitable databases should be developed which provide the information on authorised uses of pesticides for the individual crops. In the framework of the MRL review of pesticides under Article 12 of Regulation (EC) No 396/2005 the information on authorised uses will be compiled for all pesticides covered by the review programme. With this information it will be possible to identify the cases described above as case a) (no-authorisation/no-use situation). For food originating from the EU, the LOQ results could be replaced by zero in a refined exposure calculation.

The use of a database on the authorised uses would be only a first step of the refinement. In addition, it would be desirable to collect information on the actual use of the pesticides belonging to the common assessment groups to estimate the percentage of crops treated (case (b) above mentioned). The more detailed information is available, preferably at Member State level, the more refined calculations will be possible, reducing the overall uncertainty of the calculations.

Another strategy to refine the exposure assessment is to improve the sensitivity of analytical methods which would allow lowering the LOQs. Thus, this measure would have an influence on the mean residue concentrations calculated. Since the costs for analysis usually increase with decreased LOQs, a careful impact assessment needs to be performed. However, for pesticides with very low

[78] This enumeration is not exhaustive, and focuses only on the use of pesticides on primary crops.

toxicological reference values the increasing of the sensitivity of the analytical methods would be a benefit.

Finally, the reporting of monitoring results could be revised with view on reducing the uncertainties for exposure assessments resulting form non-detects (results below the limit of quantification, <LOQ). In addition to the mandatory information whether a residue was measured below or above the LOQ, Member States report only on a voluntary basis the limit of detection (LOD)[79] and if the residues analysed were found to be below the limit of detection (<LOD). However, in order to calculate more accurate input values for the exposure assessment, this would be valuable additional information to decide whether the LOQ should be replaced by zero. Therefore it is recommended to explore with Member State experts the possibility to report the results differently for samples where the residues were between the LOD and the LOQ.

Other limitations regarding the implementation of cumulative risk assessment were identified regarding the availability of processing and consumption data for processed commodities.

Finally, the risk assessment screening was performed with a simple deterministic tool taking into account the food commodities covered by the EU-coordinated programme and restricted to the results reported for the pesticides covered by the EU-coordinated programme. The approach to use a simple deterministic screening tool for a lower tier approach would be very useful. Deterministic methods based on the hazard index are normally considered as highly conservative. However, EFSA is of the opinion that before using deterministic models as screening tool, the conservatism of these methods should be confirmed by validating them by performing calculation of comparable scenarios with a probabilistic approach and comparing the results.

5.5.3. Methodology for acute cumulative exposure assessment

Exposure to more than one pesticide within a short period of time is related to the consumption of a single food item containing residues of multiple pesticides or to the consumption of different food items in a single meal containing different pesticides. While in the first case a simple deterministic tool could be used as a first tier for the estimation of the consumer exposure, the estimation of the acute cumulative exposure related to the latter case requires the use of more sophisticated probabilistic models which take into account the probability of a consumer eating more than one food containing residues, the distribution of the residue concentrations found for the pertinent food items and the distribution of the food consumption.

As mentioned before, one of the main purposes of the cumulative exposure assessment in the framework of this exercise is to test the suitability of the reported monitoring data to perform cumulative exposure assessments. EFSA therefore used a simple deterministic approach which allows estimating the exposure resulting form a single food during a single meal. The modelling approach applied for this exercise is described in Table 5-9. This example is intended mainly to gain more practical experience regarding the suitability of the monitoring data to perform this task in the future, and does not prejudice the final decision on the methodology that will be used in the future.

[79] See “Limit of Quantification/Limit of Detection” in the Glossary.

Table 5-9: Description of the modelling approach used for the acute (short-term) cumulative exposure assessment.

Reference to paragraph in scientific opinion (EFSA, 2008)	Approach used	Justification
1.1. Sources and pathways of exposure	**Exposure to multiple residues present on lettuce**	Since lettuce was the food item which was discussed in details regarding multiple residues in Section 4.6.5.1, the cumulative exposure focussed on this commodity. (**1,041 unprocessed lettuce** samples which contained multiple residues).
1.2. Types of combined action	**Dose addition** applied by default for all pesticides found on individual lettuce samples. It is noted that in this exercise all substances are grouped together even in the absence of any indication that in practice their effects are additive.	As a worst case scenario it is assumed that all pesticides found on a single food item would contribute to the same toxicological effect. It is without prejudice to the final decision on common assessment groups which is currently under discussion (EFSA-Q-2009-00860).
1.3 Types of exposure scenario	Assessment of the **acute (short-term) actual exposure**	Relevant scenario for this exercise.
2.2. Methods for the assessment of the combined risk	**Hazard index** (HI) (expressed in percent of the reference value).	The HI is considered as a transparent and understandable approach (EFSA, 2009) which does not require further toxicological assessments. Thus, as it can be implemented without any further toxicological data analysis it is the approach most suitable for this exercise. The exposure is expressed in percent of the toxicological threshold for short-term exposure: thus, an exposure equal or below 100% of toxicological threshold means that the exposure is not likely to pose a consumer health risk. This presentation of the results allows a direct comparison with the results derived for the individual exposure assessments where the results are expressed in % of the ARfD.
2.2.1.Toxicological reference value	**ARfD** as reported in Table 5-1 (for the substances covered by the EU-coordinated programme). Lacking an ARfD, the ADI is used as a surrogate, unless from the toxicological evaluation it was concluded that no ARfD is necessary. For the additional pesticides found on lettuce, which were not covered by the coordinated programme, the ARfD values reported in Table 5-10 were used. Parent compound and metabolites included in the residue definition are considered as having comparable toxicity.	Conservative approach which does not require further toxicological evaluations. Pesticides for which the toxicological assessment concluded that no ARfD is necessary because of the low acute toxicity, were excluded from this exercise.
3.2. Residues data; 3.2.1.2. Monitoring data	**Results** reported in the framework of the EU-**coordinated monitoring and national programme for lettuce**. Results which were **compliant with the legal enforcement**	The screening of results not fully compliant with the residue definition was made in order not to omit results for compounds included in the residue definition which are of toxicological

Reference to paragraph in scientific opinion (EFSA, 2008)	Approach used	Justification
	residue definition were included. Results that were not fully compliant with the legal enforcement residue definition were screened and a case-by-case decision was taken whether they need to be considered for cumulative exposure assessment. **No processing data** (e.g. washing of lettuce, removal of outer leaves) are considered. In compliance with the IESTI calculation, it is assumed that the lettuce eaten contains **5 times the residue concentration measured in the sample** (composite sample).	relevance. E.g. if a sample was analysed only for the parent compound, but not for a metabolite included in the residue definition which is of lower acute toxicological relevance, the result was included in the exposure calculation for this sample. The PPR Panel noted that for acute risk assessment it is desirable to use residue data present on single items rather than for composite samples. However, since such data are not available the variability of concentrations in individual units needs to be considered. Using the default variability factor of 5 as used for lettuce is a very conservative assumption which means that the model assumptions are that a consumer eats a large portion of lettuce containing the 5-fold pesticide concentration reported by the reporting country.
3.2.1.3. Using censored data	Only **results greater than the LOQ** were considered.	On average ca. 300 different compounds were analysed on the individual lettuce sample (in total more than 30.000 individual determinations were reported). All results below the LOQ were disregarded to avoid overly conservative assumptions which would lead to a gross overestimation. Alternative approaches may be further explored.
3.3.3. Food consumption data in acute intake assessments	**Large portion consumption** data represented in the acute risk assessment of EFSA **PRIMo revision 2**.	To be consistent with the risk assessment performed for the single substances, the consumption data of the standard risk assessment model were used. The German children had compared with other diets the highest large portion normalised by body weight (large portion 5.38 g consumption of lettuce per kg body weight).
3.4 Determination of the exposure to each pesticide	**Deterministic approach** using the IESTI equation. The unit weight and the variability factor used in the standard setting of the EFSA PRIMo were applied.	First tier calculation suitable to get indicative results. This approach is considered to be sufficiently conservative because it is assumed that the consumer eats a large portion of lettuce containing five times the measured residue concentration (variability factor of 5). The calculation with the deterministic model is less resources intensive compared to probabilistic methodology and therefore suitable as a screening tool.

Table 5-10: ARfD for pesticides found on lettuce but not covered by EU-coordinated monitoring programme.

Pesticide	ARfD (mg/kg bw)	ARfD evaluation year	ARfD source
Benalaxyl	ARfD not necessary	2004	COM
Benfluralin	ARfD not necessary	2011	COM
Carbetamide	0.3	2011	COM
Chlorantraniliprole	ARfD not necessary	2008	DAR (Ireland)
Chlorthal-dimethyl	0.5	2007	DAR (Greece)
Cyromazine	0.1	2009	COM
Dodine	0.1	2010	EFSA
Ethiofencarb	0.1	1982	JMPR
Famoxadone	0.2	2002	COM
Fenamidone	ARfD not necessary	2003	COM
Fenpropidin	0.02	2008	COM
Fenpyroximate	0.02	2008	COM
Mandipropamid	ARfD not necessary	2012	EFSA
Metobromuron	0.03	1987	Belgium
Promecarb	No toxicological reference values available		
Proquinazid	0.2	2009	EFSA
Pymetrozine	0.1	2001	COM
Pyridate (sum)	ARfD not necessary	2001	COM
Quizalofop	0.1	2008	EFSA
Quizalofop-P-ethyl	ARfD not necessary	2008	EFSA
Quizalofop-P-tefuryl	0.1	2008	EFSA
Spinetoram	0.3	2009	EFSA
Sulphur	ARfD not necessary	2008	EFSA
Terbuthylazine	0.008	2011	EFSA

5.5.4. Results for acute cumulative exposure assessment

In total 1,041 lettuce samples containing multiple residues were identified according to the above mentioned criteria; 106 different pesticides were found in concentrations above the LOQ.

109 samples contained exclusively pesticides which were not qualified as acutely toxic and for which therefore no ARfD was considered necessary. For these samples the cumulative acute exposure is considered as not relevant. For the majority of the samples (578 samples) the cumulative exposure expressed in % of the toxicological threshold accounted for less than 10%. The toxicological threshold was exceeded for 30 samples (2.8% of the samples with multiple residues). The overall distribution of the calculated exposure, grouped in exposure classes, is presented in the histogram in Figure 5-11.

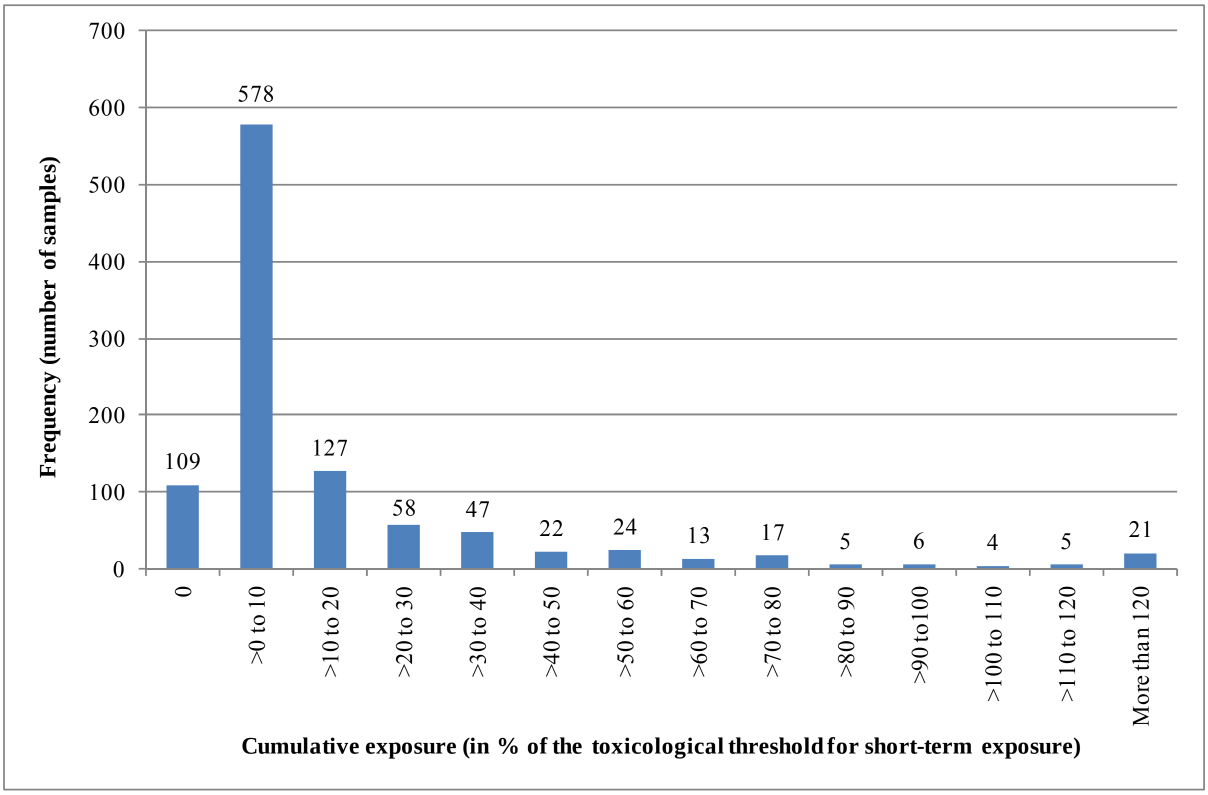

Figure 5-11: Short-term cumulative risk assessment for lettuce: frequency of number of samples according to exposure classes (expressed in % of the toxicological threshold for short-term exposure).

Figure 5-12 presents a further analysis of the 30 samples exceeding the 100% threshold. For each sample the contribution of the individual pesticides found to the overall cumulative exposure is presented. The labels on the x-axis of the chart refer to the following information:

- the ranking of the sample with regard to the calculated cumulative exposure,
- the country of origin of the sample;
- the country where the sample was taken;
- the number of different pesticides found in concentrations greater than the LOQ;
- the number of acutely toxic pesticides (pesticides with ARfD) found in concentrations greater than the LOQ.

From this analysis it becomes evident that for 21 out of the 30 samples the toxicological threshold for short-term exposure was exceeded not because of the cumulative exposure but because of the high concentrations related to a single pesticide (i.e. MRL was exceeded for at least one pesticide). The remaining nine samples contained combinations of fungicides and insecticides where a further toxicological assessment is needed to identify whether the individual pesticides belong to common assessment groups.

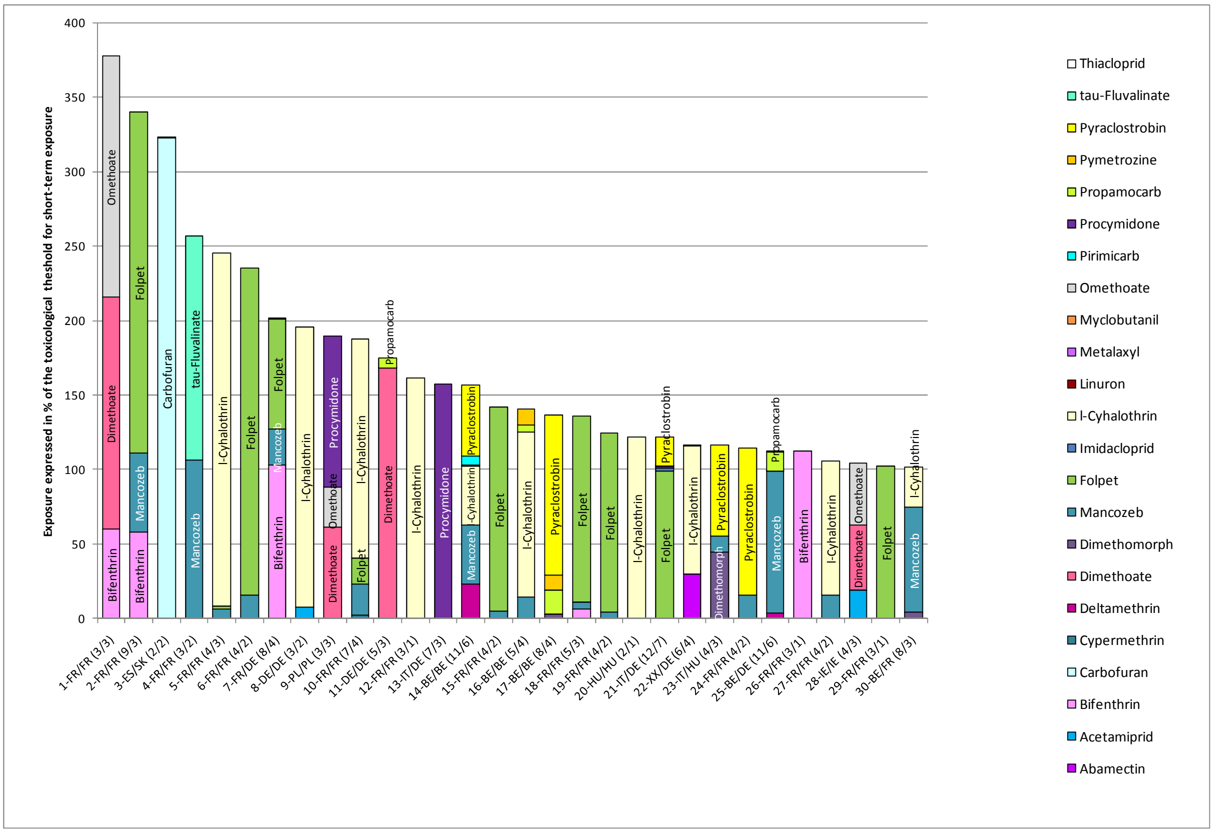

Figure 5-12: Short-term cumulative risk assessment for lettuce: results for individual samples (only samples with cumulative exposure exceeding the toxicological threshold for acute exposure).

The exercise for the acute cumulative exposure assessment with the methodology described above revealed that the way how results are reported for so-called complex residue definitions, i.e. residue definitions which comprise more than one compound (like parent compound and metabolites) causes some difficulties for the exposure calculation. In particular, the following problems were encountered:

a) The residue definition comprises compounds with different toxicity (e.g. dimethoate and omethoate, expressed as dimethoate):

- For some samples only the total residue concentration was reported, without providing the results for the individual compounds. Without discrimination of the nature of the individual compounds an accurate risk assessment cannot be performed. For these samples risk assessment can be calculated in two scenarios: the pessimistic scenario assuming the total residue comprises only the more toxic component and the optimistic scenario assuming the residue concentration refers to the less toxic compound. However, both results are affected with high uncertainties and are therefore not reliable.

- Reporting mistakes were also identified for samples which were analyzed for the individual compounds but for which the total residue was not reported or was not reported correctly.

b) Common moiety residue definitions (e.g. dithiocarbamates) which comprise active substances with different toxicological properties.

- For these residue definitions no unequivocal risk assessment can be performed.

c) The complex residue definition comprises compounds with the same toxicity (e.g. sum of pirimicarb and desmethyl-pirimicarb, expressed as pirimicarb):

- Samples which were analysed only for a part of the compounds included in the residue definition (e.g. pirimicarb) were reported as being not compliant with the residue definition. Because of this deficiency it cannot be concluded whether the sample was compliant with the MRL. However for risk assessment it is inappropriate to omit this result completely.

To overcome these deficiencies related to the reporting of results for complex residue definitions EFSA identified the need to give further guidance how the monitoring results should be reported to EFSA. In addition, validation rules should be implemented that force the Member States for case a) to report the individual compounds separately. An alternative option would be to establish separate MRLs for the individual components currently covered by the complex residue definition. For case c) it should be obligatory to report the total residue concentration which needs to be considered for the exposure assessment, regardless whether it is fully compliant with the legal residue definition. For common moiety residue definitions (case b) EFSA would recommend to calculate the exposure for the most likely scenario, considering which pesticide is actually used on the different crops. In case of the dithiocarbamates the footnotes to the MRLs indicate the active substance which was the basis for the MRL setting. A similar approach should be taken for other common moiety residue definitions.

5.5.5. Overall conclusions on cumulative risk assessment

Taking into account the experience gained with the first exercise on chronic and acute cumulative risk assessment, the following steps are to be taken for implementing cumulative risk assessment on a routine base in the actual exposure assessment with monitoring data:

- **Definition of common assessment groups** and establishment of adjusted **hazard indices** or **relative potency factors**. Since the total number of pesticides that could be present of food is very high, priorities need to be defined for assessing pesticides with regard to the common assessment groups. The following criteria for prioritisation should be considered:
  - Approval of a pesticide in the EU;
  - Non-approved pesticides that are regularly found in imported crops;
  - Non-approved pesticides that are persistent in the environment and are therefore found on food (EU origin and imported food);
  - Assessment of metabolites included in the residue definition with regard to their toxicological potencies;
  - If necessary, revision of the EU-coordinated monitoring programme with view of including the pesticides which are to be considered for cumulative exposure assessment;
  - The nature of the effects caused by combined toxicity of pesticides and the severity of those effects.
- **Agreement on the risk assessment tools** for screening and for refined cumulative exposure calculations:
  - For acute and chronic effects, agreement and definition of the parameterisation and assumptions applicable to the assessment of the cumulative risk. E.g. deterministic calculation of adjusted **hazard indexes** and probabilistic modelling after derivation of **relative potency factors;**
  - Validation of the deterministic methodology described in section 5.5.1 to assess whether this approach is conservative enough for screening of chronic cumulative exposure. Development of a revised methodology if validation fails;

- Assessment whether the food commodities currently included in the EU-coordinated monitoring programme and the number of samples taken for each crop are sufficient to estimate the overall cumulative dietary exposure. If necessary, include additional food commodities in the EU-coordinated monitoring programme;

- Compilation of processing/peeling data to be used for refined exposure calculations;

- Compilation of food consumption data for the relevant subgroups of the population to be used in probabilistic calculations for chronic and acute cumulative exposure assessments, respectively.

- **Development of an approach how to deal with censored data ("non-detects"):**

  - Set up of a database on the authorised uses of pesticides for crops which are of relevance for exposure calculations.

  - Collection of pesticide use statistics for the EU to derive an estimate of the percentage of treated crops.

- **Improvements of monitoring data/ data reporting:**

  - Exploring the possibility to lower LOQs, in particular for very toxic pesticides;

  - Exploring the possibility to report more details for censored results, i.e. reporting whether a pesticide was not detected on a sample - samples below limit of detection - or whether the pesticide was detected, but in concentrations below the limit of quantification.

SUMMARY CHAPTER 5

The **acute (short-term) consumer exposure** assessment was performed for the 134 pesticides covered by the EU-coordinated monitoring programme that were considered relevant for acute risk assessment. The assessment focussed on the 12 target food commodities of the 2010 monitoring programme. For 20 of these pesticides no residues were detected in quantifiable concentrations in any of the samples taken, i.e.: aldrin and dieldrin, benfuracarb, bromuconazole, cadusafos, carbosulfan, chlordane, chlorbenzilate, dinocap, fipronil, fosthiazate, metconazole, methoxychlor, parathion, phenthoate, phoxim, prothioconazole, pyrazophos, resmethrin, tecnazene and triticonazole. Thus, for these substances the dietary exposure resulting from the food commodities covered by the EU-coordinated monitoring programme was negligible.

Considering the remaining pesticides covered by the programme, a potential acute risk could not be excluded for 79 samples (out of the 18,243 samples considered) concerning 30 different pesticides. However, for two pesticides included in the EU-coordinated programme the residue definition contains two or more compounds with different toxicological properties. Thus, for these substances two scenarios were calculated, an optimistic scenario, assuming the residue concentrations measured refer to the less toxic substance and a pessimistic scenario, which is considered as the less likely, using the ARfD for the more toxic substance. Under the pessimistic scenario, the number of samples which exceeded the respective toxicological reference value increased from 79 to 200. The commodities for which no risk was identified were milk, oats, rye and swine meat. The commodities with the most frequent exceedance of the ARfD were apples, lettuce and tomatoes (23, 22 and 21 samples, respectively) in the optimistic scenario; also in the pessimistic scenario these commodities exceeded most frequently the toxicological threshold (45, 87 and 29 samples, respectively). Of the samples posing a potential acute consumer risk none concerned organically produced food.

The **long-term (chronic) exposure assessment** was performed for 171 of the 178 substances covered by the EU-coordinated monitoring programme and for which toxicological reference values were available, and it was based on the residue findings for the 28 most prominent food commodities in the human diet. For none of the pesticides included in the 2010 EU-coordinated control programme the exposure exceeded the toxicologically acceptable limits. Based on the current scientific knowledge, it is therefore concluded that the food commodities covered by the EU monitoring programme did not pose a long-term consumer health risk. For more than half of the substances assessed (105 substances), the estimated exposure accounted for less than 2% of the ADI; only for 3 substances the estimated exposure accounted for more than 50% of the ADI (the maximum calculated exposure accounted for 93.2% of the ADI).

Cumulative exposure assessment

For the first time EFSA performed an indicative cumulative risk assessment on the basis of the analytical results of the EU-coordinated monitoring programme with the purpose of exploring possible deficiencies in the monitoring data (e.g. if the level of detail of the data reported was sufficient) and other limitations, which may impede the practical implementation of the cumulative assessment methodologies currently under development. Since the work on the establishment of common assessment groups (i.e. pesticides which are expected to share the same toxicological effects) and the methodology is not yet completed, the results of the exposure assessments should be regarded as indicative only.

In the **chronic cumulative exposure assessment** the overall exposure resulting from 42 organophosphates and carbamates pesticides was calculated; these are pesticides that are likely to share a common mode of action. As a high percentage of the samples did not contain measurable residues above the limit of quantification, EFSA considered three different scenarios to assess the impact of non-detects on the exposure estimates. In a “pessimistic” scenario, samples without detectable residues were considered as containing residues at the full limit of quantification. In a second, less conservative scenario, a refinement was introduced by replacing the limit of quantification for non-detects with zero where the MRL gave an indication that the pesticide was actually not authorised (i.e. for pesticide/crop combinations where the MRL is set at the LOQ). The third “optimistic” scenario was based on the assumption that all the samples where no measurable residues were detected are completely free of pesticides. Since the results of the three scenarios showed a high variation in terms of consumer exposure, the calculations using the simple deterministic calculation methodology do not allow to draw a conclusion whether the exposure to the group of organophosphates pesticides and carbamates represented a potential long-term consumer health risk. The calculations are affected by uncertainties, which are mainly related to the high number of non-detects among the residue results. It is therefore considered necessary to reduce the uncertainties by refining the exposure calculations. For this purpose, it is essential to retrieve more information about the “real” residue levels in samples which are reported as non-detects to perform more accurate cumulative exposure assessment. A number of recommendations were derived how this data gap could be addressed.

The scenario to assess **acute cumulative exposure** focussed on lettuce samples containing multiple residues. The exposure resulting from the individual compounds present on a single sample was summed up, assuming by default dose addition for all pesticides present on lettuce samples. The toxicological potency of the individual pesticide was derived from its ARfD. It is noted that in this exercise all substances are grouped together even in the absence of any indication that in practice their effects are additive. The exposure was calculated under the assumption that a consumer eats a large portion of lettuce containing the 5-fold pesticide concentrations reported for the sample. Under these very conservative assumptions, the acute cumulative exposure accounted for less than 10% of the toxicological threshold for the majority of the samples (687 samples out of 1041 lettuce samples containing multiple residues). The toxicological threshold was exceeded for 30 samples (2.8% of the samples considered). In addition, it was noted that for 21 out of the 30 samples the toxicological threshold for short-term exposure was exceeded not because of the cumulative exposure but because of the high concentrations related to a single pesticide. The remaining nine samples contained combinations of fungicides and insecticides; further toxicological assessment is needed to identify whether these individual pesticides belong to a common assessment group.

The cumulative exposure assessment carried out with the 2010 pesticide monitoring data highlighted that the available monitoring data have some limitations regarding the suitability to perform cumulative risk assessments. The deficiencies are not related to the quality of the analytical results as such, but rather to the lack of knowledge on the actual use of pesticides on samples which were found to be free of detectable residues.

Recommendations

On the basis of the results of the risk assessment, EFSA recommends:

- To continue monitoring of food covered by the EU-coordinated monitoring programmes for the pesticides for which a potential consumer risk could not be excluded;
- The current methodology used by EFSA was derived from a methodology which was originally developed for enforcement purposes. It is therefore recommended to have a general discussion in the framework of a workshop of the appropriateness of the methodology for actual consumer assessment;
- For pesticides with residue definitions which contain compounds with different toxicological potencies (e.g. dimethoate/omethoate) Member States should report the results for the individual compounds separately, otherwise an accurate consumer risk assessment cannot be performed;

- To review the existing EU MRLs for certain pesticide/crop combinations for which an acute risk could not be excluded and for which the MRLs were not exceeded (i.e. bifenthrin/lettuce, bitertanol/peaches and tomatoes, imazalil/apples and tomatoes, endosulfan/tomatoes, lambda-cyhalothrin/apples and peaches, pyraclostrobin/lettuce, tebuconazole/apples and peaches);
- To explore the possibility of lowering LOQ-MRLs for substances with extremely low ARfD values, like carbofuran and chlorfenvinphos;
- To request Member States to report whether a lot which was found to exceed the legal limit was placed on the market and therefore reached the consumers or whether it was destroyed/rejected at the border and therefore was not relevant for consumer risk assessment;
- To give more guidance to the reporting countries on how to report residue findings for pesticides with complex residue definitions;
- To develop a database containing conversion factors for residue definitions;
- To develop a database compiling the authorised uses of pesticides on crops relevant for consumer risk assessment;
- To develop pesticide use statistics (e.g. on the percentage of crop treated with a pertinent pesticide);
- To discuss the feasibility to provide more information for samples with non-detectable residues (residue concentration <LOQ). In particular the reporting of the LOD should be considered (residue below or above LOD).

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GLOSSARY

This section provides explanations of terms frequently used in this report.

Authorisation of pesticides/plant protection products
The quality and yield of agricultural and horticultural crops is jeopardised by plant diseases and infestation by pests. In order to protect crops before and after harvest, pesticides[80] are used. Since the active substances used in pesticides can have harmful effects on human health, wildlife and the environment, a strict system of pesticide authorisation and control of use has been established at EU level (Directive 91/414/EEC[81] and Regulation (EC) No 1107/2009[82]). In the framework of the authorisation procedure, companies asking for the authorisation of plant protection products have to demonstrate that food treated with these products will not pose a risk to consumer health.

Pesticide residues
Pesticide residues are the measurable amounts of the active substances used in plant protection products, their metabolites and/or breakdown or reaction products resulting from current or formerly used plant protection products that can be found on harvested crops or in food of animal origin.

According to the timing of application or the direction of use of an active substance, pesticide residues can be considered[83]:

- ‘Systemic pesticides’ that are active substances and/or relevant metabolites that are transported in the plant.
- ‘Non-systemic pesticides’ that are active substances and/or relevant metabolites that are not transported in the plant.

Pesticide use
The national authorised or registered use of a plant protection product reflects the *safe* use of a pesticide under *actual* agricultural conditions and implies the use of the minimum quantity of pesticides which allows the desired effect to be obtained (referred to as Good Agricultural Practice - GAP). Authorisations are granted on national level, taking into account the local and environmental conditions and the occurrence of pests. MRLs are derived from studies reflecting the most critical authorised GAPs, provided that a consumer health risk can be excluded for these uses.

Good Agricultural Practice - GAP
In Regulation (EC) No 396/2005 GAP is defined as follows:

"‘Good agricultural practice’ (GAP) means the nationally recommended, authorised or registered safe use of plant protection products under actual conditions at any stage of production, storage, transport, distribution and processing of food and feed. It also implies the application, in conformity with Directive 91/414/EEC, of the principles of integrated pest control in a given climate zone, as well as using the minimum quantity of pesticides and setting MRLs/temporary MRLs at the lowest level which allows the desired effect to be obtained […]"

Food commodities
Annex I of Regulation (EC) No 396/2005 defines the food commodities for which the MRLs are applicable. The description of the commodities and the parts of the products to which the MRLs apply

[80] In the report the term “pesticide” is used as a synonym of “plant protection product”.
[81] Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market. OJ L 230, 19.8.1991, p. 1–32.
[82] Regulation (EC) No 1107/2009 has repealed Directive 91/414/EEC. This regulation entered into force on 15.12.2009, but applied from 14 June 2011 on.
[83] SANCO 7525/VI/95 – Rev. 9, March 2011. http://ec.europa.eu/food/plant/protection/resources/app-d.pdf

can be found in Annex I to Regulation (EC) No 396/2005, published by Regulation (EC) No 178/2006[84], and amended by Regulation (EU) No 600/2010[85].

Raw commodities of plant and animal origin are listed in Annex I, subdivided into 12 subgroups. In total, *ca.* 400 different food commodities are covered by the Regulation.

The main food classification groups are:

1. Fruit fresh or frozen, nuts
2. Vegetables fresh or frozen
3. Pulses, dry
4. Oilseeds and oil fruits
5. Cereals
6. Tea, coffee, herbal infusions and cocoa
7. Hops (dried), including hop pellets and unconcentrated powder
8. Spices
9. Sugar plants
10. Products of animal origin - terrestrial animals
11. Fish, fish products, molluscs and other marine and freshwater products[86]
12. Crops or parts of crops exclusively used for animal feed[87]

With a few exceptions, processed foods are not listed in Annex I of Regulation (EC) No 396/2005. In this report, "processed food" refers to products derived from commodities as specified in Annex I of Regulation (EC) No 396/2005 by food processing technologies. Typical examples are juices from fruit and vegetables, other beverages (wine, beer) or flour from cereals.

In some sections of this report the results for individual crops are aggregated and reported for the following categories:

- Fruits and nuts (covering classification group 1, including processed food derived thereof)
- Vegetables (covering classification group 2, including processed food derived thereof)
- Cereals (covering classification group 5, including processed food derived thereof)
- Other plant products (covering classification groups 3, 4, 6, 7, 8 and 9)
- Animal products (covering classification group 10)
- Fish products (covering classification group 11)
- Baby food (as defined in baby food legislation, see "MRL" in the this section)
- Other products (products which could not be assigned to a certain raw commodity or a specific processed food are summarised under this subcategory)

[84] Commission Regulation (EC) No 178/2006 of 1 February 2006 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council to establish Annex I listing the food and feed products to which maximum levels for pesticide residues apply. OJ L 29, 2.2.2006, p. 3-25.
[85] Commission Regulation (EU) No 600/2010 of 8 July 2010 amending Annex I to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards additions and modification of the examples of related varieties or other products to which the same MRL applies. OJ L 174. 9.7.2010, p. 18-39.
[86] For this category the detailed food classification is not yet established. Thus, currently MRLs are not yet applicable.
[87] For this category the detailed food classification is not yet established. Thus, currently MRLs are not yet applicable.

Residue definition
Active substances applied on a crop are often not stable, but the applied molecule undergoes to a certain extent a degradation induced by plant enzymes, light, humidity and/or other environmental factors. Thus, on the harvested food commodity, also other chemical substances (usually referred to as metabolites) than the active substances originally applied may be present. Since not all of these degradation products are harmless, they have to be taken into account in the consumer risk assessment. In certain cases, the parent compound (i.e. the substance originally applied on the crop) is not found at all in the harvested crops, but only one or several typical metabolites, which are an indicator of the use of this parent compound. The concept of residue definition is used to define the active substance used in plant protection products and its metabolites, degradates and other transformation products relevant for consumer exposure[88]. For each pesticide, two residue definitions are set:

The *residue definition for dietary risk assessment* (or briefly residue definition for risk assessment) includes the parent compound, its metabolites, derivatives and related compounds which are relevant for consumer exposure.

The *residue definition for MRL setting* (also referred as residue definition for MRL enforcement purposes, or briefly enforcement residue definition) comprises those compounds which are indicators for the use of the pesticide and which can be analysed in routine monitoring, ideally by a multi-residue method.

In many cases, these two residue definitions are identical. However, if the residue definition for risk assessment covers more components than the enforcement residue definition, the residue concentrations measured in monitoring programmes and reported according to the enforcement residue definition may not be directly used for calculating the actual consumer exposure. A conversion factor, which is normally derived from supervised field trials or metabolism studies, has to be applied to derive the concentration that is relevant for consumer exposure (e.g. fluazinam: residue definition for monitoring: fluazinam; residue definition for risk assessment: fluazinam, AMPA-Fluazinam and AMGT; conversion factor 3). Conversion factors are reported in different sources (e.g. EFSA conclusions, JMPR Reports). A comprehensive list of conversion factors is currently not yet established, but would be needed to reduce the uncertainties in dietary exposure assessments performed with monitoring data.

MRL
Maximum Residue Levels (MRLs) for pesticides are defined as the upper legal levels of a concentration for a pesticide residue (expressed in mg/kg) in or on food or feed in accordance to Regulation (EC) No 396/2005, based on authorised Good Agricultural Practice (GAP) and the lowest possible consumer exposure to protect vulnerable consumers. Food of plant or animal origin with pesticide residues above the MRL shall not be placed on the market. MRLs are derived by statistical calculation methods from supervised field trials which reflect the intended GAPs. The MRLs are set at a level which should ensure that normally the harvested crop does not exceed the legal limit if the crop was produced according to GAP[89].

Before an MRL is established, a risk assessment has to prove that the limit is safe for consumer health. In the past, responsibility for risk assessment in the MRL setting procedure was shared between Member States and the European Commission. Since Regulation (EC) No 396/2005 became fully applicable on 1 September 2008, EFSA is involved in all MRL setting procedures as independent body responsible for the risk assessment of new or revised MRLs.

[88] In cases of complex residue definitions have been established (i.e. residue definitions which contain more than one chemical element) the results reported in the Tables and Figures in the present report are labelled with the name of the pesticide and the term "sum". For example, when "endosulfan (sum)" is reported, this refers to the following complex residue definition: sum of alpha- and beta-isomers and endosulfan-sulfate expressed as endosulfan.

[89] The statistical concept for MRL setting implies that a minor percentage of the crops treated according to the GAP will nevertheless exceed the MRL.

MRLs are fixed by the European Commission. The MRL applicable in Europe can be consulted on the database developed and maintained by the European Commission[90].

MRLs are not primarily toxicological safety limits, but reflect the use of minimum quantities of pesticides to achieve effective plant protection, applied in such a manner that the amount of residue is the smallest practicable and are set at levels which are safe for consumers. In most cases the MRLs are well below the concentrations which are expected to lead to adverse effects on the health of consumers.

If a pesticide residue is found on a given crop at or below the MRL, then the crop can be considered safe for consumer health. On the other hand, if a residue exceeds the MRL, it is not necessarily true that the consumer is at risk: a specific assessment has to be performed, comparing the expected exposure with the toxicological reference values (ADI, ARfD; see below). If the exposure exceeds the toxicological reference values, a potential consumer health risk is identified.

MRLs are established for Raw Agricultural Commodities (RAC) of plant or animal origin placed on the market as described in Annex I of Regulation (EC) No 396/2005, i.e. fresh or frozen products without processing. In most cases the MRLs refer not only to the edible parts of the plant, but also comprise inedible parts (e.g. bananas with peel, peaches including the stones).

In September 2008, harmonised EU MRLs were established in Annexes II and III of Regulation (EC) No 396/2005, repealing the previously set EU and national MRLs. This regulation provides a harmonised system for the setting of the MRL, which applies to all food commodities available in all EU Member States. This regulation covers about 510 pesticides. For pesticides not explicitly mentioned in Annexes II, III or IV[91] of the Regulation, a default MRL of 0.01 mg/kg is applicable. MRLs are established at the limit of quantification (LOQ) if a pesticide is not authorised for use on a specific crop.

For processed or composite food commodities, the MRLs established in the MRL legislation for raw commodities are applied by taking into account changes in the levels of pesticide residues caused by processing or mixing (processing factors).

It should also be mentioned that for organic products no specific MRLs have been established at EU level. For these products the same MRLs as for conventional products apply, but additional production and labelling rules have to be respected (Regulation (EC) No 834/2007, Regulation (EC) No 889/2008).

For infant formulae, follow-on formulae and for processed cereal-based foods and baby foods for infants and young children, a default MRL of 0.01 mg/kg is applicable, unless a specific lower MRL has been set in Directives 2006/125/EC and 2006/141/EC.

Food business operators as defined in the Regulation (EC) No 178/2002[92] ("European food law") have to ensure at all stages of production, processing and distribution that food or feed satisfies the requirements of the food law which are relevant to their activities and shall verify that such requirements are met. Member States shall monitor and verify that the relevant requirements of the European food law are fulfilled by food and feed business operators at all stages of production, processing and distribution. Therefore, the control of pesticide residues by the competent authorities in

[90] The MRL database of the European Commission is available at: http://ec.europa.eu/food/plant/protection/pesticides/database_pesticide_en.htm

[91] Annex IV of Regulation (EC) No 396/2005 contains those pesticides which are exempted from the setting of MRLs because of their low risk profile.

[92] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. Official Journal L 31, 1.2.2002, P. 1 – 21.

Member States is only one element of control activities striving to ensure food safety at European level.

MRL exceedance
In the context of this report the term "MRL exceedance" refers to a situation where the legal limit is exceeded numerically, without considering measurement uncertainty. Thus, this term should not be understood as MRL non-compliance that triggers legal consequences.

MRL compliance/non-compliance
If the residue level measured in a sample taking into account the measurement uncertainty exceeds the legal MRL, the sample is considered as non-compliant and the competent national authorities shall apply the sanctions applicable to the infringements. The sanctions must be effective, proportionate and dissuasive. A sample is compliant with the MRL if the measured value does not exceed the MRL taking into account the measurement uncertainty.

Threshold residue level/threshold MRL
As explained, the MRL is not a toxicological limit, but it is based on GAP. For the purpose of the risk assessment, EFSA introduced two new concepts: the "threshold residue level (edible portion)" and the "threshold residue level (raw agricultural commodity)".

A *threshold residue level (edible portion)* (TRL_{ep}) is the theoretical, calculated maximum residue in the edible part of the crop which would be acceptable from a consumer safety point of view. The threshold residue gives an intake corresponding to 100% of the ARfD and it is calculated on the basis of the consumer group with the highest consumption per unit body weight (i.e. the most critical consumer) identified among all the national consumer groups for which consumption data are available to EFSA.

The *threshold residue level (raw agricultural commodity)* (TRL_{rac}) is the threshold residue level that refers to the whole commodity, e.g. the unpeeled orange, and which gives an intake corresponding to 100% of the ARfD. For crops that are consumed in peeled and/or processed form, a peeling factor and/or processing factor has to be considered to derive the TRL_{rac}. If the crop of concern can be consumed as a whole without any processing/peeling, the calculated TRL_{ep} and the TRL_{rac} have the same value.

Import Tolerance
In Commission Regulation (EC) No 396/2008 the term "import tolerance" is defined as follows:

"Import tolerance" means an MRL set for imported products to meet the needs of international trade where:

- the use of the active substance in a plant protection product on a given product is not authorised in the Union for reasons other than public health reasons for the specific product and specific use; or

- a different level is appropriate because the existing Community MRL was set for reasons other than public health reasons for the specific product and specific use.

Dietary exposure assessment and risk assessment
Dietary exposure assessment is the quantitative evaluation of the intake of pesticides via food. In the chronic and acute risk assessment, the estimated long-term and short-term dietary exposure, calculated per kg body weight, is compared with the relevant toxicological reference values, i.e. the acceptable daily intake (ADI) and the Acute Reference Dose (ARfD), respectively, (see "ADI" and "ARfD" below). A consumer exposure is of concern if the estimated dietary exposure to a pesticide exceeds the ADI and/or the ARfD. In case an ADI or ARfD is revised due to new scientific findings, the consumer risk assessment has to be updated to guarantee the safety of the legal limits.

Acceptable Daily Intake (ADI)
The Acceptable Daily Intake (ADI) is the estimated amount of a substance in food, usually expressed in mg/kg on a body weight basis that can be ingested daily over a lifetime without appreciable chronic long-term risk to any consumer. The ADI is set on the basis of all known facts at the time of evaluation, taking into account sensitive groups within the population (e.g. children).

Acute Reference Dose (ARfD)
The Acute Reference Dose (ARfD) is the estimated amount of substance in food, usually expressed in mg/kg on a body weight basis, which can be ingested over a short period of time, usually during one day, without appreciable risk to the consumer. The ARfD is set on the basis of the data produced by appropriate toxicological studies and taking into account sensitive groups within the population (e.g. children). An ARfD is set only for active substances which have a potential acute toxicity.

Analytical methods
The results of monitoring analyses are strongly influenced by the analytical methods used to analyse the samples. The analytical methods used in pesticide residue analyses have to fulfil certain criteria regarding specificity, sensitivity, precision accuracy, robustness and linearity which are defined in guidance documents[93]. The sensitivity and selectivity of the analytical methods has an impact on the number of positive findings in samples analysed. If the analytical method applied is not capable of detecting a certain pesticide applied to the crop – or its toxicologically relevant metabolites or break-down products – the sample may be mistakenly considered to be free of pesticide residues. Additionally, if the analytical method is not sensitive enough, the pesticide will not be detected. Therefore, the results have to be considered in connection with the performance analytical methods used.

The analytical methods used to detect and quantify pesticide residues in food commodities fall into two general types of methods: *multi-residue* and *single-residue* methods.

Multi-residue methods are able to analyse a high number of different pesticide residues in the same sample in the course of the same analysis. However, certain pesticides and metabolites cannot be included in multi-residue methods because of their physical-chemical properties (e.g. acidic or polar chemicals). In these cases, single-residue methods have to be applied.

Single-residue methods allow the identification and quantification of only one or a few pesticide residues in one sample.

Multi-residue methods are usually preferred, as they are generally more cost efficient, but in order to fulfil the general control obligations for pesticides which cannot be detected with multi-residue methods, also single-residue methods have to be used.

European Reference Laboratory (EURL)
The European Reference Laboratories (EURLs)[94] are appointed by the European Commission to co-ordinate, to train staff, to develop methods of analysis and to organise tests to evaluate the skills of the different national control laboratories. The overall objective of the EURLs is to improve the quality, accuracy and comparability of the results from national control laboratories. The EURLs have the responsibility to network closely with the National Reference Laboratories (NRLs) in the Member States, which have the same liability on national level.

The nominated EURLs (Annex VII of Regulation (EC) No 882/2004) for residues of pesticides are:

[93] Method validation and quality control procedures for pesticide residues analysis in food and feed. In 2010 the valid revision of the guidance document was Document No. SANCO/10684/2009. The newest Version No. SANCO/12495/2011 is available on the web under http://ec.europa.eu/food/plant/protection/pesticides/docs/qualcontrol_en.pdf or http://www.eurl-pesticides.eu/library/docs/fv/SANCO12495-2011.pdf.
[94] Before 2010 the EURLs were called Community Reference Laboratories (CRLs).

Fødevareinstituttet Danmarks Tekniske Universitet København, Denmark	Cereals and feeding stuffs
Chemisches und Veterinäruntersuchungsamt (CVUA) Freiburg Freiburg, Germany	Food of animal origin and commodities with high fat content
Laboratorio Agrario de la Generalitat Valenciana (LAGV) Valencia, Spain Grupo de Residuos de Plaguicidas de la Universidad de Almería (PRRG) Almería, Spain	Fruits and vegetables, including commodities with high water and high acid content
Chemisches und Veterinäruntersuchungsamt (CVUA) Stuttgart Fellbach, Germany	Single residue methods

Limit of Quantification (LOQ)/ Limit of Detection (LOD)
The Limit of Quantification (LOQ) is the lowest residue concentration, which can be quantified and reported in routine monitoring with validated methods. In the context of this report, samples reported as having residues below the LOQ are considered to be free of the pertinent residue or to contain very low concentrations at a level that cannot be quantified with acceptable certainty. The Limit of Detection (LOD) is the lowest residue concentration, which can be detected with acceptable certainty, but not quantifiable with validated method.

In the present report, the term Reporting Level (see "Reporting Level" below) is also used as a synonym of the LOQ[95].

Reporting Level (RL)
The Reporting Level is the lowest level at which residues will be reported as absolute numbers. It may coincide with the LOQ, or, for reasons of limiting the cost of the analysis, it may be above that level, but it has to be at or below the MRL. For those pesticides for which a complex residue definition (e.g. a residue definition which contains more than one compounds) is set the RL may be set at the highest LOQ used for those components in the residue definition.

Confidence interval (CI)
Several tables show information on the percentage of samples with residues above the MRL. As the percentages calculated from samples have an inherent statistical uncertainty, an estimate for the true proportion in the sampling population is given by the CI. It shows the most probable (95%) range of percentage values. The mathematical calculation in this report is done with a Bayesian approach.

Control programmes
According to Regulation (EC) No 396/2005, Member States shall carry out official controls on pesticide residues in order to enforce compliance with the regulation, in accordance with the relevant provisions of Community law relating to official controls for food and feed (Regulation (EC) No 882/2004). In this report, the term "monitoring programme" is used as a synonym of "control programme".

Typically, two control programmes are in place:

*Coordinated multiannual Community control programme (**EUCP**)*: On a yearly basis, the European Commission prepares a specific control programme describing the pesticide/crop combinations that

[95] In the EU MRL legislation, the term LOD (Limit of Detection) is used but refers to the term of LOQ. However, EFSA prefers using the term LOQ in order to avoid possible confusion with the term LOD that indicates the Limit of Detection.

have to be analysed. The programme takes into account food items which are of relevance for human consumption and pesticides which are of relevance for dietary exposure because of their toxicological profile or the specific problems identified in previous years. The EU-coordinated programme aims to provide statistically representative data regarding pesticide residues in food available to European consumers.

*National control programmes for pesticide residues (**NCP**)*: Member States set up national control programmes for pesticide residues. Those programmes are often risk-based and focus on commodities and/or pesticides which are considered of particular relevance for consumer safety or MRL compliance. The national control programmes are defined in advance in multiannual programmes which are updated every year.

Reporting countries

All 27 Member States of the European Union have to report their results regarding the coordinated programme and the national control programmes. In addition, the EFTA countries Iceland and Norway report their results according to the EEA-agreement. Therefore, 29 reporting countries are contributing to the current report. Throughout the report, these countries are referred to as EU or reporting countries.

Sampling methodology

To ensure that a sample is representative of a given food lot/consignment, the sampling has to be performed according to the sampling methodology for the official control of pesticide residues as established by Commission Directive 2002/63/EC[96]. For most plant products the minimum size of a laboratory sample lies between one and two kilograms of the food item which have to be selected randomly from the lot or consignment subject to the sampling.

Sampling strategy

The sampling strategy is the approach used to select the units of the target population subject to control. Implementation of an efficient, targeted sampling strategy would result in a higher percentage of positive findings and non-compliant results. Thus, for a correct interpretation of the results obtained in control programmes information about the sampling strategy applied is indispensable. In the report, the following terminology was used to distinguish between more or less targeted sampling.

Surveillance sampling: samples are collected without any particular suspicion towards a particular producer, consignment, etc. Surveillance samples may be targeted at specific food products and countries, but the selection of consignment/lot is randomised. The samples taken in the framework of the EU-coordinated programme are considered to be surveillance samples.

Enforcement sampling: samples are taken if there is suspicion about the safety or non-compliance of a product and/or as a follow-up of violations found previously. The selection of the consignment/lot is not randomised and therefore cannot be considered representative of the food available on the European market. Follow-up or enforcement sampling is directed to a specific grower/producer or to a specific consignment. In enforcement programmes, the probability of finding samples with positive results or samples exceeding the legal limits is higher than in surveillance programmes in which, by definition, the selection of samples is randomised and not directed towards a specific food sample/consignment of a defined population of a given crop. In enforcement sampling the samples are not taken randomly and therefore cannot be considered representative of the food item available in the market place. Typically, enforcement samples are collected if there is a suspicion about the safety of a product and/or as follow-up of violations found previously.

[96] Commission Directive 2002/63/EC of 11 July 2002 establishing Community methods of sampling for the official control of pesticide residues in and on products of plant and animal origin and repealing Directive 79/700/EEC. Official Journal L 187, 16.7.2002, p. 30 – 43.

In Appendix II to the present report, more details on the general sampling strategies applied at national level are reported.

Import control
Article 15 of Regulation (EC) No 882/2004 lays down that the national competent authority shall carry out regular official controls on feed and food of non-animal origin imported into the territories. They shall organise these controls on the basis of the multiannual national control plan. These controls shall be carried out at appropriate places, including the point of entry of the goods into one of the territories of the Community.

In addition, for some specific commodities imported from third countries, Commission Regulation (EC) No 669/2009 amended by Commission Regulation (EC) No 878/2010[97] lay down rules concerning the increased level of official controls to be carried out at the points of entry into the territories on imports of the food of non-animal origin. These regulations specify pesticide/commodity/country combinations and the frequencies of controls.

Data collection
With the full implementation of Regulation (EC) No 396/2005, in 2006 EFSA took over from the European Commission the responsibility to collect the pesticide monitoring data and the preparation of the Annual Report on pesticide residues. In 2009, EFSA developed the Standard Sample Description (SSD), which is a standardised model for the reporting of harmonised data on analytical measurements of chemical substances (including pesticide residues) occurring in food, feed and water (EFSA, 2010; EFSA, 2012c).
The SSD includes a list of standardised data elements, controlled terminologies and validation rules (such as country of origin, product, analytical method, limit of detection, results reported, etc.) that aims to facilitate and harmonised the reporting of the data, enhancing its quality. The collection of these data is supported by a Data Collection Framework (DCF), which is a web platform conceived for the efficiency of data submission and exchange between Member States and EFSA. Data providers can submit their files through the DCF taking care of selecting using specific file formats for data transmission (i.e. XML) and specific data protocols to support specific for electronic data exchange. Once the data are transmitted to EFSA, these are cleaned and eventually recoded – if appropriate – to make them comparable and enable their suitable for statistical analysis.

Quality assurance
In accordance with Regulation (EC) No 882/2004 all laboratories performing analysis of pesticide residues in food have to be accredited to certain standards such as ISO 17025. This standard is on the one hand ISO 17025 (General requirements for the competence of testing and calibration laboratories) and on the other hand the laboratories take into account the AQC Guidance Document of the EURLs (Method Validation and Quality Control Procedures for Pesticide Residues Analysis in Food and Feed).

Commission Regulation (EC) No 901/2009 requires Member States to provide information about the details of accreditation of the laboratories which carry out the analysis for the control programme, about the application of the EU Quality Control Procedures for Pesticide Residue Analysis and about their participation in proficiency and ring tests. It also requires the reporting countries contributing to the control programme to provide the accreditation certificates. These provisions should ensure that controls are of consistently high quality.

Rapid Alert System for Food and Feed (RASFF)
If control activities identify samples with pesticide concentrations which are of concern for consumer health (e.g. the estimated short-term intake is higher than the acute reference dose (ARfD) for the

[97] Commission Regulation (EU) No 878/2010 of 6 October 2010 amending Annex I to Regulation (EC) No 669/2009 implementing Regulation (EC) No 882/2004 of the European Parliament and of the Council as regards the increased level of official controls on imports of certain feed and food of non-animal origin. Official Journal L 264, 7.10.2010, p. 1 – 6.

substance found), Member States have to inform the other Member States and the European Commission via the Rapid Alert System for Food and Feed (RASFF).

The RASFF ensures that relevant information is shared among all members of the RASFF (EU Member States, Commission, EFSA and Norway, Liechtenstein and Iceland) without delays to allow Member States to take timely appropriate risk management actions. The European Commission has provided the RASSF portal database as a search tool, where information of RASFF-notifications is published[98].

Third countries
Any country that is neither a Member State nor a country from the EEA area.

[98] http://ec.europa.eu/food/food/rapidalert/rasff_portal_database_en.htm

ABBREVIATIONS

ADI	Acceptable Daily Intake
ARfD	Acute Reference Dose
AT	Austria
BE	Belgium
BG	Bulgaria
CI	Confidence Interval
COM	European Commission
CRA	Cumulative Risk Assessment
CY	Cyprus
CZ	Czech Republic
DAR	Draft Assessment Report
DE	Germany
DK	Denmark
EC	European Commission
EE	Estonia
EEA	European Economic Area
EEC	European Economic Community
EFSA	European Food Safety Authority
EFTA	European Free Trade Association
ES	Spain
EU	European Union
EUCP	EU-coordinated programme
EURL	European Reference Laboratory
FAO	Food and Agricultural Organization
FI	Finland
FR	France
GAP	Good Agricultural Practice
GR	Greece

HRM	Highest Residue Measured in monitoring samples
HU	Hungary
IE	Ireland
IESTI	International Estimated Short Term Intake
IS	Island
ISO/IEC	The International Organization for Standardization/ International Electrotechnical Commission
IT	Italy
JMPR	Joint FAO/WHO Meeting on Pesticide Residues
LCL	Lower Confidence Limit
LOQ	Analytical Limit Of Quantification
LT	Lithuania
LU	Luxembourg
LV	Latvia
MRL	Maximum Residue Level
MT	Malta
NCP	National control programmes for pesticide residues
NL	the Netherlands
NO	Norway
NRL	National Reference Laboratory
PL	Poland
POP	Persistent Organic Pollutant
PRIMo	Pesticide Residue Intake Model
PT	Portugal
RAC	Raw Agricultural Commodity
RASFF	Rapid Alert System for Food and Feed
RO	Romania
SANCO	Directorate General for Health & Consumers
SE	Sweden
SI	Slovenia

SK Slovakia

SSD Standard Sample Description

TMDI Theoretical Maximum Daily Intake

TRL_{ep} threshold residue level (edible portion)

TRL_{rac} threshold MRL or threshold residue level (raw agricultural commodity)

UCL Upper Confidence Limit

UK the United Kingdom

WHO World Health Organization

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