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Review of the existing maximum residue levels for copper compounds according to Article 12 of Regulation (EC) No 396/2005

European Food Safety Authority (EFSA)

Abstract

According to Article 12 of Regulation (EC) No 396/2005, EFSA has reviewed the maximum residue levels (MRLs) currently established at European level for the pesticide active substance copper compounds. To assess the occurrence of copper compounds residues in plants, processed commodities, rotational crops and livestock, EFSA considered the conclusions derived in the framework of Directive 91/414/EEC and under Regulation (EC) No 1107/2009 as well as the European authorisations reported by Member States (including the supporting residues data). Considering the fact that copper is an element also naturally present in the environment, any data regarding the inherent content of copper in plant and livestock were also considered. Based on the assessment of the available data, MRL proposals were derived and a consumer risk assessment was carried out. Some information required by the regulatory framework was missing and a possible chronic risk to consumers was identified. Hence, the consumer risk assessment is considered indicative only and some MRL proposals derived by EFSA still require further consideration by risk managers. Measures for reduction of the consumer exposure may also be considered.

Keywords: copper compounds, MRL review, Regulation (EC) No 396/2005, consumer risk assessment, inorganic pesticide, fungicide, bactericide

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Summary

Copper compounds was included in Annex I to Directive 91/414/EEC on 23 April 2009 by Commission Directive 2009/37/EC, and has been deemed to be approved under Regulation (EC) No 1107/2009, in accordance with Commission Implementing Regulation (EU) No 540/2011, as amended by Commission Implementing Regulations (EU) No 541/2011, 2015/232 and 2018/84. As the active substance was approved after the entry into force of Regulation (EC) No 396/2005 on 2 September 2008, the European Food Safety Authority (EFSA) is required to provide a reasoned opinion on the review of the existing maximum residue levels (MRLs) for that active substance in compliance with Article 12(1) of the aforementioned regulation. To collect the relevant pesticide residues data, EFSA asked France, as the designated rapporteur Member State (RMS), to complete the Pesticide Residues Overview File (PROFile) and to prepare a supporting evaluation report. The PROFile and evaluation report provided by the RMS were made available to the Member States. A request for additional information was addressed to the Member States in the framework of a completeness check period, which was initiated by EFSA on 20 June 2016 and finalised on 12 September 2016. After having considered all the information provided, EFSA prepared a completeness check report which was made available to Member States on 7 December 2016.

Based on the conclusions derived by EFSA in the framework of Directive 91/414/EEC and the additional information provided by the RMS and Member States, EFSA prepared in November 2017 a draft reasoned opinion, which was circulated to Member States for consultation via a written procedure. Comments received by 10 January were considered during the finalisation of this reasoned opinion. The following conclusions are derived.

Copper is a monoatomic element and therefore inherently stable. As no metabolites are expected, the nature of residues in primary crops, rotational crops and processed commodities as well as the storage stability are considered addressed and specific studies are not required. The relevant residue for monitoring and risk assessment was defined as total copper, including copper residues arising from all forms of copper. Analytical methods for enforcement of mineral copper independently from its chemical form are available for high water and high acid content commodities. However, these are still missing for commodities with high oil content, dry commodities as well as for any other complex matrices (hops, herbal infusions, etc.).

Due to the endogenous occurrence of copper in soil and plant commodities, MRLs were derived for all plant commodities included in the Annex I to Regulation (EC) No 396/2005.

For those commodities for which Good Agricultural Practices (GAPs) are authorised MRL and risk assessment values were derived in accordance with the standard procedure. However, for certain commodities, the derived MRL was found to be lower than the background levels expected in the commodity itself. For these commodities and for the commodities where trials were not sufficient to derive MRLs, tentative MRLs were then derived on the basis of the monitoring data and/or background levels. For these commodities for which no GAPs are authorised, EFSA derived MRLs proposals and risk assessment values on the basis of background levels in order to allow risk managers to consider the fact that inherent copper levels may occur independently from the pesticide authorisations of the molecule. For that purpose, EFSA used the results of a comprehensive survey performed by the RMS. It was noted that these MRLs would also cover the possible residue uptakes that may occur in succeeding crops.

Copper compounds are used on many crops that might be fed to livestock and may also be present in feed commodities for which no GAPs are authorised. Thus, the calculated dietary burdens highly exceed the trigger value for all groups of livestock. For the same reason as reported for the nature of residues in plant commodities, the residue definition for livestock commodities can be defined as total copper for both enforcement and risk assessment without requiring further studies. This residue definition includes copper residues arising from all forms of copper. An analytical method for enforcement in livestock commodities is available but its performance characteristic should still be demonstrated.

Copper is an essential micronutrient for animals and can also be used as a feed additive. For that purpose, maximum contents of copper in feedstuffs are currently in place in the framework of the feed legislation. Since these levels are legal values which are not supposed to be exceeded, MRL and risk assessment values were derived assuming that the current maximum contents of copper in feedstuffs are respected. As this would imply that livestock exposure to copper residues has remained constant over the last years, the monitoring data as well as the survey on background levels were considered as reliable sources to estimate MRL and risk assessment values in commodities of animal origin. When

possible, MRLs were derived from monitoring data unless the background levels reported by the RMS indicated higher residues. In this latter case, MRLs were then derived from the background levels. For those commodities where no monitoring data were available, MRLs were directly derived from the background levels.

Chronic exposure calculations were performed using revision 2 of the EFSA Pesticide Residues Intake Model (PRIMo) and were compared with the acceptable daily intake (ADI) for copper previously derived by EFSA (2008) and confirmed in the EFSA renewal (2018a) under Regulation (EC) No 1107/2009. Acute exposure calculations were not carried out because an acute reference dose (ARfD) was not deemed necessary for this active substance. A first calculation was performed considering the MRLs derived for all commodities of plant and animal origin, including the crops for which pesticide uses are authorised as well as all other crops where a significant background concentration of copper is expected. It is noted that this calculation would then cover residues arising from the authorised GAPs as well as from any other sources of residues, including among others residues from rotational crops. The highest chronic exposure was calculated for WHO Cluster diet B, for which a chronic intake concern was identified as the highest chronic exposure represented 109% of the ADI. It is noted that for all other diets, the chronic exposures were below the ADI, ranging from 14% to 86% of the ADI.

The major contributors to the calculated exposure were identified and different options for risk mitigations measures to reduce the chronic exposure were assessed by EFSA. It was shown that lettuces (8.2% ADI), tomatoes (5.1% ADI), wine grapes (3% ADI) and potatoes (3.6% ADI) were the main commodities for which efficient risk mitigations measures could be possible. For potatoes, a fall-back GAP was identified and a lower MRL could be proposed. For lettuce, tomatoes and wine grapes, however, no fall-back GAPs were identified. Chronic exposures were recalculated in accordance with a second scenario where risk mitigation would be taken on the above mentioned crops. In this calculation, the highest chronic exposure declined to 93.4% of the ADI for WHO Cluster diet B. It is highlighted that this scenario is not necessarily the only alternative to reduce the chronic exposure to copper and other minor contributors were also identified. Finally, it was noted that for the most important contributors (wheat, maize, sunflower seed, soya bean and bovine liver), risk mitigation measures were very limited because MRL and risk assessment values derived for these commodities are not necessarily associated to an agricultural practice in particular. Consequently, lowering the MRL to limit of quantification (LOQ) for these commodities may not be applicable in practice.

In addition to food of plant and animal origin, an estimation of the consumer exposure that would results from copper present in drinking water was also provided. The exposures calculated with the occurrence data in tap water (reported by the RMS) and the WHO default consumption values for water indicate that copper intake through drinking water range between 0.62% and 15.1% of the ADI when considering median/average concentrations. Reference was also made to a previous assessment of EFSA where the average copper intake associated to water and water-based beverages was equivalent to 0.2–4.6% of the ADI. However, the above figures do not consider the possible higher chronic exposures which may be due to local high concentration of copper in tap water.

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Background

Regulation (EC) No 396/2005[1] (hereinafter referred to as 'the Regulation') establishes the rules governing the setting and the review of pesticide maximum residue levels (MRLs) at European level. Article 12(1) of that Regulation stipulates that the European Food Safety Authority (EFSA) shall provide, within 12 months from the date of the inclusion or non-inclusion of an active substance in Annex I to Directive 91/414/EEC[2] a reasoned opinion on the review of the existing MRLs for that active substance. As copper compounds was included in Annex I to Council Directive 91/414/EEC on 23 April 2009 by means of Commission Directive 2009/37/EC,[3] and has been deemed to be approved under Regulation (EC) No 1107/2009[4], in accordance with Commission Implementing Regulation (EU) No 540/2011[5], as amended by Commission Implementing Regulation (EU) No 541/2011[6], EFSA initiated the review of all existing MRLs for that active substance.

According to the legal provisions, EFSA shall base its reasoned opinion in particular on the relevant assessment report prepared under Directive 91/414/EEC. It should be noted, however, that, in the framework of Directive 91/414/EEC, only a few representative uses are evaluated, whereas MRLs set out in Regulation (EC) No 396/2005 should accommodate all uses authorised within the European Union (EU), and uses authorised in third countries that have a significant impact on international trade. The information included in the assessment report prepared under Directive 91/414/EEC is therefore insufficient for the assessment of all existing MRLs for a given active substance.

To gain an overview of the pesticide residues data that have been considered for the setting of the existing MRLs, EFSA developed the Pesticide Residues Overview File (PROFile). The PROFile is an inventory of all pesticide residues data relevant to the risk assessment and MRL setting for a given active substance. This includes data on:

- the nature and magnitude of residues in primary crops;
- the nature and magnitude of residues in processed commodities;
- the nature and magnitude of residues in rotational crops;
- the nature and magnitude of residues in livestock commodities;
- the analytical methods for enforcement of the proposed MRLs.

France, the designated rapporteur Member State (RMS) in the framework of Directive 91/414/EEC, was asked to complete the PROFile for copper compounds and to prepare a supporting evaluation report. The PROFile and the supporting evaluation report were submitted to EFSA on 2 October 2014 and updated by the RMS in 2016 (France, 2016). These documents were then made available to the Member States. A request for additional information was addressed to the Member States in the framework of a completeness check period which was initiated by EFSA on 20 June 2016 and finalised on 12 September 2016. Additional evaluation reports were submitted by Austria, Belgium, the Czech Republic, Germany, Spain, Greece, Hungary, Italy and Portugal (Austria, 2016; Belgium, 2016; Germany, 2016, 2017; Greece, 2016; Hungary, 2016; Portugal, 2016; Spain, 2016; Czech Republic, 2017; Italy, 2017) and, after having considered all the information provided by RMS and Member States, EFSA prepared a completeness check report which was made available to all Member States on 7 December 2016. Further clarifications were sought from Member States via a written procedure in December 2016–January 2017.

Based on the conclusions derived by EFSA in the framework of Directive 91/414/EEC and the additional information provided by the Member States, EFSA prepared in November 2017 a draft reasoned opinion, which was submitted to Member States for commenting via a written procedure. All

[1] 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.

[2] 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. Repealed by Regulation (EC) No 1107/2009.

[3] Commission Directive 2009/37/EC of 23 April 2009 amending Council Directive 91/414/EEC to include chlormequat, copper compounds, propaquizafop, quizalofop-P, teflubenzuron and zeta-cypermethrin as active substances. OJ L 104, 24.4.2009, p. 23–32.

[4] Regulation (EC) No 1107/2009 of the European Parliament and of the Council 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.

[5] Commission Implementing Regulation (EU) No 540/2011 of 25 May 2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards the list of approved active substances. OJ L 153, 11.6.2011, p. 1–186.

[6] Commission Implementing Regulation (EU) No 541/2011 of 1 June 2011 amending Implementing Regulation (EU) No 540/2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards the list of approved active substances. OJ L 153, 11.6.2011, p. 187–188.

comments received by 10 January 2018 were considered by EFSA during the finalisation of the reasoned opinion.

In addition, during the finalisation of the assessment, additional clarifications were requested to RMS and Germany on these studies as key elements to assess the most critical Good Agricultural Practices (cGAP) on potatoes. Therefore, further amendments have become necessary at the final stage. More specifically, the evaluation of the MRL derived on potatoes from the northern European Union (NEU) GAP and trials are update following consideration of the raw studies made available to EFSA in February 2018.

The evaluation report submitted by the France (2016) and the evaluation reports submitted by Member States Austria, Belgium, the Czech Republic, Germany, Spain, Greece, Hungary, Italy and Portugal (Austria, 2016; Belgium, 2016; Germany, 2016, 2017; Greece, 2016; Hungary, 2016; Portugal, 2016; Spain, 2016; Czech Republic, 2017; Italy, 2017) are considered as supporting documents to this reasoned opinion and, thus, are made publicly available.

In addition, key supporting documents to this reasoned opinion are the completeness check report (EFSA, 2017) and the Member States consultation report (EFSA, 2018b). These reports are developed to address all issues raised in the course of the review, from the initial completeness check to the reasoned opinion. Also, the chronic exposure calculations for all crops reported in the framework of this review performed using the EFSA Pesticide Residues Intake Model (PRIMo) (excel file) and the PROFile are key supporting documents and made publicly available as background documents to this reasoned opinion. Furthermore, a screenshot of the Report sheet of the PRIMo (EU1 and EU2) is presented in Appendix C.

Considering the importance of the completeness check and consultation report, all documents are considered as background documents to this reasoned opinion and, thus, are made publicly available.

Terms of Reference

According to Article 12 of Regulation (EC) No 396/2005, EFSA shall provide a reasoned opinion on:

- the inclusion of the active substance in Annex IV to the Regulation, when appropriate;
- the necessity of setting new MRLs for the active substance or deleting/modifying existing MRLs set out in Annex II or III of the Regulation;
- the inclusion of the recommended MRLs in Annex II or III to the Regulation;
- the setting of specific processing factor (PFs) as referred to in Article 20(2) of the Regulation.

The active substance and its use pattern

There is no ISO common name for copper (I), copper (II) variants (not an ISO common name) (IUPAC).

Copper compounds belong to the group of inorganic compounds which are used as a fungicide and bactericide. Copper compounds is taken up from the soil by plant roots and translocated to other parts of the plant mainly via the sap. In the plant, copper plays an important role in respiration and photosynthesis. It is a component of several enzyme systems involved in carbohydrate, nitrogen and cell metabolism. However, when used as a fungicide/bactericide copper is applied as a contact protective foliar spray to the crops leaves. Once absorbed, copper is thought to disrupt the enzyme systems of the pathogenic organisms. Copper is not converted to a metabolite or degradation product in order to exert its intended effect.

Copper compounds was evaluated in the framework of Directive 91/414/EEC with France designated as RMS. The representative uses supported for the peer review process were spraying applications for tomatoes and grapes. Following the first peer review (EFSA, 2008), a decision on inclusion of the active substance in Annex I to Directive 91/414/EEC was published by means of Commission Directive 2009/37/EC, which entered into force on 1 December 2009, and has been deemed to be approved under Regulation (EC) No 1107/2009, in accordance with Commission Implementing Regulation (EU) No 540/2011, as amended by Commission Implementing Regulations (EU) No 541/2011. After Annex I inclusion, confirmatory data were submitted to the European commission by France and peer reviewed by EFSA (2013). Following consideration of these additional data, a revised final review report was published by the European commission (2015). The conditions of the approval were further amended by Commission Implementing Regulation (EU) 2015/232[7] and

[7] Commission Implementing Regulation (EU) 2015/232 of 13 February 2015 amending and correcting Implementing Regulation (EU) No 540/2011 as regards the conditions of approval of the active substance copper compounds. OJ L 39, 14.2.2015, p. 7–10.

Commission Implementing Regulation (EU) 2018/84[8]. This approval is restricted to uses as bactericide and fungicide only.

EFSA carried out the peer review of the pesticide risk assessment for its renewal (EFSA, 2018a), under Commission Implementing Regulation (EU) No 844/2012[9], in the framework of the Commission Regulation (EC) No 686/2012, with France designated as RMS and Germany as co-RMS. EFSA peer-review conclusions (EFSA, 2018a), supersedes the previous EFSA assessment (EFSA, 2008) and confirmatory data for environmental fate and behaviour and ecotoxicology data (EFSA, 2013). The representative uses supported for the peer review renewal process were as a fungicide/bactericide on field applications on grapes and field and greenhouse applications on tomatoes and cucurbits.

The EU MRLs for copper compounds are established in Annexes IIIA of Regulation (EC) No 396/2005 and codex maximum residue limits (CXLs) for copper compounds are not available. An overview of the MRL changes that occurred since the entry into force of the Regulation mentioned above is provided in Table 1.

Table 1: Overview of the MRL changes since the entry into force of Regulation (EC) No 396/2005

Procedure	Legal implementation	Remarks
Art. 10 (EFSA, 2014)	Not yet implemented	Reasoned opinion on setting of an MRL for copper compounds in wild game. As MRL of 4 mg/kg (instead of 0.01* mg/kg) was proposed based on monitoring data obtained on wild game.

MRL: maximum residue level.
*: Indicates that the MRL is set at the limit of quantification.

For the purpose of this MRL review, the critical uses of copper compounds currently authorised within the EU have been collected by the RMS and reported in the PROFile. The additional GAPs reported by Member States during the completeness check were also considered. The details of the authorised GAP(s) for active substance are given in Appendix A. The RMS did not report any use authorised in third countries that might have a significant impact on international trade.

Assessment

EFSA has based its assessment on the PROFile submitted by the RMS, the evaluation report accompanying the PROFile (France, 2016), the assessment report and its addenda prepared under the first peer-review and under Regulation (EC) No 1107/2009 (France, 2007, 2012, 2013) the EFSA conclusion on the peer review of the pesticide risk assessment of the active substance copper compounds in the context of the renewal procedure under Commission Regulation (EC) No 686/2012[9] (EFSA, 2018a). Several previous EFSA's opinions on copper compounds were also considered for this assessment, including one reasoned opinion on MRLs (EFSA, 2014), the opinion of the NDA panel on the Dietary Reference Values for copper (EFSA NDA Panel, 2015) and the opinions of the FEEDAP panel on the revision of the currently authorised maximum copper content in complete feed (EFSA FEEDAP Panel, 2012, 2016). Furthermore, the evaluation reports submitted during the completeness check (Austria, 2016; Belgium, 2016; Czech Republic, 2017; Germany, 2016, 2017; Spain, 2016; Greece, 2016; Hungary, 2016; Italy, 2017; Portugal, 2016) were also taken on board. The assessment is performed in accordance with the legal provisions of the uniform principles for evaluation and authorisation of plant protection products as set out in Commission Regulation (EU) No 546/2011[10] and the currently applicable guidance documents relevant for the consumer risk assessment of pesticide residues (European Commission, 1997a–g, 2000, 2010a,b, 2017; OECD, 2011, 2013).

More detailed information on the available data and on the conclusions derived by EFSA can be retrieved from the list of end points reported in Appendix B.

[8] Commission Implementing Regulation (EU) 2018/84 of 19 January 2018 amending Implementing Regulation (EU) No 540/2011 as regards the extension of the approval periods of the active substances chlorpyrifos, chlorpyrifos-methyl, clothianidin, copper compounds, dimoxystrobin, mancozeb, mecoprop-p, metiram, oxamyl, pethoxamid, propiconazole, propineb, propyzamide, pyraclostrobin and zoxamide OJ L 16, 20.1.2018, p. 8–10.

[9] Commission Implementing Regulation (EU) No 844/2012 of 18 September 2012 setting out the provisions necessary for the implementation of the renewal procedure for active substances, as provided for in Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market. OJ L 252, 19.9.2012, p. 26–32.

[10] Commission Regulation (EU) No 546/2011 of 10 June 2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards uniform principles for evaluation and authorisation of plant protection products. OJ L 155, 11.06.2011, p. 127–175.

1. Residues in plants

1.1. Nature of residues and methods of analysis in plants

1.1.1. Nature of residues in primary crops

Specific studies evaluating metabolism and distribution of residue in plants following the use of copper as a plant protection product are not available. However, the public scientific literature reported in the framework of the first peer review provided enough information on the uptake, translocation and effects of copper in plants (EFSA, 2008, 2018a).

In plants, copper is absorbed from soil through the roots. From the roots, copper is transported in the sap to the rest of the plant. Upon foliar application, transportation and distribution of copper in plants are limited. Copper is a monoatomic element and therefore inherently stable. It does not degrade and no metabolites are expected.

1.1.2. Nature of residues in rotational crops

Copper is extremely stable in soil and since no degradation is expected in soil, no DT_{50}/DT_{90} were derived during the peer review (EFSA, 2008, 2018a). However, for the same reason as mentioned in Section 1.1.1, specific studies to evaluate the nature of residues in succeeding crops are not necessary.

As copper is absorbed from soil and can be transported to the rest of the plant, residue uptake in succeeding crops is a relevant issue in the framework of this MRL review. This point is discussed under Section 1.2.2.1.

1.1.3. Nature of residues in processed commodities

No studies investigating the effects of industrial processing or household preparation on the nature of residues are available. However, such studies are not necessary as copper is known to be inherently stable (see also Section 1.1.1) and therefore is not expected to be degraded into any other material.

1.1.4. Methods of analysis in plants

Analytical methods for enforcement of copper residues in plant matrices were provided and evaluated in the framework of the initial peer review (EFSA, 2008). The available methods for the determination of copper residues in plants involve atomic absorption spectrometry (AAS) and were validated in commodities with high water content (limit of quantification (LOQ) of 2 mg/kg) and high acid content (LOQ of 5 mg/kg). It is noted that in the framework of the assessment for Annex I Renewal of copper compounds, similar methods were reassessed and there are indications that lower LOQ could be achieved in these crops (EFSA, 2018a).

As the method is considered to be highly specific, no confirmatory method is required. No independent laboratory validation (ILV) is available but this is not deemed necessary since AAS are recognised as standard methods of analysis for inorganic elements.

As the reported analytical methods include a mineralisation of the samples (by acid digestion), it is expected that all forms of copper present in the plant are converted to Cu^{2+}. Therefore, total copper content can measured regardless from its chemical form.

No analytical methods are available for commodities with high oil content and dry commodities as well as for any other complex matrices (hops, herbal infusions, etc.). Since MRLs are derived on commodities belonging to these categories, additional analytical methods for enforcement in these matrices should be required.

1.1.5. Stability of residues in plants

There are no standard studies investigating the storage stability of copper residues in plant matrices. However, as copper is a monoatomic element and inherently stable it is not expected to undergo degradation during storage. Therefore, residues of copper are expected to be stable in all residue trials samples.

1.1.6. Proposed residue definitions

Based on the information reported above, the meeting of experts concluded that the relevant residue for monitoring and risk assessment should be defined as total copper (EFSA, 2008, 2018a). This definition is expected to include copper residues arising from all forms of copper as they would be

converted to Cu^{2+} during the analytical phase (see also Section 1.1.4). This conclusion is still valid in the framework on of this review.

1.2. Magnitude of residues in plants

1.2.1. Magnitude of residues in primary crops

To assess the magnitude of copper compounds residues resulting from the reported GAPs, EFSA considered all residue trials reported by the RMS in its evaluation report (France, 2016), including residue trials evaluated in the framework of the peer reviews (France, 2007, 2017) and additional data submitted during the completeness check (Germany, 2016; Spain, 2016). Considering that copper residues are stable in all plant matrices (see also Section 1.1.5), decline of residues during storage of the trial samples is not expected.

The number of residue trials and extrapolations were evaluated in accordance with the European guidelines on comparability, extrapolation, group tolerances and data requirements for setting MRLs (European Commission, 2016).

Residue trials are not available or not sufficient to support the authorisations on figs, passion fruits, mangoes, cherimoyas, beans (without pods), lentils (fresh), asparagus, cardoons, beans (dry), lentils (dry), sunflower seeds, rapeseeds, soya beans and sugar beets (roots and tops). Therefore, MRL or risk assessment values in line with the cGAPs could not be derived for these crops and the following data gaps were identified:

- Figs: four trials compliant with the southern outdoor GAP are required.
- Passion fruits: four trials compliant with the southern outdoor GAP are required.
- Mangoes: four trials compliant with the southern outdoor GAP are required.
- Cherimoyas: four trials compliant with the southern outdoor GAP are required.
- Head cabbages: only two trials performed on savoy cabbage are available to support the northern outdoor GAP (Germany, 2016). Germany also proposed to use two additional trials performed on Brussels sprouts to derive a tentative MRL. It is acknowledged that residues observed in these commodities are below the LOQ of the trials (i.e. < 5 mg/kg). However, trials on Brussels sprouts are not appropriate to support a GAP on head cabbage and that the LOQ for enforcement is 2* mg/kg for this crop. Furthermore, based on the cGAP reported for head cabbage (four applications at 0.5 kg a.s./ha; preharvest interval (PHI) 7 days), there is no apparent reason to expect a no residue situation in this crop. Therefore, eight residue trials performed on head cabbage and compliant with the northern outdoor GAP are required.
- Beans (without pods): eight trials compliant with the southern outdoor GAP are required.
- Lentils (fresh): four trials compliant with the southern outdoor GAP are required.
- Asparagus: four trials compliant with the southern outdoor GAP are required.
- Cardoons: four trials compliant with the southern outdoor GAP are required.
- Beans (dry) and lentils (dry): eight trials on dry beans (or dry peas) compliant with the southern outdoor GAP on these crops are required.
- Sunflower seeds: eight trials compliant with the southern outdoor GAP are required.
- Rapeseeds: eight trials compliant with the southern outdoor GAP are required.
- Soya beans: eight trials compliant with the southern outdoor GAP are required.
- Sugar beets (roots and tops): six trials compliant with the northern outdoor GAP and six trials compliant with the southern outdoor GAP are required.
- Turnips (tops): MRL and risk assessment values could not be derived for this feed item. However, as MRL for feed item are not yet a requirement since residues in this commodity are not expected to have an impact on the MRL derived in livestock commodities (see also Section 2.3), this only considered as a minor deficiency. Thus, four trials compliant with the northern outdoor GAP and four trials compliant with the southern outdoor GAP are desirable.

For other crops, the number of GAP-compliant residue trials reported is not compliant with the data requirements. Therefore, only tentative MRL and risk assessment values could be derived by EFSA and the following data gaps were identified:

- Citrus fruits: two additional trials on oranges and two additional trials on mandarins compliant with the southern outdoor GAP on citrus fruits are required.
- Plums: eight trials compliant with the northern outdoor GAP and four additional trials compliant with the southern outdoor GAP are required.

- Kiwi fruits: four additional trials compliant with the southern outdoor GAP are required.
- Carrots, beetroots, celeriacs, horseradishes, Jerusalem artichokes, parsnips, parsley roots, radishes, salsifies, swedes and turnips: four additional trials on carrots compliant with the northern outdoor GAP and seven additional trials compliant with the southern outdoor GAP are required.
- Cucurbits with inedible peel: tentative MRL and risk assessment values can be derived from the southern data which are all below LOQ (France, 2016). However, the LOQs of these trials (5–10 mg/kg) are much higher that the LOQ for enforcement for high water content commodities (2 mg/kg). Therefore, the proposed MRL and risk assessment values may probably be overestimated. Consequently, eight trials on melons compliant with the southern outdoor GAP and performed with a lower LOQ are required. Furthermore, four trials on melons compliant with the northern outdoor GAP and two trials on melons compliant with the indoor GAP are also required.
- Watercress: a tentative MRL can be derived from seven southern trials performed on lettuce, out of which only four were performed on open leaf varieties. Therefore, five additional trials performed on open leaf varieties of lettuce (or on watercress) compliant with the southern outdoor GAP are still required.
- Beans (with pods) and peas (with pods): two additional trials compliant with the northern outdoor GAP and two additional trials compliant with the southern outdoor GAP are required.
- Peas (without pods): two additional trials compliant with the northern outdoor GAP and five additional trials compliant with the southern outdoor GAP are required.
- Hops: tentative MRL and risk assessment values can be derived based on seven overdosed northern trials available for this crop. However, four trials compliant with the northern outdoor GAP are still required.

For all other crops, available residue trials are sufficient to derive MRL and risk assessment values, taking note of the following considerations:

- Almonds, chestnuts, hazelnuts and walnuts: although appropriate MRL and risk assessment values can be derived from the southern data, six trials in total on two representatives of the group of tree nuts (except coconuts) compliant with the northern outdoor GAP are still required.
- Apples, pears and quinces: although appropriate MRL and risk assessment values can be derived from the southern data, eight trials on apples/pears (with a minimum of four trials on apples) compliant with the northern outdoor GAP are still required.
- Apricots: although appropriate MRL and risk assessment values can be derived from the northern data, eight trials compliant with the southern outdoor GAP are still required.
- Cherries and jambuls/jambolans: although appropriate MRL and risk assessment values can be derived from the southern data, five additional trials on cherries compliant with the northern outdoor GAP are still required.
- Peaches: although appropriate MRL and risk assessment values can be derived from the southern data, five trials compliant with the northern outdoor GAP are still required.
- Tables and wine grapes: although appropriate MRL and risk assessment values can be derived from the northern data, five additional trials compliant with the southern outdoor GAP are still required.
- Strawberries: it is noted that seven residue trials instead of eight are available to support the southern outdoor GAP. However, this is deemed acceptable in this case because a full data set compliant with the indoor GAP indicates that the indoor GAP is probably more critical than the outdoor GAPs. Further residue trials are therefore not required and MRL and risk assessment values can be derived from the indoor GAP.
- Blueberries: although appropriate MRL and risk assessment values can be derived from the northern data, four trials compliant with the southern outdoor GAP are still required.
- Cane fruits and other small fruits and berries (except dewberries): it is noted that no trials are available to support the indoor GAP. However, based on the northern outdoor trials, it is expected that treatment before flowering or after commercial harvest will not results in residues above the enforcement LOQ for these crops (i.e. 5* mg/kg). Further residue trials are therefore not required and MRL can be proposed at the LOQ.
- Potatoes: it is noted that the validity of the residue trials supporting the northern GAP on potatoes was discussed during the Member State (MS) consultation (EFSA, 2018b). Based on the additional information provided by Germany, these trials were considered valid and thus, appropriate MRL and risk assessment values can be derived from the northern GAP. As only

seven trials are available, one additional trial compliant with the northern GAP is still desirable to complete the data set; this is deemed as a minor deficiency.

- Onions, garlic and shallots: although appropriate MRL and risk assessment values can be derived from the northern data, four additional trials on onions compliant with the southern outdoor GAP are still required.
- Tomatoes and aubergines: although appropriate MRL and risk assessment values can be derived from the northern data, three additional trials on tomatoes compliant with the southern outdoor GAP and four trials compliant with the indoor GAP are still required.
- Peppers: although appropriate MRL and risk assessment values can be derived from the southern data, four additional trials compliant with the northern outdoor GAP are still required.
- Cucurbits with edible peel: although appropriate MRL and risk assessment values can be derived from the indoor data, eight trials on cucumbers and/or courgettes compliant with the northern outdoor GAP are still required.
- Lettuce and other leafy crops: although appropriate MRL and risk assessment values can be derived from the indoor data, eight trials on lettuce (open leaf varieties) compliant with the northern outdoor GAP and five additional trials on lettuce (open leaf varieties) compliant with the southern outdoor GAP are still required. It is also noted that one additional trial on lettuce (open leaf variety) compliant with the indoor GAP is still desirable to complete the data set (minor deficiency).

1.2.2. Magnitude of copper in plant resulting from soil uptake

Copper is a ubiquitous molecule which may also be present in plant commodities that are not supposed to undergo pesticide treatments with copper. As copper is a natural element, it is also present in soil, which is essential for normal plant growth development. Therefore, all soil-grown crops may contain copper. Although copper can have significant phytotoxicity at high soil concentrations, it is also known that plants can accumulate copper to various extents, depending on plant species and copper content in soils. Consequently, further investigation is needed to assess copper residues in rotational crops as well as endogenous levels of copper in plant commodities.

1.2.2.1. Magnitude of residues in rotational crops

According to the scientific literature, there is a significant background concentration of copper in soil. In a previous assessment of confirmatory data submitted for the active substance copper, the soil concentration in arable field was estimated at around 32 mg/kg of soil (EFSA, 2013). This concentration may be due to natural presence of copper in soil but also to pesticides and fertilisers uses. Considering the maximum annual application rate of copper on crops and the conservative assumption that 100% of the applied copper reaches the soil surface, the critical uses of copper as plant protection product are expected to contribute to 3–11 mg/kg soil per year.[11] Although this is lower than the background level of 32 mg/kg soil, it is noted that degradation of copper in soil is not expected. Therefore, this annual contribution is significant and needs to be considered in view of assessing the potential uptake of copper in succeeding crops.

Due to the ubiquitous property of copper, which naturally present in plants as an essential micronutrient, field trials on rotational crops according to the current OECD recommendations would not be helpful to assess residues in rotational crops. These studies are therefore not required.

Based on several scientific publications reported by the RMS, bioavailable copper is taken up by crops according to the plant needs. Therefore, independently from the copper contamination in soil, plants are not expected to absorb more than the essential nutritional amount. It is highlighted that an excess of copper absorption by plant may cause phytotoxic effects. Consequently, it is assumed that copper uptake is succeeding crop is naturally auto regulated by the crops.

Considering the above, it is concluded that copper can be present in succeeding crops (annual and permanent) as an endogenous compound, following natural soil absorption as a micronutrient. The RMS provided a comprehensive survey on the endogenous copper levels in all plant commodities. This survey is further discussed in Section 1.2.2.2 and is considered sufficient to cover the residue levels that may occur in succeeding crops. During the Annex I Renewal, the results of this survey were confirmed by the control samples taken from the residue field trials performed on the representative

[11] 11 mg/kg soil per year: maximal copper concentration expected in soil after one year, assuming the maximum annual application of 8 kg/ha, soil depth of 5 cm and soil density of 1.5 g/cm^3.

uses (EFSA, 2018a). Furthermore, these data were considered reliable by the experts (EFSA, 2018c). These data can be considered as a surrogate to rotational crops studies and could allow deriving MRLs and risk assessment values for plant commodities for which no GAPs are currently authorised within the EU (also referred to as 'off-label' crops).

1.2.2.2. Endogenous residue levels of copper in plant commodities

Due to its natural function of micronutrient taken up from soil (see also Section 1.2.2.1), copper is present in almost all plant commodities. As it was not possible to quantify the residue uptake from soil to crops, further investigations were carried out to assess the endogenous levels of copper in plant commodities. The RMS performed a literature search on the copper levels present in plant commodities. The outcome of this survey was then compared with the results of the available monitoring data. The monitoring data are generated by the EU National laboratories and are collected each year by EFSA in the framework of the monitoring program.

RMS survey on background residue levels (France, 2016):

In order to assess the background levels of copper in all plant commodities, the RMS performed a comprehensive literature survey. Details on this literature search are reported in the French evaluation report (France, 2016). The RMS was able to retrieve data on copper occurrence for almost all commodities included in the Annex I to Regulation (EC) No 396/2005. These figures give indication on the copper content in plant commodities without considerations on the history of the fields. Therefore, it is supposed to reflect the background levels of copper in plant commodities. An overview of this survey is reported in Annex A of the present opinion.

The available data shows that significant levels of copper can be found in almost all plant commodities, including the ones for which no pesticide uses are authorised. For instance, fairly high levels of copper are observed in tree nuts (4.5–37 mg/kg), pulses (10.9–17 mg/kg), oilseeds (1.3–21.5 mg/kg), cereals (2.8–10 mg/kg) and spices (3.4–13.7 mg/kg). These findings are consistent with several previous publications on consumer exposure to copper among which, the EFSA opinion of Panel on Dietetic Products, Nutrition and Allergies (NDA) (EFSA NDA Panel, 2015) can be highlighted: '*rich dietary sources of copper are […] nuts (particularly cashew) and seeds*'. It is noted that this previous opinion of EFSA based its assessment on an ad-hoc survey on the copper nutrient content in food items (Roe et al., 2013; see also on Nutrient composition data base[12]).

In the RMS survey, the number of available data per commodity varies between 1 and 13 data; for a few minor commodities (e.g. medlar, star apples, American persimmon, oil palm fruits/kernels, kapok, land cress, etc.), no data are available. In order to consolidate the data sets, EFSA proposed to group the occurrence data for commodities belonging to the same crop group when similar ranges of copper levels are observed. For instance, background levels of grapefruits, oranges, lemons, limes and mandarins can all be considered in the same group to assess the endogenous levels of copper in citrus fruits. When no data were available for a commodity, extrapolation from the similar commodity was also proposed to complete the data set (e.g. from lettuce to 'herbal infusions from leaves and herbs'). A presentation of the combined data sets resulting from this methodology is also available in Annex A.

Monitoring data on copper:

In the aim of cross-checking the above survey with another source of information, EFSA extracted the monitoring data for copper compounds obtained from the national control programmes of years 2009–2015. It is noted that monitoring data for copper are available from a limited number of MSs. However, as the objective is to collect information on the endogenous level of copper, samples originating from EU and non-EU countries were all considered in this data collection. Overall, 7,002 individual data for 111 different plant commodities (unprocessed) are available. Residues at or above the LOQs were observed in a total of 5,368 samples, corresponding to 77% of the samples analysed. A detailed summary of these monitoring data is available in Annex B. It is noted that the data were collected and all expressed as copper, in accordance with the residue definition.

As in the RMS survey, significant levels of copper are observed in plant commodities for which no pesticide uses are authorised such as dry peas (max 10.9 mg/kg), linseeds, poppy seeds, sesame seeds, mustard seeds and pumpkins seeds (12.3–41 mg/kg), barley, rice, wheat (10.1–12.2 mg/kg), teas (21.8 mg/kg) and coffee beans (max 23.4 mg/kg).

[12] EFSA Nutrient composition data base: https://dwh.efsa.europa.eu/bi/asp/Main.aspx?rwtrep=701

In general, the monitoring data corroborate the findings of the RMS survey on background levels; for most of the commodities similar ranges of copper levels are observed from the RMS survey and in the monitoring data. However, for a few commodities, monitoring data can indicate much higher levels compared to the background levels retrieved by the RMS. For those commodities where GAPs are authorised, this may be explained by the fact that authorised GAPs for foliar applications can induce higher residues (found in monitoring) compared to the background concentrations. However, for those commodities where no GAPs were reported in the framework of this review, this may indicate possible misuses or unexpected drift contaminations following foliar applications. For instance, maximum residues levels found in wild fungi (34.7 mg/kg) or in grape leaves (64 mg/kg) should probably not reflect the natural copper content expected in these commodities. Therefore, EFSA is of the opinion that the monitoring data should not be considered for setting MRLs in off-label commodities.

It is noted that the copper levels measured in the monitoring of a specific commodity mainly depend on the current authorisations associated to the relevant crops. Therefore, it was decided not to pool the monitoring data from commodities belonging to the same group, in opposition to what was proposed for the background levels.

1.2.3. Magnitude of residues in processed commodities

Studies investigating the magnitude of residues in processed commodities were initially reported in the framework of the first peer review (EFSA, 2008). Furthermore, new studies were assessed by the RMS under this MRL review (France, 2016); it is noted that some of these studies were also submitted under the Annex I Renewal of the active substance (France, 2017). An overview of all available processing studies is available in Appendix B.1.2.3.

Among others, robust PFs for enforcement and risk assessment were derived for peeled fruits (oranges, mandarins, kiwi fruits and melons), juices (orange, apples and wine grapes), canned commodities (peaches, cherries, peas without pods), dried fruits (plums and table grapes), olive oil and press cake, strawberries jam and orange marmalade, wines (red and white) and beer. With regard to feed processed commodities, however, only tentative PFs could be derived for oranges and apples pomaces as they were not sufficiently supported by studies (only 1 or 2 studies available). Based on two available data, a tentative PF of 0.73 could be proposed for apple wet pomace. However, the available data for orange pomaces indicate a potential residue concentration in citrus pomaces (wet and dry). It is noted that the RMS proposed a waiver for further investigations in citrus pomaces based on the assumption that copper residues which are not transferred to juice (PF=0.94) would entirely be retrieved in the pomace fractions. A theoretical PF of 1.06 (=1/0.94) was then proposed by the RMS (France, 2016). However, this approach was not retained by EFSA because this calculation does not take into account the fact that the PF of 0.94 in juice may also be due to the concentration following juice pasteurisation step. Furthermore, the empirical PF derived from the single available study (PF = 8.6) should not be disregarded and is in contradiction with the theoretical calculation of the RMS. This empirical PF is rather consistent with default PF usually considered for citrus dried pulp (PF = 10) when no data on magnitude of residues in processed commodities are available. Consequently, the tentative PF derived from the available studies were considered for pomace commodities (apples and citrus).

Further processing studies are not required although they could allow to further refine the consumer risk assessment (e.g. for cereal processed commodities) or the dietary burden calculations (e.g. for citrus pomaces and potatoes by-products). If more robust PFs were to be required by risk managers, in particular for enforcement purposes, additional processing studies would be needed.

1.2.4. Proposed MRLs in plant commodities

Due to the endogenous occurrence of copper in soil and plant commodities, MRLs were derived for all commodities included in the Annex I to Regulation (EC) No 396/2005. Based on the initial proposal of the RMS, EFSA developed an ad-hoc methodology which is summarised in the decision tree presented in Appendix E.1. A major distinction is made between those commodities where a GAP is authorised in the EU and the other commodities for which no GAPs are authorised.

Commodities for which GAPs are authorised:

When sufficient residue data were available, MRL and risk assessment values were derived in accordance with the standard rules, thus considering the GAP-compliant residue trials and using the OECD calculator. For 99 out of 103 commodities for which an MRL could be derived according to this methodology, the proposed MRL was found to cover the background levels and the monitoring data

reported in Annexes A and B. For the four remaining commodities (cashew nuts, coconuts, pine nuts and garlic), the background levels and/or the monitoring data indicate that higher copper levels could be retrieved in practice. For these commodities, tentative MRLs were then derived on the basis of the monitoring data[13] and/or background levels,[14] in accordance with the decision tree reported in Appendix E.1. For figs, passion fruits, mangoes, cherimoyas, head cabbages, beans (without pods), lentils (fresh), asparagus, cardoons, beans (dry), lentils (dry), sunflower seeds, rapeseeds, soya beans and sugar beets (roots and tops), residue data were not available or not sufficient to derive MRLs according to the standard procedure. Exceptionally, tentative MRLs were also derived from the monitoring data and/or background levels for these crops, highlighting that additional data are still required to confirm these values.

Commodities for which no GAPs are authorised:

It was demonstrated by the RMS as well as by other sources that copper is also present in several plant commodities which are not supposed to be treated with copper (see Section 1.2.2). It is acknowledged that the occurrence of copper in plant independently from the direct pesticide application is mainly due to the roots uptake of copper as a micronutrient into soil. Furthermore, the copper content of soil may be due to copper pesticides and fertilisers uses over the years as well as to natural presence of copper in the environment. Therefore, in order to accommodate with this situation, risk managers may have interest to also set MRLs on off-label commodities. In this eventuality and also to assess the consumer exposure accordingly, EFSA derived MRLs proposals and risk assessment values for all off-labels commodities. For these commodities, it was decided to use only the background levels from the RMS survey. As discussed in Section 1.2.2.2, the monitoring data may bias the MRL proposal as they may also reflect misuses or avoidable cross-contaminations.

For all commodities of the Annex I to Regulation (EC) No 396/2005, MRL proposals derived in accordance with the above mentioned methodology are reported in Appendix F.1. For each MRL proposal, the rational is reported in the column 'comment on MRL proposal'. Nevertheless, a risk management decision should still be taken on whether MRLs should be proposed for commodities for which no pesticides uses are authorised and on the period of their applicability.

2. Residues in livestock

Copper compounds are used on crops that might be fed to livestock such as citrus fruits, potatoes, apples and soya bean. Furthermore, copper naturally occurs in plant and is also an essential micronutrient for animals. Various copper compounds are authorised as feed additives.[15] Many occurrence data collected in different frameworks indicate that copper is retrieved in significant levels in commodities of animal origin (EFSA NDA Panel, 2015; EFSA FEEDAP Panel, 2015). Therefore, a detailed assessment of copper residues in livestock is triggered under this review.

2.1. Nature of residues and methods of analysis in livestock

The metabolism of copper in livestock was not assessed during the peer review. However, copper is a monoatomic element which cannot be degraded, and thus, no metabolites are expected. Therefore, the residue definition proposed for plant as total copper is also applicable to products of animal origin. This residue definition is valid for both enforcement and risk assessment and is expected to cover copper residues arising from all forms of copper.

There are indications that the method described in the European Standard EN 14082:2003 can be used to analyse total copper in animal matrices. This method is based on dry washing of the foodstuffs at 450°C and quantification by flame AAS. Since analyses are performed after dry ashing, the method should in principle be applicable for all types of matrices, including food of animal origin. However, the performance characteristics of this method were not adequately demonstrated as it was highlighted during the peer review under the Annex I Renewal (EFSA, 2018a). This data gap should be addressed in order to validate the performance of this method. In the meanwhile, a LOQ ranging between 0.5 and 1 mg/kg is considered for livestock commodities in line with the previous assessment of EFSA (2014).

[13] To derive MRL from the monitoring data, EFSA used the 'spices approach' based on the upper confidence interval of the percentile 95th; this approach is applicable when more than 58 data were available. For the commodities where the number of data was too limited, the MRL proposal is based on the highest value of the monitoring data.

[14] The MRLs derived from background levels are based on the highest value of the data set given for a certain commodity.

[15] Detailed uses are available in the EU Register for feed additives: https://ec.europa.eu/food/sites/food/files/safety/docs/animal-feed-eu-reg-comm_register_feed_additives_1831-03.pdf

2.2. Copper concentration in animal diets

2.2.1. Livestock exposure to pesticide residues of copper: 'dietary burden'

Copper compounds are authorised for pesticide use on many crops that might be fed to livestock such as citrus fruits, apples, potatoes, head cabbages and several root crops. Furthermore, many major feed items which are not treated with copper as a fungicide (e.g. cereals and oilseeds; see also Section 1.2) may also contribute to the livestock dietary burdens. Therefore, the dietary burdens were calculated not only considering residues from the authorised uses, but also including the background residue levels and monitoring data. It is noted that such a calculation does also cover the residues expected from rotational crops. Livestock dietary burdens were calculated for different groups of livestock according to OECD guidance (OECD, 2013), which has now also been agreed upon at European level.

The selection of the input values followed the same rules as for the MRL proposals derived in Section 1.2.4 (see also decision tree in Appendix E.1). Therefore, for those commodities where MRLs were derived from the authorised GAPs, input values were derived from the supporting residue trials. When MRLs were based on the background levels data, the respective median and/or highest values were taken into account for the dietary burden assessment. If MRLs were derived from the monitoring data, the corresponding mean and/or highest values were considered. The detailed input values for this calculation are summarised in Appendix D.1. For the feed commodities for which no MRLs could be proposed in Section 1, background levels and monitoring data were considered in the calculation. For instance, as the residue levels in sugar beet (roots and tops) could not be properly assessed because of the limited residue trials supporting this GAP, the input values for these feed items were derived from the background levels.

The dietary burdens calculated for all groups of livestock were found to highly exceed the trigger value of 0.1 mg/kg dry matter (DM). The calculated dietary burdens range between 19.1 mg/kg DM (poultry layer) to 147.6 mg/kg DM (cattle) (see also Appendix B.2). For information purpose, EFSA also assessed the theoretical dietary burdens which would result from the authorised uses only, meaning without consideration of the background levels and monitoring data. The dietary burdens hereby calculated would range between 14.8 and 138.7 mg/kg DM, which is in the same range than the overall dietary burdens resulting from the above mentioned calculation. As this calculation is just theoretical, it was not reported in the list of end points of the present opinion. However, this result just shows that the residues arising from the direct authorised pesticide uses (in particular potatoes and by-products of potato industry) are the main drivers of the dietary burden compared to the background levels of copper.

2.2.2. Copper content authorised in complete feed

Copper is an essential micronutrient for animals and some specific copper compounds can also be used as feed additives in animal nutrition, when needed. For that purpose, maximum contents of copper in feedstuffs are currently in place in the framework of different Feed Regulations.[16] The maximum contents of copper in feedstuffs defined in these Regulations were reported in Table 2. It is noted that the livestock categories defined in the Feed Regulations are more detailed than the ones considered for the pesticide dietary burden calculations. Therefore, in order to allow comparison with the dietary burdens calculated under the present review, EFSA made an attempt to aggregate the detailed species defined in the Feed Regulations to make them fit with the livestock groups considered for the dietary burden calculations. For example, while the Feed Regulations need to distinguish between 'piglets up to 12 weeks' and 'other pigs', these two subgroups were considered together under the category 'swine (all diets)'. In addition, the original values were expressed on dry matter basis assuming that standard diets contain 88% of DM. It is noted that new proposals for maximum contents of copper were derived by EFSA in the context of the revision of the maximum authorised content of copper in feed (EFSA FEEDAP Panel, 2015). However, these values are not yet implemented in the Regulation and are not drastically different that the ones reported below.

[16] Commission Regulation (EC) No 479/2006 of 23 March 2006 as regards the authorisation of certain additives belonging to the group compounds of trace elements. OJ L 86, 24.3.2006, p. 4–7. Commission Regulation (EC) No 349/2010 of 23 April 2010 concerning the authorisation of copper chelate of hydroxyl analogue of methionine as a feed additive for all animal species. OJ L 104, 24.4.2010, p. 31–33. Commission implementing Regulation (EC) (EU) No 1230/2014 of 17 November 2014 concerning the authorisation of copper bilysinate as a feed additive for all animal species. OJ L 331, 18.11.2014, p. 18–21. Commission implementing Regulation (EC) (EU) 2016/2261 of 15 December 2016 concerning the authorisation of copper(I) oxide as a feed additive for all animal species. OJ L 342, 16.12.2016, p. 18–21.

Table 2: Currently authorised maximum copper contents in feed in the European Union

Livestock group	Maximum copper content[(a)] (mg/kg complete feed)	Maximum copper content (mg/kg complete feed DM basis)[(b)]
Cattle (all diets)	15–35	17–39.8
Cattle (dairy only)	15–35	17–39.8
Sheep (all diets)	15	17
Sheep (ewe only)	15	17
Swine (all diets)	25–170	28.4–193
Poultry (all diets)	25	28.4
Poultry (layer only)	25	28.4

DM: dry matter.
(a): According to current Feed Regulations.[16]
(b): Assuming standard diets containing 88% of dry matter.

2.2.3. Comparison between dietary burden and copper content in complete feed

A comparison between the maximum dietary burdens calculated under this review with the currently authorised maximum copper contents in feed (expressed on DM basis) is reported in Table 3 below. For cattle and sheep, it is remarkable that the maximum dietary burdens calculated from the pesticide residues are much higher than the currently authorised maximum copper contents in feed. This indicates that copper residues resulting from pesticides uses may theoretically induce exceedances of the authorised maximum contents of copper in feedstuffs. However, the available data from monitoring activities performed on complete feed in different European countries indicate that this may not often occur in practice. According to these data, maximum copper concentrations in feedstuffs prepared for cattle and sheep do not exceed 45 mg/kg DM[17] (EFSA FEEDAP Panel, 2015). In practice, exceedances of the authorised maximum contents of copper in feedstuffs of cattle and sheep represent less than 6.5%[18] of the samples (EFSA FEEDAP Panel, 2015). It is acknowledged that the monitoring data on copper concentration in feedstuff are still quite limited: data were available from only 14 MS and the number of data on dairy cows, cattle for fattening and sheep is small (number of samples analysed ranges between 8 and 111). Nevertheless, it is highlighted that the maximum contents of copper in complete feed set in the Feed Regulations are legal limits which are therefore expected to be monitored by feed business operators when completing the feed diets. Consequently, the maximum copper content in complete feed reported in the Feed Regulations should guarantee that the copper animal intake remain under these levels. In addition, it should also be noted that the theoretical maximal dietary burdens calculated under Section 2.2.1 are not expected to occur in practice because they would anyways not be tolerated by most of the animal species (see also EFSA FEEDAP Panel, 2015).

Table 3: Comparison of the maximum dietary burdens with maximum copper contents to be authorised in complete feed

Livestock group	Max dietary burden (mg/kg DM)[(a)]	Maximum copper content[(b)] (mg/kg complete feed DM basis)[(c)]
Cattle (all diets)	147.6	17–39.8
Cattle (dairy only)	114.1	17–39.8
Sheep (all diets)	143.9	17
Sheep (ewe only)	143.9	17
Swine (all diets)	81.4	28.4–193
Poultry (all diets)	22.5	28.4

[17] See appendix D of the EFSA FEEDAP Panel opinion of 2015: the copper content reported in feed for calves milk replacer, fattening cattle, dairy cows, sheep and goat ranges between 2 and 40 mg/kg feed, equivalent to a maximum of 45 mg/kg DM.
[18] See appendix D of the EFSA FEEDAP Panel opinion of 2015: the maximum rate of exceedance (6.5%) was identified for dairy cows.

Livestock group	Max dietary burden (mg/kg DM)[a]	Maximum copper content[b] (mg/kg complete feed DM basis)[c]
Poultry (layer only)	19.1	28.4

DM: dry matter.
(a): Maximum dietary burden calculated under this review using OECD guidance(OECD, 2013) and pesticide residue data (see also Appendix B.2).
(b): According to current Feed Regulations.[12]
(c): Assuming standard diets containing 88% of dry matter.

Copper residues in feed commodities arising from pesticide uses can theoretically induce high dietary exposure of livestock to copper. However, copper compounds are routinely used as feed additives and concentrations of copper in complete feed shall not exceed the ones authorised by the Feed Regulations; if the concentrations are exceeded, the feed is non-compliant and must be withdrawn. It is noted that the maximum dietary burden resulting from the calculation derived in the present review is a worst-case scenario which is not expected to frequently occur in practice. Furthermore, the conservative assumptions behind this calculation such as use of default processing factors could be refined if further data on the effect of magnitude of residue in processed commodities (in particular for potatoes dried pulp and potatoes processed waste) would be available.

Nevertheless, if risk manager wish to reduce the probability that residues arising from pesticide uses may induce concerns to feed producers, restriction measures on pesticide uses can be proposed to lower the potential copper residues arising from pesticide uses. The main contributors to the dietary burden are potatoes and potato processed commodities, thus withdrawal of the most cGAP reported for potatoes (i.e. deriving an MRL based on the southern GAP instead of considering the northern GAP; see also scenario 2 in Section 3) would decrease the livestock dietary burden of around 30% for cattle, sheep and swine.

2.3. Magnitude of residues in livestock

In a scenario where the currently authorised maximum copper contents in complete feed were respected, it can reasonably be assumed that livestock exposure to copper residues has remained constant over the last years. Therefore, copper levels observed in the monitoring data or in any other reliable sources dealing with copper occurrence in food commodities are good indicators to estimate MRL and risk assessment values in commodities of animal origin.

2.3.1. Available data on copper occurrence in animal commodities

Due to its presence in the animal diets (as an essential nutrient, as a feed additive and as a residue of pesticide uses), copper is expected to be retrieved in almost all livestock commodities. Further investigations were then carried out to quantify the copper levels in livestock commodities. First, EFSA considered the results of residue analysis performed on livestock commodities in the framework of European monitoring programmes. These data are generated by the EU National laboratories and are collected each year by EFSA in the framework of the monitoring programme. In addition, the literature search on the copper background levels in animal commodities provided by the RMS was also considered in this Section.

Monitoring data on copper:

EFSA extracted the monitoring data for copper compounds in animal commodities obtained from the national control programmes of years 2009–2015. As for plant commodities, monitoring data for copper comes from a limited number of MSs. In total, 1,730 individual data taken from 17 different animal commodities (unprocessed) are available. Residues at or above the LOQs were observed in a total of 1,402 samples, corresponding to 81% of the samples analysed. A detailed summary of these monitoring data is available in Annex B. It is noted that the data were collected and all expressed as copper, in accordance with the residue definition.

Over the period 2009–2015, the most controlled commodities were milks (n = 433), bovine liver (n = 206), eggs (n = 145) and meat/muscle from different ruminants (n = 925). It is noted that monitoring data are available for both meat and muscle because meat was still considered a relevant commodity during the first part of the period 2009–2015. However, considering that MRLs should now be set for muscle only (no longer for meat), it was considered appropriate to use only the data reported for muscle. The highest levels of copper are observed in bovine and swine liver

(max 454 mg/kg and 19.2 mg/kg, respectively) and in bovine kidney (3.5 mg/kg). The maximum results observed in muscles range between 1.3 and 3 mg/kg (all animal considered). No data are available for fat tissues. Compared to the other commodities, residues levels observed in milk and eggs are quite low.

In addition to the data extracted by EFSA, monitoring results from a previous survey provided by Germany were also taken on board to consider the copper residues in wild terrestrial animal vertebrate. This survey was conducted in Germany in 2012 and reported to EFSA in the framework of an application for setting MRL for copper compounds in wild game (EFSA, 2014). The detailed results of this survey are also reported in Annex B.

RMS survey on background residue levels (France, 2016):

The RMS has performed a comprehensive literature survey for which all detailed sources are available in the French evaluation report (France, 2016). The RMS was able to retrieve data on copper occurrence for all animal commodities relevant in the framework of the MRL review. An overview of this survey is reported in Annex A of the present opinion.

The data provided by RMS are consistent with the monitoring data presented above. Very high levels of copper in animal liver are confirmed (max values from 75 to 374 mg/kg) and similar ranges of copper concentrations were reported for muscle (2.2–6 mg/kg). Low levels in milks and eggs are also reported in this survey (max 1.1 mg/kg). Some differences between background data and monitoring data were observed for the commodities for which number of monitoring data was very poor (e.g. poultry liver and bovine kidney, n = 1). Therefore, the comparison for these commodities is limited.

As for plant commodities, EFSA proposed a consolidation of these data by grouping the figures for similar commodities when equivalent residue levels are observed. For examples, background levels observed in sheep and goat liver were considered together to assess the residues in ovine and caprine liver while data for bovine were combined with the ones of equine. This approach is in line with the current rules of extrapolations for livestock. The same was done for the other tissues. For milks, however, as data for bovine, sheep, goat and horses showed similar results, all below the LOQ of 1* mg/kg, they were all combined in order to obtain a consolidated data set. When no data are available for a commodity, extrapolations from a similar commodity were proposed to complete the data set (e.g. from bovine tissues to horse tissues). A presentation of the combined data sets resulting from this methodology is also available in Annex A.

Additional sources:

Overall, both sources of data (monitoring data and RMS survey) are consistent. Furthermore, it is noted that these figures are also in line with previous works performed on copper. In the EFSA opinion of Panel on Dietetic Products, Nutrition and Allergies (NDA) (EFSA NDA Panel, 2015), liver was already identified as a potential dietary source of copper and, according to the EFSA Nutrient composition data base[19] (Roe et al., 2013) contains in average 55 mg /kg. For the other commodities of animal origin, the Nutrient composition data base also indicates consistent average values with regards to the data reported above. Some information on copper concentrations in swine and ruminant liver was also reported under the revision of maximum authorised content of copper in feed (EFSA FEEDAP Panel, 2015) with concentrations ranging between 30.6 and 356 mg/kg. For all of these reasons, EFSA considers that the data reported by the RMS and the monitoring data constitute a relevant basis to derive MRLs and risk assessment values.

2.3.2. Proposed MRLs in livestock commodities

MRLs can be derived for all relevant tissues of swine, ruminants, equine and poultry as well as for milk and eggs on the basis of the monitoring data and/or background levels in accordance with the decision tree reported in Appendix E.2.

For those commodities where sufficient monitoring data were available, MRLs were first derived from these data.[20] When the MRL derived from monitoring data was found to cover the background data, it was confirmed as the final recommendation. Following this criterion, MRL for bovine liver (400 mg/kg), poultry muscle (7 mg/kg), milk (1 mg/kg), eggs (1 mg/kg) and wild terrestrial animal

[19] EFSA Nutrient composition data base: https://dwh.efsa.europa.eu/bi/asp/Main.aspx?rwtrep=701

[20] To derive MRL from the monitoring data, EFSA attempted to use the 'spices approach' based on the upper confidence interval of the percentile 95th; this approach was applicable when more than 58 data were available. For the commodities where the number of data was too limited, the MRL proposal was based on the highest value of the monitoring data.

vertebrate (3 mg/kg) were derived from the monitoring data (see details in Appendix F.2). For this later, it is noted that an MRL of 4 mg/kg was previously proposed in reasoned opinion of EFSA on setting MRL for copper compounds in wild game (EFSA, 2014). The data used in this previous assessment were exactly the same as the ones considered in the present opinion (see also Annex B) but the MRL proposal of 4 mg/kg was based on the highest residue level observed in the survey. For sake of consistency with the other MRL proposals based on monitoring data, EFSA considers that a MRL of 3 mg/kg, based on the upper confidence interval of the 95th percentile,[16] can now be proposed for this commodity.

When the MRL derived from monitoring data was below the maximum of the background levels retrieved from the survey of the RMS, an MRL proposal was then derived from the background levels.[14] Therefore, MRL for swine muscle, swine liver, bovine muscle, bovine kidney, sheep muscle and poultry liver were derived from the background data (see details in Appendix F.2).

For the remaining commodities, MRLs were directly derived from the background levels as no monitoring data were available (see details in Appendix F.2). All MRL proposals derived in accordance with the above mentioned methodology are reported in Appendix F.2. For each MRL proposal, the rational is reported in the column 'comment on MRL proposal'.

It is noted that the need for MRLs for copper in livestock commodities was already discussed in the framework of other legislations. In the feed additives area, it was previously considered that MRL should not be proposed for essential trace elements such as copper because it was assumed that the maximum copper contents in feedstuffs set by EU Feed legislations should be sufficient to regulate the copper levels that may occur in livestock commodities (EFSA FEEDAP Panel, 2016). In the veterinary medicines area,[21] no MRLs in food of animal origin were required for the copper compounds that are used as pharmacologically active substances (copper chloride, gluconate, heptanoate, methionate, oxide, sulfate). Therefore, a risk management decision should still be taken on whether MRLs for animal commodities should be set in the Pesticide Regulation and on the period of applicability of such MRLs. In any cases, these MRLs should be considered on a tentative and temporary basis because they may need to be updated regularly considering any eventual monitoring data provided in the future. It is also noted that if copper MRLs would be set in livestock commodities, a data gap for the performance characteristic of the available analytical method for animal matrices should be set (see also Section 2.1).

3. Consumer risk assessment

3.1. Risk assessment considering all commodities of plant and animal origin

In the framework of this review, MRLs were derived for all commodities of plant and animal origin. This covers the crops for which pesticide uses are authorised (see Appendix A) as well as all other crops where a background concentration of copper is expected on the basis of monitoring data and/or additional surveys (see Sections 1.2.4 and 2.3.2). The consumer exposure resulting from these MRLs was therefore calculated with consideration of residues arising from authorised uses as well as from any other sources (background concentrations, uptake from soil, etc.). It is noted that this calculation also covers residues that may be up-taken in rotational crops.

Chronic exposure calculations were performed using revision 2 of the EFSA PRIMo (EFSA, 2007). The selection of the input values followed the same rules as for the MRL proposals derived in Sections 1.2.4 and 2.3.2 (see also decision trees in Appendix E.1 and E.2). For those commodities where MRLs were derived from the authorised GAPs, input values were derived from the supporting residue trials in accordance with the standard internationally agreed methodologies (FAO, 2009). For all other commodities expect oil palm kernels, oil palm fruits and kapok, risk assessment values were derived from monitoring data and/or from background levels. For oil palm kernels, oil palm fruits and kapok, the current EU MRLs were used for an indicative calculation as no GAPs are authorised and neither monitoring data nor background levels were available for these commodities. When MRLs were derived from the monitoring data, the corresponding mean values were considered and when MRLs were derived from the background data, the respective median values were considered. The issue on whether to use the median or mean values of the background levels was discussed in the framework of the Annex I Renewal (EFSA, 2018a,c); the meeting of experts concluded that the median values

[21] See Commission Regulation (EU) No 37/2010 of 22 December 2009 on pharmacologically active substances and their classification regarding maximum residue limits in foodstuffs of animal origin. OJ L 15, 20.1.2010, p. 1–72.

were more relevant, especially for those small data sets where the extreme values may bias the results. Furthermore, it was also demonstrated by the RMS that considering median or mean values would not impact significantly the outcome of the calculations. This approach was followed for plant and animal commodities.

The input values correspond the residues in raw commodities expect for citrus fruits, cucurbits with inedible peel, wine grapes, rapeseed and olives for oil production where refined input values were considered based on processing factors. For citrus fruits and cucurbits with inedible peel, the relevant peeling factors were applied to only consider the edible part of these commodities (pulp). As the consumption of wine grapes refers to grape juice (children) and wine (adults), the PF derived in Section 1.2.3 could be used to refine the input values for wine grapes. It is noted that the median PF for grape juice (0.39) is higher than the PF for wine production (0.04). However, as many of the chronic diets do not distinguish between children and adults, it was preferred to use the more conservative PF (i.e. grape juice) for the refined chronic exposure. Furthermore, the consumption data of wine grapes was corrected by using the yield factor of juice (0.75).[22] These considerations allowed EFSA to propose a refined input value for wine grapes. A similar approach was proposed for rapeseed and olives for oil production, considering the PF for oil processing (< 0.1) which was derived from studies performed on olive oil (see Section 1.2.3). For other oilseeds (e.g. sunflower seeds, soya bean, poppy seeds, etc.), the effect of oil processing was not considered in this assessment as these commodities are not exclusively used for oil production. It is highlighted that, due to the high LOQ reported in the residue trials supporting the GAPs for melons (10 mg/kg), fairly high risk assessment values were considered for this commodity. It was not possible to refine this value as there is no detailed data on the expected residue levels in this commodity. However, further refined would be possible in the future if trials performed with a lower LOQ would be provided for this crop. The detailed input values for the chronic exposure are summarised in Appendix D.2.

The exposures calculated were compared with the acceptable daily intake (ADI) for copper, derived by EFSA (2008) and confirmed in the EFSA renewal (EFSA, 2018a) under Regulation (EC) No 1107/2009. It is noted that acute exposure calculations were not carried out because an acute reference dose (ARfD) was not deemed necessary for this active substance. In this first scenario (also reported as scenario 1), the highest chronic exposure was calculated for WHO Cluster diet B, for which a chronic intake concern was identified as the highest chronic exposure represented 109% of the ADI. It is noted that for all other diets, the chronic exposures are below the ADI, ranging from 14% to 86% of the ADI.

In the present opinion, it was not possible to assess separately the exposure due to pesticide residues from the background exposure since copper concentrations assessed in the background levels and in the monitoring data may also reflect the possible uptake from soil. However, an assessment of the total background exposure to copper was performed in the context of the scientific opinion on dietary reference values for copper (EFSA NDA Panel, 2015). In this opinion, the average dietary intake of copper for different age classes, based on the nutrient composition of food items, was estimated between 11% and 66% of the ADI.[23] This result implies that the background exposure to copper may already contribute to a significant part of the ADI. However, risk manager still have a margin to mitigate the total exposure calculated in this review.

3.2. Assessment of risk mitigation options

In order to assist risk managers in the view of potential risk mitigation measures, EFSA identified the main contributors to this highest chronic exposure calculated under scenario 1; these commodities are reported in Tables 4 and 5 below. For two of the most important contributors (wheat and maize), the copper levels assessed in this calculation are not associated with a pesticide use in particular as no GAPs are authorised for these commodities. The consumer intake of copper via wheat and maize is due to the background occurrence of copper in these commodities, which was already well documented in the literature (see also Section 1.2.2.2). It is acknowledged that the calculation performed under this review is not refined for cereal-based products as it does not consider the potential effect of processing on the magnitude of residues in processed commodities of cereals. However, the intake of copper through cereal commodities was also assessed in the scientific opinion of dietary reference values for copper (EFSA NDA Panel, 2015). In this opinion, detailed values for each food item of the category 'grain and grain-based products' were taken into account. The outcome

[22] Yield factor of 0.75, assuming that 1 kg of wine grapes produce 0.75 kg of juice.

[23] The maximal average copper intake was calculated for German infants (survey VELS) and equal to 0.099 mg/ kg bw per day, corresponding to an intake of 0.495 mg per day with an average weight of 5 kg (EFSA NDA Panel, 2015).

of this calculation also indicated that grain and grain-based products were main contributors of the total intake (equivalent to 15% of the ADI). The natural content of copper in cereals, the potential uptake from soil as well as its use as a fertiliser may explain the high concentrations of copper in these crops. However, in the absence of detailed information on it, possibilities for risk mitigation measures in cereal commodities are very limited. A similar situation is identified for bovine liver, which may contain copper residues not only arising from a pesticide use in particular (see also Section 2.3) and which were also identified as important contributors to the total exposure in the scientific opinion of dietary reference values for copper (EFSA NDA Panel, 2015).

For sunflower seeds and soya bean, risk migration measures (e.g. withdrawing of the current authorisations) could be proposed. However it is not possible to quantify the effect of such a risk mitigation measure since, as no GAP-compliant trials are available, EFSA is not in position to conclude whether the residue levels observed in monitoring data and background levels are directly linked to the current authorisations or to the inherent copper concentrations in these crops. Detailed considerations for these commodities are reported in Table 4.

Table 4: Main contributors to the chronic exposure (with limited risk mitigation possibilities)

Commodity	Contribution to diet[(a)] (ADI)	Input value from	Comment
Main contributors with limited possibilities for efficient risk mitigation measures			
Wheat	23.6%	Monitoring data	Intake resulting from endogenous levels. Further refinement could be possible considering detailed copper concentrations in wheat-based processed products Risk mitigation measures are very limited since no GAP is authorised on this crop (monitoring data reflect the background levels)
Maize	6.8%	Background levels	Intake resulting from endogenous levels. Further refinement could be possible considering detailed copper concentrations in maize-based processed products Risk mitigation measures are very limited since no GAP is authorised on this crop
Bovine liver	4.2%	Monitoring data	Intake resulting from endogenous levels Risk mitigation measures are very limited since monitoring data reflect the background levels (copper concentration in bovine liver may not only be due to pesticide residues in feed items, but also to the use as feed additive or any other source of copper feed items)
Main contributors with possibilities for risk mitigation measures, but not quantifiable			
Sunflower seed	9.1%	Monitoring data	Intake resulting from GAP and/or endogenous levels (GAP is authorised but GAP compliant residue trials are not available). Refinement is not possible as it cannot be excluded that sunflower seed may be eaten unprocessed Impact of risk mitigation measures cannot be quantified in this absence of GAP-compliant trials
Soya bean	4.9%	Background levels	Intake resulting from GAP and/or endogenous levels (GAP is authorised but GAP-compliant residue trials are not available). Refinement is not possible as it cannot be excluded that soya bean are not exclusively eaten as oil Impact of risk mitigation measures cannot be quantified in this absence of GAP-compliant trials

ADI: acceptable daily intake; GAP: Good Agricultural Practice.
(a): Percentage of ADI calculated for the most critical chronic exposure (WHO Cluster diet B).

The other main drivers of the chronic exposure reported in Table 5 (lettuce, tomatoes, wine grapes and potatoes) contribute together to 19.9% of the ADI. For these crops, several GAPs were reported and EFSA made an attempt to assess the possible impact of eventual risk mitigation measures which could be taken on these crops. For potatoes, the available data would allow deriving lower MRLs on the

basis of less critical GAP reported in this review. Proposing an MRL of 4 mg/kg[24] (instead of 7 mg/kg) for potatoes would slightly reduce the chronic exposure (see details in Table 5). For lettuce, tomatoes and wine grapes, however, the fall-back GAPs and residue trials reported in this review do not allow to derive (lower) MRLs (see details in Section 1.2 and Appendix B.1.2.1). Therefore, for these commodities the only risk mitigation option identified would be to lower the MRL to the background levels, which could correspond to the withdrawal of the current authorisations of copper as a plant protection product. Such a decision would reduce the contribution of lettuce (from 8.2% to 0.20% ADI), tomatoes (from 5.1% to 1.5%) and of wine grapes (from 3.0% to 0.41% ADI). A theoretical exposure calculation considering all the above risk mitigation measures was performed. According to the results of this calculation, the highest chronic exposure declined to 93.4% of the ADI for WHO Cluster diet B.

Based on the same principle, further minor decreases of the chronic exposure could be obtained by withdrawing (or modifying) the current authorisations on table grapes, watermelons, spinach, melons, tropical root and tuber vegetable, peppers, fresh herbs, which individually contribute to 1–2% of the ADI.

Table 5: Main contributors to the chronic exposure (with possible risk mitigation measures)

Commodity	Contribution to diet (ADI) before risk mitigation[(a)]	Input value from	Comment	Contribution to diet (ADI) after risk mitigation[(a)]	Input value from
Lettuce	8.2%	STMR (indoor)	Possible risk mitigation measure excluding critical GAPs authorised on lettuce (no fall-back GAP identified)	0.20%	Background levels
Tomatoes	5.1%	STMR (outdoor)	Possible risk mitigation measure: excluding critical GAPs on tomatoes (no fall-back GAP identified)	1.5%	Background levels
Potatoes	3.6%	STMR (NEU)	Possible risk mitigation measure: excluding the northern GAP on potatoes; a fall-back option is identified with the southern GAP (MRL of 4 mg/kg)	2.3%	STMR (SEU)
Wine grapes	3.0%	STMR (NEU) × PF × yield factor	Possible risk mitigation measure: excluding critical GAPs authorised on wine grapes (no fall-back GAP identified)	0.41%	Background levels × PF × yield factor
Total	19.9%	–	–	4.4%	–

ADI: acceptable daily intake; STMR: supervised trials median residue; GAP: Good Agricultural Practice; NEU: northern European Union; SEU: southern European Union.
(a): Percentage of ADI calculated for the most critical chronic exposure (WHO Cluster diet B).

3.3. Consumer exposure to copper via drinking water

In addition to food of plant and animal origin, drinking water can be another significant source of exposure to copper. As the estimation of the consumer exposure should investigate all the potential sources of exposure, assessment of the chronic exposure to copper via drinking water is considered relevant in the framework of this review.

Occurrence data:

In the EU, the maximum permitted concentration of copper in water intended for human consumption is 2 mg/L. However, the mineral content in drinking water is very variable. Factors such as natural mineral content, pH and a copper or non-copper plumbing system determine copper concentration in water (EFSA NDA Panel, 2015). For the purpose of the present review, RMS has reported data from measurements performed in France between 2009 and 2013. These data come

[24] A MRL of 4 mg/kg can be derived from the southern GAP reported for potatoes (see Appendix B.1.2.1).

from 'SISE-Eaux database',[25] which is managed by the French Ministry of Health. The database includes analytical results from sanitary control on the tap water from 16,300 treatment stations and 25,300 drinking water distribution units. Detailed results were reported in the evaluation of the RMS (France, 2016) as well as in the framework of the Annex I Renewal (see Table 6) (France, 2017; EFSA, 2018c). The data reported by France show a wide distribution of the concentration levels with highest values up to the legal limit of 2 mg/L or above (0.53% of the samples exceed the legal limit).

Table 6: Copper levels in tap water measured in France (2016)

n=	Median (mg/L)	Average (mg/L)	95th percentile (mg/L)	Source
85,892	0.028	0.151	0.434 mg/L	SISE-Eaux database – 1/1/2009 to 31/12/2013 (France, 2016)

Consumption data:

To assess the copper exposure from drinking water, EFSA used the default consumption values for water recommended in the European Guidance on Assessment of the Relevance of Metabolites in Groundwater of Substances Regulated under Council Directive 91/414/EEC (European Commission, 2003). Different values are considered for adults (0.03 L/kg body weight (bw) per day), children (0.10 L/kg bw per day) and infant (0.15 L/kg bw per day), corresponding to 2, 1 and 0.75 L/day, respectively.

Exposure:

Assuming that the occurrence data reported by the RMS would be representative of the concentrations expected in different MS, and assuming a conservative scenario where drinking water would exclusively correspond to tap water, the copper exposure through drinking water can be estimated according to different assumptions on the concentration (median, mean and percentile 95) and considering the respective consumption data of adults, children and infants. The results of these calculations are reported in Table 7. The calculated exposures to copper through drinking water range between 0.62% and 15.1% of the ADI when considering a median or an average concentration of copper in tap water. However, considering that local concentrations in tap water may be higher (see 95th percentile), it cannot be excluded that local exposures to tap water may be higher than these values (9.6–43.4% ADI).

Table 7: Copper exposure from drinking water

Copper concentration in water		Water consumption		Exposure (% ADI)
Value (mg/L)	Comment	Value (L/kg bw per day)	Comment	
0.028	Median French data	0.033	Adults 60 kg – 2 L/day	0.62
0.028	Median French data	0.100	Child 10 kg – 1 L/day	1.87
0.028	Median French data	0.150	Infant 5 kg – 0.75 L/day	2.80
0.151	Mean French data	0.033	Adults 60 kg – 2 L/day	3.36
0.151	Mean French data	0.100	Child 10 kg – 1 L/day	10.1
0.151	Mean French data	0.150	Infant 5 kg – 0.75 L/day	15.1
0.434	P95 French data	0.033	Adults 60 kg – 2 L/day	9.64
0.434	P95 French data	0.100	Child 10 kg – 1 L/day	28.9
0.434	P95 French data	0.150	Infant 5 kg – 0.75 L/day	43.4

P95: 95th percentile; bw: body weight; ADI: acceptable daily intake.

It is noted that the copper exposure from 'water and water-based beverages' was also calculated in the scientific opinion on dietary reference values for copper (EFSA NDA Panel, 2015). In this opinion, the group water and water-based beverages included not only tap water but also, among others, natural mineral water, bottled drinking water, soft drinks, flavoured waters. The average copper concentrations in water and water-based beverages reported from different countries were used to assess the exposure of each respective population. The outcome of this assessment was that water

[25] http://social-sante.gouv.fr/sante-et-environnement/eaux/article/le-controle-de-la-qualite-de-l-eau-du-robinet

and water-based beverages may drive between 0.2% and 5.4% of the ADI, contributing for up to 12% of the total copper intake calculated in this previous opinion. These figures are considered more refined than the global assessment reported above. However, they also do not reflect the possible higher chronic exposures which may be due to local high concentration of copper in tap water.

3.4. Overall conclusion on risk assessment

Based on the above calculations, a chronic intake concern cannot be excluded when considering copper intake from food (109% ADI) plus through drinking water (3.36–15.1% in average). Furthermore, higher concentrations in tap water may locally induce higher chronic exposures in certain cases. Therefore, a risk management decision needs to be taken on which MRLs should be implemented and on the period of their applicability.

Major contributors and different options for risk mitigations measures were identified in Section 3.2. It was shown that lettuces, tomatoes, wine grapes and potatoes were the main commodities for which efficient risk mitigations measures could be possible. For potatoes, a fall-back GAP was identified and a lower MRL could be proposed. It is also highlighted that proposing a lower MRL for potatoes would also decrease the livestock dietary burden of 30% for cattle, sheep and swine (see Section 2.2.3). For lettuce, tomatoes and wine grapes, however, no fall-back GAPs were identified and lower MRLs could be derived from the background levels. Nevertheless, it is highlighted that the scenario 2 assessed by EFSA is not necessarily the only alternative to reduce the chronic exposure to copper. Other minor contributors were also identified (table grapes, watermelons, spinach, melons, tropical root and tuber vegetable, peppers, fresh herbs). For the other major contributors (wheat, maize, sunflower seed, soya bean and bovine liver), risk mitigation measures are very limited because MRL and risk assessment values derived for these commodities are not associated to an agricultural practice in particular. Consequently, lowering the MRL to LOQ for these commodities may not be applicable in practice.

Conclusions

Copper is a monoatomic element and therefore inherently stable. As no metabolites are expected, the nature of residues in primary crops, rotational crops and processed commodities as well as the storage stability are considered addressed and specific studies are not required. The relevant residue for monitoring and risk assessment was defined as total copper, including copper residues arising from all forms of copper. Analytical methods for enforcement of mineral copper independently from its chemical form are available for high water and high acid content commodities. However, these are still missing for commodities with high oil content, dry commodities as well as for any other complex matrices (hops, herbal infusions, etc.).

Due to the endogenous occurrence of copper in soil and plant commodities, MRLs were derived for all plant commodities included in the Annex I to Regulation (EC) No 396/2005.

For those commodities for which GAPs are authorised, MRL and risk assessment values were derived in accordance with the standard procedure. However, for certain commodities, the derived MRL was found to be lower than the background levels expected in the commodity itself. For these commodities and for the commodities where trials were not sufficient to derive MRLs, tentative MRLs were then derived on the basis of the monitoring data and/or background levels. For these commodities for which no GAPs are authorised, EFSA derived MRLs proposals and risk assessment values on the basis of background levels in order to allow risk managers to consider the fact that inherent copper levels may occur independently from the pesticide authorisations of the molecule. For that purpose, EFSA used the results of a comprehensive survey performed by the RMS. It was noted that these MRLs would also cover the possible residue uptakes that may occur in succeeding crops.

Copper compounds are used on many crops that might be fed to livestock and may also be present in feed commodities for which no GAPs are authorised. Thus, the calculated dietary burdens highly exceed the trigger value for all groups of livestock. For the same reason as reported for the nature of residues in plant commodities, the residue definition for livestock commodities can be defined as total copper for both enforcement and risk assessment without requiring further studies. This residue definition includes copper residues arising from all forms of copper. An analytical method for enforcement in livestock commodities is available but its performance characteristic should still be demonstrated.

Copper is an essential micronutrient for animals and can also be used as a feed additive. For that purpose, maximum contents of copper in feedstuffs are currently in place in the framework of the feed legislation. Since these levels are legal values which are not supposed to be exceeded, MRL and risk

assessment values were derived assuming that the current maximum contents of copper in feedstuffs are respected. As this would imply that livestock exposure to copper residues has remained constant over the last years, the monitoring data as well as the survey on background levels were considered as reliable sources to estimate MRL and risk assessment values in commodities of animal origin. When possible, MRLs were derived from monitoring data unless the background levels reported by the RMS indicated higher residues. In this latter case, MRLs were then derived from the background levels. For those commodities where no monitoring data were available, MRLs were directly derived from the background levels.

Chronic exposure calculations were performed using revision 2 of the EFSA PRIMo and were compared with the ADI for copper previously derived by EFSA (EFSA, 2008) and confirmed in the EFSA renewal (2018a) under Regulation (EC) No 1107/2009. Acute exposure calculations were not carried out because an ARfD was not deemed necessary for this active substance. A first calculation was performed considering the MRLs derived for all commodities of plant and animal origin, including the crops for which pesticide uses are authorised as well as all other crops where a significant background concentration of copper is expected. It is noted that this calculation would then cover residues arising from the authorised GAPs as well as from any other sources of residues, including among others residues from rotational crops. The highest chronic exposure was calculated for WHO Cluster diet B, for which a chronic intake concern was identified as the highest chronic exposure represented 109% of the ADI. It is noted that for all other diets, the chronic exposures were below the ADI, ranging from 14% to 86% of the ADI.

The major contributors to the calculated exposure were identified and different options for risk mitigations measures to reduce the chronic exposure were assessed by EFSA. It was shown that lettuces (8.2% ADI), tomatoes (5.1% ADI), wine grapes (3% ADI) and potatoes (3.6% ADI) were the main commodities for which efficient risk mitigations measures could be possible. For potatoes, a fall-back GAP was identified and a lower MRL could be proposed. For lettuce, tomatoes and wine grapes however, no fall-back GAPs were identified. Chronic exposures were recalculated in accordance with a second scenario where risk mitigation would be taken on the above mentioned crops. In this calculation, the highest chronic exposure declined to 93.4% of the ADI for WHO Cluster diet B. It is highlighted that this scenario is not necessarily the only alternative to reduce the chronic exposure to copper and other minor contributors were also identified. Finally, it was noted that for the most important contributors (wheat, maize, sunflower seed, soya bean and bovine liver), risk mitigation measures were very limited because MRL and risk assessment values derived for these commodities are not necessarily associated to an agricultural practice in particular. Consequently, lowering the MRL to LOQ for these commodities may not be applicable in practice.

In addition to food of plant and animal origin, an estimation of the consumer exposure that would results from copper present in drinking water was also provided. The exposures calculated with the occurrence data in tap water (reported by the RMS) and the WHO default consumption values for water indicate that copper intake through drinking water range between 0.62% and 15.1% of the ADI when considering median/average concentrations. Reference was also made to a previous assessment of EFSA where the average copper intake associated to water and water-based beverages was equivalent to 0.2–4.6% of the ADI. However, the above figures do not consider the possible higher chronic exposures which may be due to local high concentration of copper in tap water.

Recommendations

Due to the inherent content of copper observed in many plant commodities as well as in livestock commodities, MRLs were derived for almost all commodities included in the Annex I to Regulation (EC) No 396/2005. In the framework of this specific assessment, EFSA developed an ad-hoc methodology which is summarised in the decision trees reported in Appendices E.1 and E.2. MRL recommendations were derived in compliance with these decision trees (see summary Table 8). The MRL values listed as 'Recommended' in the table are sufficiently supported by data and are therefore proposed for inclusion in Annex II to the Regulation. The remaining MRL values listed in the table are not recommended for inclusion in Annex II because they require further consideration by risk managers (see summary table footnotes for details).

For many crops for which GAPs are authorised, some tentative MRLs and/or existing EU MRLs need to be confirmed by the following data:

- Analytical methods for enforcement in commodities with high oil content, dry commodities as well as for any other complex matrices (hops, herbal infusions, spices, etc.);

- Validation of the performance characteristic of the analytical method for enforcement in commodities of animal origin;
- Residue trials supporting the GAPs on figs, passion fruits, mangoes, cherimoyas, beans (without pods), lentils (fresh), asparagus, cardoons, beans (dry) and lentils (dry), sunflower seeds, rapeseeds, soya beans, sugar beets;
- Additional residue trials supporting the GAPs on citrus fruits, plums, kiwi fruits, carrots, beetroots, celeriacs, horseradishes, Jerusalem artichokes, parsnips, parsley roots, radishes, salsifies, swedes and turnips, cucurbits with inedible peel, head cabbages, watercress, beans (with pods) and peas (with pods), peas (without pods) and hops.

It is highlighted that some of the MRLs derived result from a GAP in one climatic zone only, whereas other GAPs reported in this review were not fully supported by data. EFSA therefore identified the following data gaps which are not expected to impact on the validity of the MRLs derived but which might have an impact on national authorisations:

- additional residue trials supporting the GAPs on almonds, chestnuts, hazelnuts, walnuts, apples, pears and quinces, apricots, cherries, jambuls/jambolans, peaches, table and wine grapes, blueberries, onions, garlic, shallots, tomatoes, aubergines, peppers, cucurbits with edible peel, lettuce and other leafy crops.

If the above reported data gaps are not addressed in the future, Member States are recommended to withdraw or modify the relevant authorisations at national level.

Minor deficiencies were also identified in the assessment but these deficiencies are not expected to impact either on the validity of the MRLs derived or on the national authorisations. The following data are therefore considered desirable but not essential:

- additional residue trials supporting the northern GAP on potatoes (one trial) and the indoor GAP on lettuce (one trial);
- Additional trials performed on turnips providing analysis on turnip tops.

Furthermore, it is highlighted that a chronic exposure concern was identified when considering copper residues associated to the MRLs derived in this opinion plus the average contributions of drinking water. Therefore, a risk management decision should be taken regarding the optional MRLs proposed for some major contributing commodities identified by EFSA: potatoes, tomatoes, lettuces and wine grapes. It is however highlighted that the risk mitigations identified by EFSA are not necessarily the only alternative to reduce the chronic exposure to copper. Other minor contributors were also identified (table grapes, watermelons, spinach, melons, tropical root and tuber vegetable, peppers, fresh herbs) and further fall-back options may be proposed by Member States. In any case, consequently to the future risk management decision on MRL values, Member States should assess the need to reconsider or withdraw their national authorisations on these crops in order to ensure compliance with the future MRLs. It is also noted that depending on the MRL proposal retained for potatoes, tomatoes, lettuce and wine grapes, some of the data gaps identified for these crops may need to be reconsidered.

Finally, it is noted that some MRLs were also proposed to accommodate with the inherent content of copper in certain plant and animal commodities. These MRLs would not be helpful to enforce misuses but risk managers may have interest to set these MRLs as it could help to monitor the consumer exposure to copper. Therefore, a risk management decision should still be taken on whether these MRLs should be taken into account and on the period of their applicability. In any case, these MRLs are proposed on a tentative basis as they may need to be updated regularly in view of the future monitoring results.

Table 8: Summary table

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
Enforcement residue definition (existing): copper compounds (copper) **Enforcement residue definition (proposed):** total copper				
110010	Grapefruits	20	15	Further consideration needed[a]
110020	Oranges	20	15	Further consideration needed[a]
110030	Lemons	20	15	Further consideration needed[a]
110040	Limes	20	15	Further consideration needed[a]
110050	Mandarins	20	15	Further consideration needed[a]
120010	Almonds	30	40	Further consideration needed[a]
120020	Brazil nuts	30	40	Further consideration needed[a]
120030	Cashew nuts	30	40	Further consideration needed[b]
120040	Chestnuts	30	40	Further consideration needed[a]
120050	Coconuts	30	5	Further consideration needed[b]
120060	Hazelnuts/cobnuts	30	40	Further consideration needed[a]
120070	Macadamias	30	40	Further consideration needed[a]
120080	Pecans	30	40	Further consideration needed[a]
120090	Pine nut kernels	30	40	Further consideration needed[b]
120100	Pistachios	30	40	Further consideration needed[a]
120110	Walnuts	30	40	Further consideration needed[a]
130010	Apples	5	6	Recommended[c]
130020	Pears	5	6	Recommended[c]
130030	Quinces	5	6	Recommended[c]
130040	Medlars	5	6	Recommended[c]
130050	Loquats/Japanese medlars	5	6	Recommended[c]
140010	Apricots	5	3	Recommended[c]
140020	Cherries (sweet)	5	10	Recommended[c]
140030	Peaches	5	8	Recommended[c]
140040	Plums	5	4	Further consideration needed[a]
151010	Table grapes	50	100	Recommended[c]
151020	Wine grapes	50	100/2	Further consideration needed[d]
152000	Strawberries	5	15	Recommended[c]
153010	Blackberries	5	5*	Recommended[c]
153020	Dewberries	5	5*	Recommended[c]
153030	Raspberries (red and yellow)	5	5*	Recommended[c]
154010	Blueberries	5	5*	Recommended[c]
154020	Cranberries	5	5*	Recommended[c]
154030	Currants (black, red and white)	5	5*	Recommended[c]
154040	Gooseberries (green, red and yellow)	5	5*	Recommended[c]
154050	Rose hips	5	5*	Recommended[c]
154060	Mulberries (black and white)	5	5*	Recommended[c]
154070	Azaroles/Mediterranean medlars	5	5*	Recommended[c]
154080	Elderberries	5	5*	Recommended[c]
161010	Dates	20	2*	Further consideration needed[e]
161020	Figs	20	30	Further consideration needed[f]
161030	Table olives	30	20	Further consideration needed[a]
161040	Kumquats	20	2*	Further consideration needed[e]
161050	Carambolas	20	2*	Further consideration needed[e]
161060	Kaki/Japanese persimmons	20	2*	Further consideration needed[e]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
161070	Jambuls/jambolans	20	10	Recommended[c]
162010	Kiwi fruits (green, red, yellow)	20	30	Further consideration needed[a]
162020	Litchis/lychees	20	2*	Further consideration needed[e]
162030	Passion fruits/maracujas	20	4	Further consideration needed[f]
162040	Prickly pears/cactus fruits	20	2*	Further consideration needed[e]
162050	Star apples/cainitos	20	2*	Further consideration needed[e]
162060	American persimmons/Virginia kaki	20	2*	Further consideration needed[e]
163010	Avocados	20	6	Further consideration needed[e]
163020	Bananas	20	6	Further consideration needed[e]
163030	Mangoes	20	6	Further consideration needed[f]
163040	Papayas	20	6	Further consideration needed[e]
163050	Granate apples/pomegranates	20	6	Further consideration needed[e]
163060	Cherimoyas	20	6	Further consideration needed[f]
163070	Guavas	20	6	Further consideration needed[e]
163080	Pineapples	20	6	Further consideration needed[e]
163090	Breadfruits	20	6	Further consideration needed[e]
163100	Durians	20	6	Further consideration needed[e]
163110	Soursops/guanabanas	20	6	Further consideration needed[e]
211000	Potatoes	5	7/4	Further consideration needed [d]
212010	Cassava roots/manioc	5	4	Recommended[c]
212020	Sweet potatoes	5	4	Recommended[c]
212030	Yams	5	4	Recommended[c]
212040	Arrowroots	5	4	Recommended[c]
213010	Beetroots	5	3	Further consideration needed[a]
213020	Carrots	5	3	Further consideration needed[a]
213030	Celeriacs/turnip rooted celeries	5	3	Further consideration needed[a]
213040	Horseradishes	5	3	Further consideration needed[a]
213050	Jerusalem artichokes	5	3	Further consideration needed[a]
213060	Parsnips	5	3	Further consideration needed[a]
213070	Parsley roots/Hamburg roots parsley	5	3	Further consideration needed[a]
213080	Radishes	5	3	Further consideration needed[a]
213090	Salsifies	5	3	Further consideration needed[a]
213100	Swedes/rutabagas	5	3	Further consideration needed[a]
213110	Turnips	5	3	Further consideration needed[a]
220010	Garlic	5	4	Further consideration needed[b]
220020	Onions	5	2*	Recommended[c]
220030	Shallots	5	2*	Recommended[c]
220040	Spring onions/green onions and Welsh onions	5	70	Recommended[c]
231010	Tomatoes	5	10/2	Further consideration needed[d]
231020	Sweet peppers/bell peppers	5	20	Recommended[c]
231030	Aubergines/eggplants	5	10	Recommended[c]
231040	Okra/lady's fingers	5	2*	Further consideration needed[e]
232010	Cucumbers	5	5	Recommended[c]
232020	Gherkins	5	5	Recommended[c]
232030	Courgettes	5	5	Recommended[c]
233010	Melons	5	10	Further consideration needed[a]
233020	Pumpkins	5	10	Further consideration needed[a]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
233030	Watermelons	5	10	Further consideration needed[a]
234000	Sweet corn	10	2*	Further consideration needed[e]
241010	Broccoli	20	5	Recommended[c]
241020	Cauliflowers	20	5	Recommended[c]
242010	Brussels sprouts	20	2*	Further consideration needed[e]
242020	Head cabbages	20	2*	Further consideration needed[f]
243010	Chinese cabbages/pe-tsai	20	3	Further consideration needed[e]
243020	Kales	20	3	Further consideration needed[e]
244000	Kohlrabies	20	3	Further consideration needed[e]
251010	Lamb's lettuces/corn salads	100	150	Recommended[c]
251020	Lettuces	100	150/4	Further consideration needed[d]
251030	Escaroles/broad-leaved endives	100	150	Recommended[c]
251040	Cresses and other sprouts and shoots	100	150	Recommended[c]
251050	Land cresses	100	150	Recommended[c]
251060	Roman rocket/rucola	100	150	Recommended[c]
251070	Red mustards	100	150	Recommended[c]
251080	Baby leaf crops (including brassica species)	100	150	Recommended[c]
252010	Spinaches	20	150	Recommended[c]
252020	Purslanes	20	150	Recommended[c]
252030	Chards/beet leaves	20	150	Recommended[c]
253000	Grape leaves and similar species	20	5	Further consideration needed[e]
254000	Watercresses	20	150	Further consideration needed[a]
255000	Witloofs/Belgian endives	20	2*	Further consideration needed[e]
256010	Chervil	20	150	Recommended[c]
256020	Chives	20	150	Recommended[c]
256030	Celery leaves	50	150	Recommended[c]
256040	Parsley	20	150	Recommended[c]
256050	Sage	20	150	Recommended[c]
256060	Rosemary	20	150	Recommended[c]
256070	Thyme	20	150	Recommended[c]
256080	Basil and edible flowers	20	150	Recommended[c]
256090	Laurel/bay leave	20	150	Recommended[c]
256100	Tarragon	20	150	Recommended[c]
260010	Beans (with pods)	20	10	Further consideration needed[a]
260020	Beans (without pods)	20	4	Further consideration needed[f]
260030	Peas (with pods)	20	10	Further consideration needed[a]
260040	Peas (without pods)	20	7	Further consideration needed[a]
260050	Lentils (fresh)	20	4	Further consideration needed[f]
270010	Asparagus	5	7	Further consideration needed[f]
270020	Cardoons	20	7	Further consideration needed[f]
270030	Celeries	20	7	Further consideration needed[e]
270040	Florence fennels	20	7	Further consideration needed[e]
270050	Globe artichokes	20	30	Recommended[c]
270060	Leeks	20	70	Recommended[c]
270070	Rhubarbs	20	7	Further consideration needed[e]
270080	Bamboo shoots	20	7	Further consideration needed[e]
270090	Palm hearts	20	7	Further consideration needed[e]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
280010	Cultivated fungi	20	6	Further consideration needed[e]
280020	Wild fungi	20	6	Further consideration needed[e]
290000	Algae and prokaryotes organisms	20	3	Further consideration needed[e]
300010	Beans (dry)	20	15	Further consideration needed[f]
300020	Lentils (dry)	20	15	Further consideration needed[f]
300030	Peas (dry)	20	15	Further consideration needed[e]
300040	Lupins/lupini beans (dry)	20	15	Further consideration needed[e]
401010	Linseeds	30	30	Further consideration needed[e]
401020	Peanuts/groundnuts	30	30	Further consideration needed[e]
401030	Poppy seeds	30	30	Further consideration needed[e]
401040	Sesame seeds	30	30	Further consideration needed[e]
401050	Sunflower seeds	40	30	Further consideration needed[g]
401060	Rapeseeds/canola seeds	30	30	Further consideration needed[f]
401070	Soya beans	40	30	Further consideration needed[g]
401080	Mustard seeds	30	30	Further consideration needed[e]
401090	Cotton seeds	30	30	Further consideration needed[e]
401100	Pumpkin seeds	30	30	Further consideration needed[e]
401110	Safflower seeds	30	30	Further consideration needed[e]
401120	Borage seeds	30	30	Further consideration needed[e]
401130	Gold of pleasure seeds	30	30	Further consideration needed[e]
401140	Hemp seeds	30	30	Further consideration needed[e]
401150	Castor beans	30	30	Further consideration needed[e]
402010	Olives for oil production	30	20	Further consideration needed[a]
402020	Oil palms kernels	30	30	Further consideration needed[h]
402030	Oil palms fruits	30	30	Further consideration needed[h]
402040	Kapok	30	30	Further consideration needed[h]
500010	Barley grains	10	10	Further consideration needed[e]
500020	Buckwheat and other pseudo-cereal grains	10	15	Further consideration needed[e]
500030	Maize/corn grains	10	10	Further consideration needed[i]
500040	Common millet/proso millet grains	10	10	Further consideration needed[e]
500050	Oat grains	10	10	Further consideration needed[e]
500060	Rice grains	10	10	Further consideration needed[e]
500070	Rye grains	10	10	Further consideration needed[e]
500080	Sorghum grains	10	10	Further consideration needed[e]
500090	Wheat grains	10	10	Further consideration needed[i]
610000	Teas	40	30	Further consideration needed[e]
620000	Coffee beans	50	20	Further consideration needed[e]
631000	Herbal infusions from flowers	100	5*	Further consideration needed[e]
632000	Herbal infusions from leaves and herbs	100	5*	Further consideration needed[e]
633000	Herbal infusions from roots	100	5*	Further consideration needed[e]
640000	Cocoa beans	50	5*	Further consideration needed[e]
650000	Carobs/Saint John's breads	20	6	Further consideration needed[e]
700000	Hops	1000	1500	Further consideration needed[a]
810000	Seed spices	40	15	Further consideration needed[e]
820000	Fruit spices	40	15	Further consideration needed[e]
830000	Bark spices	40	5*	Further consideration needed[e]
840000	Root and rhizome spices	40	5*	Further consideration needed[e]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
850000	Bud spices	40	5*	Further consideration needed[e]
860000	Flower pistil spices	40	5*	Further consideration needed[e]
870000	Aril spices	40	30	Further consideration needed[e]
900010	Sugar beet roots	5	2*	Further consideration needed[f]
900020	Sugar canes	5	2*	Further consideration needed[e]
900030	Chicory roots	5	2*	Further consideration needed[e]
1011010	Swine muscle	5	7	Further consideration needed[j]
1011020	Swine fat tissue	5	2	Further consideration needed[j]
1011030	Swine liver	30	90	Further consideration needed[j]
1011040	Swine kidney	30	10	Further consideration needed[j]
1012010	Bovine muscle	5	3	Further consideration needed[j]
1012020	Bovine fat tissue	5	0.6*	Further consideration needed[j]
1012030	Bovine liver	30	400	Further consideration needed[k]
1012040	Bovine kidney	30	10	Further consideration needed[j]
1013010	Sheep muscle	5	3	Further consideration needed[j]
1013020	Sheep fat tissue	5	0.6*	Further consideration needed[j]
1013030	Sheep liver	30	150	Further consideration needed[j]
1013040	Sheep kidney	30	6	Further consideration needed[j]
1014010	Goat muscle	5	3	Further consideration needed[j]
1014020	Goat fat tissue	5	0.6*	Further consideration needed[j]
1014030	Goat liver	30	150	Further consideration needed[j]
1014040	Goat kidney	30	6	Further consideration needed[j]
1015010	Equine muscle	5	3	Further consideration needed[j]
1015020	Equine fat tissue	5	0.6*	Further consideration needed[j]
1015030	Equine liver	30	400	Further consideration needed[j]
1015040	Equine kidney	30	10	Further consideration needed[j]
1016010	Poultry muscle	5	7	Further consideration needed[j]
1016020	Poultry fat tissue	5	1*	Further consideration needed[j]
1016030	Poultry liver	30	80	Further consideration needed[j]
1020010	Cattle milk	2	1*	Further consideration needed[j]
1020020	Sheep milk	2	1*	Further consideration needed[j]
1020030	Goat milk	2	1*	Further consideration needed[j]
1020040	Horse milk	2	1*	Further consideration needed[j]
1030000	Birds eggs	2	1*	Further consideration needed[j]
1070000	Other terrestrial animal products	0.01*	3	Further consideration needed[j]

MRL: maximum residue level.
*Indicates that the MRL is set at the limit of quantification.
(a): Tentative MRL is derived from a GAP evaluated at EU level, which is not fully supported by data but for which no risk to consumers was identified; no CXL is available (case A2 in the decision tree reported in Appendix E.1).
(b): Tentative MRL is derived from monitoring data and/or background levels; GAP evaluated as EU level is expected to lead to lower residues compared to endogenous levels; no risk to consumers was identified; no CXL is available (case B in the decision tree reported in Appendix E.1).
(c): MRL is derived from a GAP evaluated at EU level, which is fully supported by data and for which no risk to consumers is identified; no CXL is available (case A1 in the decision tree reported in Appendix E.1).
(d): GAP evaluated at EU level is fully supported by data but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available. A lower MRL derived from a fall-back GAP or from the background levels may be considered (equivalent to cases A1/A2 or D1 in the decision tree reported in Appendix E.1).
(e): There are no relevant authorisations or import tolerances reported at EU level but tentative MRL is derived from background levels, for which no risk to consumers is identified; no CXL is available (cases D1 and D2 in the decision tree reported in Appendix E.1).

(f): Tentative MRL is derived from monitoring data and/or background levels; GAP evaluated at EU level is not supported by data; no risk to consumers was identified; no CXL is available (case C in the decision tree reported in Appendix E.1).
(g): GAP evaluated at EU level is not supported by data; a tentative MRL can derived from monitoring data and/or background levels but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available (equivalent to case C in the decision tree reported in Appendix E.1).
(h): There are no relevant authorisations or import tolerances reported at EU level but no risk to consumers was identified for the existing EU MRL; no CXL is available (case E in the decision tree reported in Appendix E.1).
(i): There are no relevant authorisations or import tolerances reported at EU level; tentative MRL can be derived from background levels but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available (equivalent to cases D1/D2 in the decision tree reported in Appendix E.1).
(j): Tentative MRL is derived from monitoring data and/or background levels for all food commodities of animal origin; no risk to consumers was identified for this commodity; no CXL is available (case F in the decision tree reported in Appendix E.2).
(k): Tentative MRL can be derived from monitoring data and/or background levels for all food commodities of animal origin but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available (equivalent to case F in the decision tree reported in Appendix E.2).

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Abbreviations

AAS	atomic Absorption Spectrometry
ADI	acceptable daily intake
a.i.	active ingredient
ARfD	acute reference dose
a.s.	active substance
BBCH	growth stages of mono- and dicotyledonous plants
bw	body weight
cGAP	critical GAP
CXL	codex maximum residue limit
DAT	days after treatment
DB	dietary burden
DM	dry matter
DS	powder for dry seed treatment
DT_{90}	period required for 90% dissipation (define method of estimation)
EMS	evaluating Member State
FAO	Food and Agriculture Organization of the United Nations
FEEDAP	EFSA Scientific Panel on Additives and Products or Substances used in Animal Feed
GAP	Good Agricultural Practice
HR	highest residue
IEDI	international estimated daily intake
IESTI	international estimated short-term intake
ILV	independent laboratory validation
ISO	International Organisation for Standardization
IUPAC	International Union of Pure and Applied Chemistry
LOQ	limit of quantification
MRL	maximum residue level
MS	Member States
NEU	northern European Union
NDA	EFSA Panel on Dietetic Products, Nutrition and Allergies
OECD	Organisation for Economic Co-operation and Development
PBI	plant-back interval
PF	processing factor
PHI	preharvest interval
PRIMo	(EFSA) Pesticide Residues Intake Model
PROFile	(EFSA) Pesticide Residues Overview File
RA	risk assessment
RAC	raw agricultural commodity
RD	residue definition
RMS	rapporteur Member State
SANCO	Directorate-General for Health and Consumers
SC	suspension concentrate
SEU	southern European Union
ST	water-soluble tablet

STMR	supervised trials median residue
WG	water-dispersible granule
WHO	World Health Organization
WP	wettable powder

Appendix A – Summary of authorised uses considered for the review of MRL

A.1. Authorised uses in northern outdoor EU

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Almonds	HU	F	Bacteria, fungus	WG	500 g/kg	Foliar treatment – spraying	–	3	7	–	–	1.5 kg a.i./ha	21	–
Chestnuts	HU	F	Bacteria, fungus	WG	500 g/kg	Foliar treatment – spraying	–	3	7	–	–	1.5 kg a.i./ha	21	–
Hazelnuts	HU	F	Bacteria, fungus	WG	500 g/kg	Foliar treatment – spraying	–	3	7	–	–	1.5 kg a.i./ha	21	–
Walnuts	DE	F	*Xanthomonas juglandis*	SC	200 g/L	Foliar treatment – spraying	1–87	3	7	–	–	1.05 kg a.i./ha	14	–
Apples	DE	F	*Venturia* spp.	SC	200 g/L	Foliar treatment – spraying	–	8	14	–	–	0.375 kg a.i./ha	14	–
Pears	DE	F	*Venturia* spp.	SC	200 g/L	Foliar treatment – spraying	–	8	14	–	–	0.375 kg a.i./ha	14	–
Quinces	DE	F	*Venturia* spp.	SC	200 g/L	Foliar treatment – spraying	–	8	14	–	–	0.375 kg a.i./ha	14	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Apricots	FR, HU, DE	F	*Taphrina*, *Monilia*, *Coryneum*, *Pseudomonas*, *Stigmina carpophila*, *Blumeriella*, Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	95–53	3	14	–	–	1.2 kg a.i./ha	n.a.	Pre-flowering: no treatment between BBCH 53 and harvest.
Cherries	FR	F	Bacteria	–	–	Foliar treatment – spraying	73–85	3	14	–	–	0.8 kg a.i./ha	21	–
Peaches	HU	F	Bacteria, fungus	WG	350 g/kg	Foliar treatment – spraying	85	3	7	–	–	1 kg a.i./ha	21	–
Plums	CZ	F	*Taphrina pruni*	WP	840 g/kg	Foliar treatment – spraying	1–7	–	–	–	–	3 kg a.i./ha	n.a.	Pre-flowering
Table grapes	FR	F	*Bacteria*, *Plasmopara viticola*, *Elsinoe ampelina*, Anthracnose	–	–	Foliar treatment – spraying	15–91	4	7	–	–	2 kg a.i./ha	21	BBCH 15–81 & 91 CZ GAP with PHI 7 is not supported by data.
Wine grapes	FR, AT	F	*Bacteria*, *Plasmopara viticola*, *Elsinoe ampelina*, Anthracnose	–	–	Foliar treatment – spraying	15–91	4	7	–	–	2 kg a.i./ha	21	BBCH 15–81 & 91 CZ GAP with application rate 25 kg as/ha; PHI 35 is not supported by data

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Strawberries	FR, HU	F	*Mycosphaerella*, Bacteria, *Colletotrichum*	–	–	Foliar treatment – spraying	13–85	4	7	–	–	0.8 kg a.i./ha	3	–
Blackberries	FR, HU, DE	F	*Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Dewberries	FR, HU	F	*Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Raspberries	FR, HU, DE	F	*Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Blueberries	FR, HU, DE	F	*Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Cranberries	FR, HU, DE	F	*Pseudomonas*, *Stigmina carpophila*, *Blumeriella*, Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Currants	FR, HU, DE	F	*Pseudomonas*, *Stigmina carpophila*, *Blumeriella*, Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Gooseberries	FR, HU, DE	F	*Pseudomonas*, *Stigmina carpophila*, *Blumeriella*, Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Rose hips	FR, DE	F	*Pseudomonas*, *Stigmina carpophila*, *Blumeriella*, Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Mulberries	FR, DE	F	*Pseudomonas*, *Stigmina carpophila*, *Blumeriella*, Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Azaroles	FR, DE	F	*Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre-flowering
Elderberries	FR, HU, DE	F	*Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	–	–	Foliar treatment – spraying	13–57	2	7	–	–	1.2 kg a.i./ha	n.a.	Pre–flowering
Jambuls	FR	F	Bacteria	–	–	Foliar treatment – spraying	73–85	3	14	–	–	0.8 kg a.i./ha	21	–
Potatoes	DE	F	*Phytophthora infestans*	WP	537 g/kg	Foliar treatment – spraying	37–91	4	7	–	–	0.7 kg a.i./ha	14	–
Beetroots	FR	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Carrots	FR, HU	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Celeriacs	FR, HU, DE	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Horseradishes	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Jerusalem artichokes	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Parsnips	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Parsley roots	FR, HU	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Radishes	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Salsifies	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Swedes	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Turnips	FR	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Garlic	FR	F	*Alternaria*, Anthracnose, Bacteria, *Peronospora destructor, Stemphylium*	–	–	Foliar treatment – spraying	14–47	4	7	–	–	0.8 kg a.i./ha	3	–
Onions	FR	F	*Alternaria*, Anthracnose, Bacteria, *Peronospora destructor, Stemphylium*	–	–	Foliar treatment – spraying	14–47	4	7	–	–	0.8 kg a.i./ha	3	–
Shallots	FR	F	*Alternaria*, Anthracnose, Bacteria, *Peronospora destructor, Stemphylium*	–	–	Foliar treatment – spraying	14–47	4	7	–	–	0.8 kg a.i./ha	3	–
Tomatoes	FR, HU	F	*Phytophthora spp., Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	6	7	–	–	1.25 kg a.i./ha	3	–
Sweet peppers	FR	F	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	4	7	–	–	0.8 kg a.i./ha	3	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Aubergines	FR, HU	F	*Phytophthora* spp., *Alternaria*, *Colletotrichum*, *Pseudomonas*, *Xanthomonas*	–	–	Foliar treatment – spraying	15–89	6	7	–	–	1.25 kg a.i./ha	3	–
Cucumbers	FR	F	*Peronospora cubensis*, *Alternaria*, *Colletotrichum*, Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Gherkins	FR	F	*Peronospora cubensis*, *Alternaria*, *Colletotrichum*, Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Courgettes	FR, DE	F	*Peronospora cubensis*, *Alternaria*, *Colletotrichum*, Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Melons	HU	F	Bacteria, fungus	WP	500 g/kg	Foliar treatment – spraying	–	2–3	10	–	–	1.125 kg a.i./ha	21	–
Pumpkins	HU	F	Bacteria, fungus	WP	500 g/kg	Foliar treatment – spraying	–	2–3	10	–	–	1.125 kg a.i./ha	21	–
Watermelons	HU	F	Bacteria, fungus	WP	500 g/kg	Foliar treatment – spraying	–	2–3	10	–	–	1.125 kg a.i./ha	21	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Head cabbages	DE	F	*Alternaria brassicae*	SC	200 g/L	Foliar treatment – spraying	13	4	7	–	–	0.5 kg a.i./ha	7	–
Lamb's lettuces	DE, FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Lettuces	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Escaroles	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Cresses	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Land cresses	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Roman rocket	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Red mustards	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Baby leaf crops	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Spinaches	FR, HU	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Purslanes	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chards	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chervil	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chives	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Celery leaves	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Parsley	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Sage	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Rosemary	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Thyme	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Basil	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Laurel	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Tarragon	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Beans (with pods)	FR	F	*Colletotrichum, Peronospora, Septoria, Marsonina,* bacterial diseases	–	–	Foliar treatment – spraying	61–78	4	7	–	–	0.8 kg a.i./ha	3	–
Peas (with pods)	FR	F	*Colletotrichum, Peronospora, Septoria, Marsonina,* bacterial diseases	–	–	Foliar treatment – spraying	61–78	4	7	–	–	0.8 kg a.i./ha	3	–
Peas (without pods)	FR	F	*Colletotrichum, Peronospora, Septoria, Marsonina,* bacterial diseases	–	–	Foliar treatment – spraying	61–78	4	7	–	–	0.8 kg a.i./ha	3	–
Hops	CZ	F	*Pseudoperonospora humuli*	WP	840 g/kg	Foliar treatment – spraying	–	5	7	–	–	3.8 kg a.i./ha	7	–
Sugar beets	FR, HU	F	*Cercospora*	–	–	Foliar treatment – spraying	39–49	4	14	–	–	1.2 kg a.i./ha	14	–

NEU: northern European Union; SEU: southern European Union; MS: Member State; MRL: maximum residue level; a.s.: active substance; a.i.: active ingredient; WG: water-dispersible granule; SC: suspension concentrate; GAP: Good Agricultural Practice; WP: wettable powder.
(a): Outdoor or field use (F), greenhouse application (G) or indoor application (I).
(b): CropLife International Technical Monograph no 2, 6th Edition. Revised May 2008. Catalogue of pesticide.
(c): Growth stage range from first to last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including, where relevant, information on season at time of application.
(d): PHI: minimum pre-harvest interval.

A.2. Authorised uses in southern outdoor EU

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days) [d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Grapefruits	FR	F	*Phytophthora citricola, Pseudomonas syringae, Alternaria citricola*	–	–	Foliar treatment – spraying	15–89	3	30	–	–	1.25 kg a.i./ha	14	Other GAPs reported by EL (3 × 2.4 kg as/ha; PHI 21 days) and PT (5 × 1.1 kg as/ha; PHI 14 days) but are not supported by data
Oranges	FR	F	*Phytophthora citricola, Pseudomonas syringae, Alternaria citricola*	–	–	Foliar treatment – spraying	15–89	3	30	–	–	1.25 kg a.i./ha	14	See grapefruits
Lemons	FR	F	*Phytophthora citricola, Pseudomonas syringae, Alternaria citricola*	–	–	Foliar treatment – spraying	15–89	3	30	–	–	1.25 kg a.i./ha	14	See grapefruits
Limes	FR	F	*Phytophthora citricola, Pseudomonas syringae, Alternaria citricola*	–	–	Foliar treatment – spraying	15–89	3	30	–	–	1.25 kg a.i./ha	14	See grapefruits

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Mandarins	FR	F	*Phytophthora citricola, Pseudomonas syringae, Alternaria citricola*	–	–	Foliar treatment – spraying	15–89	3	30	–	–	1.25 kg a.i./ha	14	See grapefruits
Almonds	EL, FR	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97
Brazil nuts	FR	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97
Cashew nuts	FR	F		–	–	Foliar treatment – spraying	3–55	3	14	–	–	2 kg a.i./ha	n.a.	pre–flowering
Chestnuts	FR	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97
Coconuts	FR	F		–	–	Foliar treatment – spraying	3–55	3	14	–	–	2 kg a.i./ha	n.a.	Pre-flowering
Hazelnuts	FR, PT	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Macadamias	FR	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97
Pecans	FR	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97
Pine nut kernels	FR	F		–	–	Foliar treatment – spraying	3–55	3	14	–	–	2 kg a.i./ha	n.a.	Pre–flowering
Pistachios	EL, IT	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	ST	19% (w/w)	Foliar treatment – spraying	51–97	3	14	–	–	0.75 kg a.i./ha	14	BBCH 51–79 & 91–97
Walnuts	FR	F	*Alternaria*, Anthracnose, Bacteria, *Cytospora*	–	–	Foliar treatment – spraying	51–97	3	14	–	–	1.2 kg a.i./ha	14	BBCH 51–79 & 91–97
Apples	FR, PT	F	*Venturia inaequalis, Erwinia, Pseudomonas,* other bacteriosis	–	–	Foliar treatment – spraying	59–89	3	14	–	–	0.8 kg a.i./ha	21	–
Pears	FR, PT	F	*Venturia inaequalis, Erwinia, Pseudomonas,* other bacteriosis	–	–	Foliar treatment – spraying	59–89	3	14	–	–	0.8 kg a.i./ha	21	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Quinces	FR, PT	F	*Venturia inaequalis, Erwinia, Pseudomonas,* other bacteriosis	–	–	Foliar treatment – spraying	59–89	3	14	–	–	0.8 kg a.i./ha	21	–
Medlars	FR, PT	F	*Venturia inaequalis, Erwinia, Pseudomonas,* other bacteriosis	–	–	Foliar treatment – spraying	59–89	3	14	–	–	0.8 kg a.i./ha	21	–
Loquats	FR, PT	F	*Venturia inaequalis, Erwinia, Pseudomonas,* other bacteriosis	–	–	Foliar treatment – spraying	59–89	3	14	–	–	0.8 kg a.i./ha	21	–
Apricots	IT, EL	F	*Taphrina, Monilia, Coryneum, Pseudomonas, Stigmina carpophila, Blumeriella,* Bacteria, *Leucostoma*	ST	19% (w/w)	Foliar treatment – spraying	73–85	3 to 5	14	–	–	0.5 kg a.i./ha	21	–
Cherries	FR	F	Bacteria	–	–	Foliar treatment – spraying	73–85	3	14	–	–	0.8 kg a.i./ha	21	–
Peaches	FR	F	Bacteria	–	–	Foliar treatment – spraying	73–85	5	14	–	–	0.8 kg a.i./ha	21	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Plums	FR	F	Bacteria	–	–	Foliar treatment – spraying	73–85	3	14	–	–	0.8 kg a.i./ha	21	–
Table grapes	FR	F	Bacteria, *Plasmopara viticola, Elsinoe ampelina,* Anthracnose	–	–	Foliar treatment – spraying	15–91	4	7	–	–	2 kg a.i./ha	21	BBCH 15–81 & 91
Wine grapes	FR	F	Bacteria, *Plasmopara viticola, Elsinoe ampelina,* Anthracnose	–	–	Foliar treatment – spraying	15–91	4	7	–	–	2 kg a.i./ha	21	BBCH 15–81 & 91
Strawberries	FR, PT	F	*Mycosphaerella,* Bacteria, *Colletotrichum*	–	–	Foliar treatment – spraying	13–85	4	7	–	–	0.8 kg a.i./ha	3	–
Blueberries	PT	F	*Colletotrichum gloesosporioides*	–	–	Foliar treatment – spraying		3	7	–	–	5 kg a.i./ha	7	–
Figs	ES, EL	F	*Monilia,* Bacteria, *Clasterosporium, Venturia* sp.	SC	520 g/L	Foliar treatment – spraying		3	10	–	–	1.56 kg a.i./ha	15	–
Table olives	ES	F	*Cycloconium oleaginum Gloeosporium olivarum*	WP	300 g/kg	Foliar treatment – spraying	31–85	2		–	–	2.25 kg a.i./ha	15	First in spring since beginning of flowering (BBCH 31–64) Second after summer (BBCH 74–85)

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Jambuls	FR	F	Bacteria	–	–	Foliar treatment – spraying	73–85	3	14	–	–	0.8 kg a.i./ha	21	–
Kiwi fruits	FR, EL	F	Bacterial, *Pseudomonas syringae pv. Actinidiae*	–	–	Foliar treatment – spraying	–	10	10	–	–	0.5 kg a.i./ha	15	BBCH: Autumn – winter leaf fall
Passionfruits	PT	F	*Colletotrichum gloesosporioides*	–	–	Foliar treatment – spraying	–	3	7	–	–	5 kg a.i./ha	7	–
Mangoes	PT	F	*Colletotrichum gloesosporioides*	–	–	Foliar treatment – spraying	–	3	7	–	–	5 kg a.i./ha	7	–
Cherimoyas	PT	F	*Colletotrichum gloesosporioides*	–	–	Foliar treatment – spraying		3	7	–	–	5 kg a.i./ha	7	–
Potatoes	PT, FR	F	*Bacteriosis, Phytophthora infestans, Alternaria, Colletotrichum*	–	–	Foliar treatment – spraying	15–85	5	7	–	–	1 kg a.i./ha	14	–
Cassava roots	FR	F	*Bacteriosis, Phytophthora infestans, Alternaria, Colletotrichum*	–	–	Foliar treatment – spraying	15–85	5	7	–	–	1 kg a.i./ha	14	–
Sweet potatoes	FR	F	*Bacteriosis, Phytophthora infestans, Alternaria, Colletotrichum*	–	–	Foliar treatment – spraying	15–85	5	7	–	–	1 kg a.i./ha	14	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Yams	FR	F	*Bacteriosis, Phytophthora infestans, Alternaria, Colletotrichum*	–	–	Foliar treatment – spraying	15–85	5	7	–	–	1 kg a.i./ha	14	–
Arrowroots	FR	F	*Bacteriosis, Phytophthora infestans, Alternaria, Colletotrichum*	–	–	Foliar treatment – spraying	15–85	5	7	–	–	1 kg a.i./ha	14	–
Beetroots	FR	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Carrots	FR, PT	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Celeriacs	FR	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Horseradishes	FR	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Jerusalem artichokes	FR	F	*Alternaria, Cercospora,* bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Parsnips	FR, PT	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Parsley roots	FR, PT	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Radishes	FR, PT	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Salsifies	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Swedes	FR	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Turnips	FR, PT	F	*Alternaria*, *Cercospora*, bacterial diseases	–	–	Foliar treatment – spraying	15–47	4	7	–	–	1.2 kg a.i./ha	14	–
Garlic	FR, PT	F	*Alternaria*, Anthracnose, Bacteria, *Peronospora destructor*, *Stemphylium*	–	–	Foliar treatment – spraying	14–47	4	7	–	–	0.8 kg a.i./ha	3	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Onions	FR, PT	F	*Alternaria*, Anthracnose, Bacteria, *Peronospora destructor, Stemphylium*	–	–	Foliar treatment – spraying	14–47	4	7	–	–	0.8 kg a.i./ha	3	–
Shallots	FR	F	*Alternaria*, Anthracnose, Bacteria, *Peronospora destructor, Stemphylium*	–	–	Foliar treatment – spraying	14–47	4	7	–	–	0.8 kg a.i./ha	3	–
Spring onions	FR	F	*Bremia* sp., *Ascochyta,* bacterial diseases	–	–	Foliar treatment – spraying	17–85	5	7	–	–	0.8 kg a.i./ha	3	–
Tomatoes	FR	F	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	6	7	–	–	1.25 kg a.i./ha	3	–
Sweet peppers	FR, PT	F	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	4	7	–	–	0.8 kg a.i./ha	3	–
Aubergines	FR	F	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	6	7	–	–	1.25 kg a.i./ha	3	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Cucumbers	FR, PT	F	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Gherkins	FR	F	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Courgettes	FR, PT	F	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Melons	FR, PT	F	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	4	7	–	–	0.9 kg a.i./ha	7	–
Pumpkins	FR, PT	F	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	4	7	–	–	0.9 kg a.i./ha	7	–
Watermelons	FR, PT	F	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	4	7	–	–	0.9 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Broccoli	FR, PT	F	*Phytophthora brassicae,* Bacteria	–	–	Foliar treatment – spraying	41–59	4	7	–	–	0.8 kg a.i./ha	14	–
Cauliflowers	FR, PT	F	*Phytophthora brassicae,* Bacteria	–	–	Foliar treatment – spraying	41–59	4	7	–	–	0.8 kg a.i./ha	14	–
Lamb's lettuces	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Lettuces	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Escaroles	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Cresses	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Land cresses	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Roman rocket	FR	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Red mustards	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Baby leaf crops	FR, PT	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Spinaches	FR, PT	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Purslanes	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chards	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Watercresses	PT	F	Several diseases	–	–	Foliar treatment – spraying		2	7	–	–	1 kg a.i./ha	7	–
Chervil	FR	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chives	FR, PT	F	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Celery leaves	FR, PT, IT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Parsley	FR, PT, IT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Sage	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Rosemary	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Thyme	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Basil	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Laurel	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Tarragon	FR, PT	F	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Beans (with pods)	FR, PT	F	*Colletotrichum, Peronospora, Septoria, Marsonina,* bacterial diseases	–	–	Foliar treatment – spraying	61–78	4	7	–	–	0.8 kg a.i./ha	3	–
Beans (without pods)	EL	F	*Colletotrichum; Peronospora; Septoria; Marsonina;* bacterial diseases	WG	75 g/kg	Foliar treatment – spraying	11–69	3–5	7	–	–	1 kg a.i./ha	3	–
Peas (with pods)	FR, PT	F	*Colletotrichum, Peronospora, Septoria, Marsonina,* bacterial diseases	–	–	Foliar treatment – spraying	61–78	4	7	–	–	0.8 kg a.i./ha	3	–
Peas (without pods)	FR, PT	F	*Colletotrichum, Peronospora, Septoria, Marsonina,* bacterial diseases	–	–	Foliar treatment – spraying	61–78	4	7	–	–	0.8 kg a.i./ha	3	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Lentils (fresh)	EL	F	*Colletotrichum; Peronospora; Septoria; Marsonina;* bacterial diseases	WG	75 g/kg	Foliar treatment – spraying	11–69	3–5	7	–	–	1 kg a.i./ha	3	–
Asparagus	IT	F	*Bremia* sp.; *Ascochyta*; bacterial diseases	SC	190 g/L	Foliar treatment – spraying	14–51	5	7	–	–	0.76 kg a.i./ha	3	–
Cardoons	IT	F	*Bremia* sp.; *Ascochyta;* bacterial diseases	SC	190 g/L	Foliar treatment – spraying	14–51	5	7	–	–	0.76 kg a.i./ha	3	–
Globe artichokes	FR, PT, IT	F	*Bremia* sp., *Ascochyta,* bacterial diseases	SC	190 g/L	Foliar treatment – spraying	17–55	5	7	–	–	0.8 kg a.i./ha	3	–
Leeks	FR, PT, IT	F	*Bremia* sp., *Ascochyta,* bacterial diseases	SC	190 g/L	Foliar treatment – spraying	17–85	5	7	–	–	0.8 kg a.i./ha	3	–
Beans (dry)	EL	F	*Colletotrichum; Peronospora; Septoria; Marsonina;* bacterial diseases	WG	75 g/kg	Foliar treatment – spraying	11–69	3–5	7	–	–	1 kg a.i./ha	3	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min–max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Lentils (dry)	EL	F	*Colletotrichum; Peronospora; Septoria; Marsonina;* bacterial diseases	WG	75 g/kg	Foliar treatment – spraying	11–69	3–5	7	–	–	1 kg a.i./ha	3	–
Sunflower seeds	IT	F	*Alternaria, Sclerotinia*	WP	350 g/kg	Foliar treatment – spraying	–	1	–	–	–	1.2 kg a.i./ha	20	–
Rapeseeds	IT	F	*Peronospora*	WP	350 g/kg	Foliar treatment – spraying	11–89	1	–	–	–	1.05 kg a.i./ha	20	–
Soyabeans	IT	F	*Alternaria, Sclerotinia*	WP	350 g/kg	Foliar treatment – spraying	–	1	–	–	–	1.2 kg a.i./ha	20	–
Olives for oil production	ES	F	*Cycloconium oleaginum Gloeosporium olivarum*	WP	300 g/kg	Foliar treatment – spraying	31–85	2	–	–	–	2.25 kg a.i./ha	15	First in spring since beginning of flowering (BBCH 31–64) Second after summer (BBCH 74–85)
Sugar beets	FR, IT	F	*Cercospora*	–	–	Foliar treatment – spraying	39–49	4	14	–	–	1.2 kg a.i./ha	14	–

NEU: northern European Union; SEU: southern European Union; MS: Member State; MRL: maximum residue level; a.s.: active substance; a.i.: active ingredient; BBCH: growth stages of mono- and dicotyledonous plants; GAP: Good Agricultural Practice; ST: water-soluble tablet; SC: suspension concentrate; WP: wettable powder; WG: water-dispersible granule.
(a): Outdoor or field use (F), greenhouse application (G) or indoor application (I).
(b): CropLife International Technical Monograph no 2, 6th Edition. Revised May 2008. Catalogue of pesticide.
(c): Growth stage range from first to last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including, where relevant, information on season at time of application.
(d): PHI: minimum pre-harvest interval.

A.3. Indoor authorised uses in EU

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min-max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Strawberries	FR, PT	I	*Mycosphaerella*, Bacteria, *Colletotrichum*	–	–	Foliar treatment – spraying	13–85	4	7	–	–	0.8 kg a.i./ha	3	–
Blackberries	DE	I	*Didymella applanata*, *Gloeosporium necator*, *Rhabdospora ruborum*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Raspberries	DE	I	*Didymella applanata*, *Gloeosporium necator*, *Rhabdospora ruborum*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Blueberries	DE	I	*Drepanopeziza ribis*, *Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Cranberries	DE	I	*Drepanopeziza ribis*, *Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Currants	DE	I	*Drepanopeziza ribis*, *Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Gooseberries	DE	I	*Drepanopeziza ribis*, *Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min-max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Rose hips	DE	I	*Drepanopeziza ribis, Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Mulberries	DE	I	*Drepanopeziza ribis, Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Azaroles	DE	I	*Drepanopeziza ribis, Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Elderberries	DE	I	*Drepanopeziza ribis, Cronartium ribicola*	SC	383 g/L	Foliar treatment – spraying	n.a. to 59	3	5	–	–	1 kg a.i./ha	n.a.	Application after harvest, before flowering
Tomatoes	FR	I	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15 to 89	6	7	–	–	1.25 kg a.i./ha	3	–
Sweet peppers	FR, PT	I	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	4	7	–	–	0.8 kg a.i./ha	3	–
Aubergines	FR	I	*Phytophthora* spp., *Alternaria, Colletotrichum, Pseudomonas, Xanthomonas*	–	–	Foliar treatment – spraying	15–89	6	7	–	–	1.25 kg a.i./ha	3	–
Cucumbers	FR, PT	I	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min-max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Gherkins	FR	I	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Courgettes	FR, PT	I	*Peronospora cubensis, Alternaria, Colletotrichum,* Bacteria	–	–	Foliar treatment – spraying	15–89	5	7	–	–	1 kg a.i./ha	3	–
Melons	PT	I	Several deseases	–	–	Foliar treatment – spraying		4	7	–	–	0.9 kg a.i./ha	7	–
Pumpkins	PT	I	Several deseases	–	–	Foliar treatment – spraying		4	7	–	–	0.9 kg a.i./ha	7	–
Watermelons	PT	I	Several deseases	–	–	Foliar treatment – spraying		4	7	–	–	0.9 kg a.i./ha	7	–
Lamb's lettuces	FR, PT	I	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Lettuces	FR, PT	I	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Escaroles	FR	I	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Cresses	FR	I	*Bremia, Alternaria,* bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min-max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Land cresses	FR	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Roman rocket	FR	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Red mustards	FR	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Baby leaf crops	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Spinaches	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Purslanes	FR	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chards	FR	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chervil	FR	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Chives	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Celery leaves	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

Crop and/or situation	NEU, SEU, MS or country	F G or I[a]	Pests or Group of pests controlled	Preparation		Application				Application rate per treatment			PHI (days)[d]	Remarks
				Type[b]	Conc. a.s.	Method kind	Range of growth stages & season[c]	Number min-max	Interval between application (min)	g a.s./hL min–max	Water L/ha min–max	Rate & Unit		
Parsley	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Sage	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Rosemary	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Thyme	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Basil	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Laurel	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–
Tarragon	FR, PT	I	*Bremia*, *Alternaria*, bacterial diseases	–	–	Foliar treatment – spraying	12–49	4	7	–	–	0.8 kg a.i./ha	7	–

NEU: northern European Union; SEU: southern European Union; MS: Member State; MRL: maximum residue level; a.s.: active substance; a.i.: active ingredient; SC: suspension concentrate.
(a): Outdoor or field use (F), greenhouse application (G) or indoor application (I).
(b): CropLife International Technical Monograph no 2, 6th Edition. Revised May 2008. Catalogue of pesticide.
(c): Growth stage range from first to last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including, where relevant, information on season at time of application.
(d): PHI: minimum pre-harvest interval.

Appendix B – List of end points

B.1. Residues in plants

B.1.1. Nature of residues and methods of analysis in plants

B.1.1.1. Metabolism studies, methods of analysis and residue definitions in plants

Primary crops (available studies)	**Crop groups**	**Crop(s)**	**Application(s)**	**Sampling (DAT)**
	–	–	–	–
	Copper is a monoatomic element and inherently stable. Therefore, it is not expected to metabolise or to form degradation products (EFSA, 2008, 2018a).			
Rotational crops (available studies)	**Crop groups**	**Crop(s)**	**Application(s)**	**PBI (DAT)**
	–	–	–	–
	Copper is a monoatomic element and inherently stable. Therefore, it is not expected to metabolise or to form degradation products (EFSA, 2008, 2018a).			
Processed commodities (hydrolysis study)				
	Conditions		**Investigated?**	
	Pasteurisation (20 min, 90°C, pH 4)		No	
	Baking, brewing and boiling (60 min, 100°C, pH 5)		No	
	Sterilisation (20 min, 120°C, pH 6)		No	
	Copper is a monoatomic element and inherently stable. Therefore, it is not expected to metabolise or to form degradation products (EFSA, 2008, 2018a).			

DAT: days after treatment.

Can a general residue definition be proposed for primary crops?	Yes
Rotational crop and primary crop metabolism similar?	Yes
Residue pattern in processed commodities similar to residue pattern in raw commodities?	Yes
Plant residue definition for monitoring (RD-Mo)	Total copper
Plant residue definition for risk assessment (RD-RA)	Total copper
Conversion factor (monitoring to risk assessment)	not relevant
Methods of analysis for monitoring of residues (analytical technique, crop groups, LOQs)	AAS – Atomic Absorption Spectrometry (France, 2007, 2016): • High water content commodities, LOQ: 2 mg/kg • High acid content commodities, LOQ: 5 mg/kg • ILV not required since determination by AAS are recognised as standard methods of analysis for inorganic elements

LOQ: limit of quantification; ILV: independent laboratory validation.

B.1.1.2. Stability of residues in plants

Plant products (available studies)	**Category**	**Commodity**	**T (°C)**	**Stability (months)**
	Since copper cannot degrade and since the analytical techniques measure total copper content, storage stability studies are not required (EFSA, 2008).			

B.1.2. Magnitude of residues in plants

B.1.2.1. Summary of residues data from the supervised residue trials

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Citrus fruits	SEU	Oranges: < 2.51; < 2.81; < 3.28; < 3.40; 3.78; < 5.77 Mandarins: < 2.50; < 4.08; 4.69; < 5.59; 5.97; < 7.59	Combined dataset on oranges (6) and mandarins (6) compliant with GAP (France, 2016). Extrapolation to other citrus fruits is applicable MRL_{OECD} = 10.7	15 (tentative)[d]	7.59	3.93
Almonds Brazil nuts Chestnuts Hazelnuts/ cobnuts Macadamias Pecans Walnuts	NEU	–	Northern GAPs only authorised on almonds, chestnuts, hazelnuts and walnuts. No data available	–	–	–
	SEU	Almonds: 7.29; 8.97[e]; 10.80[e]; 12.80; 15.20[e] Walnuts: 11.50; 11.90; 12.90	Combined dataset on almonds (5) and walnuts (3) compliant with GAP (France, 2016) Extrapolation to other tree nuts is applicable MRL_{OECD} = 34.3	40 (tentative)[f]	15.2	11.7
Cashew nuts Pine nut kernels Coconuts	SEU	Apples: < 1.5; < 1.5; < 1.5 Pears: < 1.5; < 1.5 Cherries: 0.79; 1.13	Combined data set of trials performed on apples (3), pears (2), cherries (2) (France, 2016), applicable to support pre-flowering uses on cashew nuts, pine nuts and coconuts MRL_{OECD} = 2.48	3 (tentative)[f]	1.5	1.5
Pistachios	SEU	Almonds: 7.29; 8.97[e]; 10.80[e]; 12.80; 15.20[e] Walnuts: 11.50; 11.90; 12.90	Overdosed trials on almonds (5) and walnuts (3) used on tentative basis to support the post-flowering GAP on pistachios (France, 2016) MRL_{OECD} = 34.3	40 (tentative)[f]	15.2	11.7
Apples Pears Quinces Loquat Medlar	NEU	–	Northern GAPs only authorised on apples, pears and quinces. No trials compliant with GAP. Trials reported by DE are performed with lower application rate (DE, 2016)	–	–	–
	SEU	1.10; 1.11; 1.30; 1.35; 1.47[e]; 1.68; 2.90; 3.37	Trials on apples compliant with GAP (France, 2016); extrapolation to other pome fruits is applicable MRL_{OECD} = 5.36	6	3.37	1.41

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Apricots	NEU	Apples: < 1.5; < 1.5; < 1.5 Pears: < 1.5; 1.52 Cherries: 0.67 Plums: 0.52	Combined data set of trials performed on apples (3), pears (2), cherries (1) and plums (1) (France, 2016). Some trials performed on pome fruits are overdosed but show residues < LOQ MRL_{OECD} = 3.03	3	1.52	1.50
	SEU	–	No data available. NB: extrapolation from peaches to apricots is not possible according to the guidance	–	–	–
Cherries (sweet)	NEU	2.08; 3.597; 4.64	Trials compliant with GAP (France, 2016). Three trials are not sufficient to derive a MRL for a major crop MRL_{OECD} = 10.32	–	–	–
	SEU	1.23; 1.61; 3.76; 5.12	Trials compliant with GAP (France, 2016) MRL_{OECD} = 10.3	10	5.12	2.69
Peaches	NEU	–	No data available	–	–	–
	SEU	1.30; 2.10; 2.18; 2.20; 2.50; 3.19; 3.29; 4.10	Trials compliant with GAP (France, 2016) MRL_{OECD} = 7.82	8	4.10	2.35
Plums	NEU	–	No data available. NB: trials with pre-flowering applications on other stone fruits are under dosed compared to this GAP	–	–	–
	SEU	0.74; 0.82[e]; 1.49; 1.69[e]	Trials compliant with GAP (France, 2016) MRL_{OECD} = 3.56	4 (tentative)[d]	1.69	1.15
Table and wine grapes	NEU	4.00; 4.20; 4.30; 6.90; 8.70; 9.90; 12; 45; 56	Trials compliant with GAP for table and wine grapes (France, 2007, 2016) MRL_{OECD} = 94.8	100	56.0	8.70
	SEU	3.7; 6.1; 17	Trials compliant with GAP for table and wine grapes (France, 2016). 3 trials are not sufficient to derive a MRL for a major crop	–	–	–

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Strawberries	NEU	0.51; 0.72; 0.87; 0.98; 0.99[e]; 1.06; 2.08; 3.44	Trials compliant with GAP (France, 2016) MRL_{OECD} = 5.21	6	3.44	0.99
	SEU	0.68[e]; 1.10; 1.44[e]; 1.77; 3.09; 3.31; 3.55	Trials compliant with GAP (France, 2016) MRL_{OECD} = 6.78	7	3.55	1.77
	EU	0.54; 1.39[e]; 1.58; 1.63; 2.95; 3.81; 5.46; 6.12	Trials compliant with GAP (France, 2016) MRL_{OECD} = 11.1	15	6.12	2.29
Cane fruits (all) Other small fruits and berries (all)	NEU	Raspberries: 0.95; 1.08 Currants: 0.77; 1.04	Trials on raspberries and currants compliant with GAP (France, 2016). Residues above the enforcement LOQ are not expected in cane fruits and other berries because copper is applied before flowering; this is confirmed by the 4 available trials MRL_{OECD} = 2.88	5*	1.08	1.00
	SEU	–	Southern GAP only authorised on blueberries. No data available	–	–	–
	EU	–	Indoor GAPs authorised on all crops except dewberries. No trials are available but, based on the outdoor trials, it is expected that treatment before flowering or after commercial harvest will not results in residue above LOQ	5*	–	–
Figs	SEU	–	No data available	–	–	–
Table olives & Olives for oil production	SEU	2.08; 4.20; 4.23; 5.45; < 7.0; < 7.1; < 8.0; 11	Trial performed on olives with 3 applications instead of 2 deemed acceptable since only the third application was performed after flowering, all other parameters are compliant with GAP (Spain, 2016) Extrapolation to olives for oil production is applicable MRL_{OECD} = 17.2	20 (tentative)[f]	11.0	6.23

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Jambuls/ jambolans	NEU	2.08; 3.597; 4.64	Extrapolation of trials performed on cherries, compliant with GAP (France, 2016). Three trials are not sufficient to derive a MRL for a major crop MRL_{OECD} = 10.3	–	–	–
	SEU	1.23; 1.61; 3.76; 5.12	Extrapolation of trials performed on cherries, compliant with GAP (France, 2016) MRL_{OECD} = 10.3	10	5.12	2.69
Kiwi fruits (green, red, yellow)	SEU	5.74; 7.02; 6.87; 11.65	Trials compliant with GAP (France, 2016) MRL_{OECD} = 23.5	30 (tentative)[d]	11.7	6.94
Passionfruits/ maracujas	SEU	–	No trials available	–	–	–
Mangoes	SEU	–	No trials available	–	–	–
Cherimoyas	SEU	–	No trials available	–	–	–
Potatoes	NEU	1.1; 1.4; 1.8; 2.0; 2.4; 2.7; 3.6	Trials on potatoes performed with 6 applications instead 4 and application rate of 0.6 instead of 0.7 kg as/ha (Germany, 2016) MRL_{OECD} = 6.43	7	3.60	2.00
	SEU	< 0.70; 1; 1.10; 1.20; 1.30; 1.30; 1.60; 1.80; 2.80	Trials on potatoes compliant with GAP (France, 2016). Extrapolation to cassava roots, sweet potatoes, yams and arrowroots is applicable MRL_{OECD} = 3.95	4	2.80	1.30
Cassava roots/ manioc Sweet potatoes Yams Arrowroots	SEU	< 0.70 ;1; 1.10; 1.20; 1.30; 1.30; 1.60; 1.80; 2.80	Trials on potatoes compliant with GAP (France, 2016). Extrapolation to cassava roots, sweet potatoes, yams and arrowroots is applicable MRL_{OECD} = 3.95	4	2.80	1.30

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Carrots Beetroots Celeriacs Horseradishes Jerusalem artichokes Parsnips Parsley roots Radishes Salsifies Swedes/ rutabagas Turnips roots	NEU	0.49; 0.56; 0.92; 1.33	Trials on carrots compliant with GAP (France, 2016). Tentative extrapolation (because only 4 trials) to other root and tuber vegetables is proposed MRL_{OECD} = 2.48	3 (tentative)[d]	1.33	0.74
	SEU	2.23	Trials on carrots compliant with GAP (France, 2016)	–	–	–
Onions Garlic Shallots	NEU	0.46; 0.48; 0.54; 0.57[e]; 0.62[e]; 0.63; 0.64[e]; 0.75	Trials on onions compliant with GAP (France, 2016). Extrapolation to shallots and garlic is applicable MRL_{OECD} = 1.76	2*	0.75	0.60
	SEU	0.39; 0.49[e]; 0.66; 0.83	Trials on onions compliant with GAP (France, 2016). Tentative extrapolation (only 4 trials) to shallots and garlic is proposed MRL_{OECD} = 1.78	2* (tentative)[d]	0.83	0.58
Spring onions	SEU	4.77; 14.20; 15.0[e]; 35.90	Trials on leeks compliant with GAP (France, 2016). Extrapolation to spring onion is applicable MRL_{OECD} = 70.0	70	35.9	14.6
Tomatoes Aubergines/ eggplants	NEU	0.70; 1.50; 1.60; 1.60; 1.70; 1.70; 2.20; 4.30; 6.60	Trials compliant with GAP (France, 2016). Extrapolation to aubergines is applicable MRL_{OECD} = 9.81	10	6.60	1.70
	SEU	1.70; 2.30; 2.50; 2.90; 3.70	Trials compliant with GAP (France, 2007). Extrapolation to aubergines is applicable MRL_{OECD} = 7.86	8 (tentative)[d]	3.70	2.50
	EU	1; 1; 2; 2	Trials compliant with GAP (France, 2007). Extrapolation to aubergines is applicable. Only 4 trials are available; considering that the indoor GAP is similar to the outdoor GAPs, it was not deemed appropriate to derive MRL from this GAP	–	–	–

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Sweet peppers/ bell peppers	NEU	1.38; 1.64[e]; 2.34; 3.32	Trials compliant with GAP (France, 2016) MRL_{OECD} = 6.51	7 (tentative)[d]	3.32	1.99
	SEU	1.92; 2.70; 3.13; 3.32; 3.57[e]; 4.13; 4.79; 13.4[e]	Trials compliant with GAP (France, 2016). The highest residue level comes from a trial on chilli peppers MRL_{OECD} = 19.2	20	13.4	3.45
	EU	1.08; 1.38; 1.52; 1.53; 2.04; 2.94; 3.79; 3.91; 3.92[e]	Trials compliant with GAP (France, 2016) MRL_{OECD} = 7.37	8	3.92	2.04
Courgettes Cucumbers Gherkins	NEU	–	No data available	–	–	–
	SEU	0.81; 0.85; 0.98; 1.20; 1.20; 1.30; 1.40; 1.70	Trials on courgettes compliant with GAP (France, 2016). Extrapolation to cucurbits with edible peel is applicable MRL_{OECD} = 3.54	4	1.70	1.20
	EU	Courgettes: 0.70; 0.78; 1.10; 1.70; 2.20; 2.50; 2.60; 3.30 Cucumbers: < 2; < 2; < 2; < 2	Combined dataset on courgettes (8) and cucumbers (4) compliant with GAP (France, 2016). Extrapolation to cucurbits with edible peel is applicable MRL_{OECD} = 4.94	5	3.30	2.00
Melons Pumpkins Watermelons	NEU	–	No data available.	–	–	–
	SEU	< 5; < 5; < 10; < 10; < 10	Trials compliant with GAP (6 app instead 4 but 2 first app performed at early stage) (France, 2016). Tentative MRL is based on the LOQ value of 10 mg/kg. Extrapolation to cucurbits with inedible peel is applicable MRL_{OECD} = not applicable	10 (tentative)[d]	10.0	10.0
	EU	< 1.97; 2× < 2.0; 2× < 2.1; 5.0	Trials compliant with GAP (6 app instead 4 but 2 first app performed at early stage) (France, 2017). Extrapolation to cucurbits with inedible peel is applicable MRL_{OECD} = 7.38	8 (tentative)[d]	5.0	2.05
Broccoli & Cauliflower	SEU	Broccoli: 1.20; 1.30[e]; 1.45[e]; 2.01 Cauliflower: 0.31[e]; 0.41; 0.42; 2.80	Combined dataset on broccoli (4) and cauliflower (4) compliant with GAP (France, 2016) MRL_{OECD} = 4.72	5	2.80	1.25

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Head cabbages	NEU	< 5; < 5	Trials performed on savoy cabbage performed with 6 applications instead of 4 (Germany, 2016); not sufficient derive an MRL	–	–	–
Lettuces Lamb's lettuces Escaroles/broad-leaved endives Cresses and other sprouts and shoots Land cresses Roman rocket/ rucola Red mustards Baby leaf crops (including brassica species) Spinaches Purslanes Chards/beet leaves Fresh herbs	NEU	–	No data available	–	–	–
	SEU	2.03; 3.22; 9.08; 11.7 Open leaf varieties: 29; 47.4; 66	Trials compliant with GAP (France, 2016). Tentative extrapolation to other salad plants is proposed (missing data on open leaf lettuce) MRL_{OECD} = 122	150 (tentative)[d]	66.0	11.7
	EU	23 Open leaf varieties: 22.9; 28.3; 34.4; 34.7; 36.8; 43.9; 83	Trials compliant with GAP (France, 2016). Extrapolation to other salad plants is applicable MRL_{OECD} = 116	150	83.0	34.6
Watercresses	SEU	2.03; 3.22; 9.08; 11.7 Open leaf varieties: 29; 47.4; 66	Tentative extrapolation of trials performed on lettuce with 4 × 0.8 kg as/ha; PHI 7 days instead of 2 × 1 kg as/ha; PHI 7 days (France, 2016); the 3 latter trials were performed on open leaf varieties (missing data on open leaf lettuce) MRL_{OECD} = 122	150 (tentative) [d]	66.0	11.7

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Beans & Peas (with pods)	NEU	2.26; 2.63[e]; 3.22[e]; 3.27; 3.48[e]; 3.66	Trials on beans with pods compliant with GAP (France, 2016). Extrapolation to peas with pods is applicable MRL_{OECD} = 9.26	10 (tentative)[d]	3.66	3.25
	SEU	1.73; 1.82; 2.83; 3.14; 4.33[e]; 4.62[e]	Trials on beans with pods compliant with GAP (France, 2016). Extrapolation to peas with pods is applicable MRL_{OECD} = 9.24	10 (tentative)[d]	4.62	2.99
Beans (without pods)	SEU	–	No data available NB: extrapolation from peas without pods trials are not proposed because GAPs are different and since only 3 trials are available on peas without pods (not enough to derive an MRL)	–	–	–
Peas (without pods)	NEU	1.60; 1.86[e]; 2.09; 2.69[e]; 2.70; 3.10[e]	Trials on peas without pods compliant with GAP (France, 2016) MRL_{OECD} = 7.02	7 (tentative)[d]	3.10	2.39
	SEU	1.69; 2.28[e]; 2.60	Trials on peas without pods compliant with GAP (France, 2016). Three trials are not sufficient to derive a MRL for a major crop	–	–	–
Lentils (fresh)	SEU	–	No data available	–	–	–
Asparagus	SEU	–	No data available	–	–	–
Cardoons	SEU	–	No data available	–	–	–
Globe artichokes	SEU	4.10; 5.37; 9.51; 15.30	Trials compliant with GAP (France, 2016) MRL_{OECD} = 28.8	30	15.3	7.44
Leeks	SEU	4.77; 14.20; 15.0[e]; 35.90	Trials on leeks compliant with GAP (France, 2016) MRL_{OECD} = 70.0	70	35.9	14.6
Beans (dry) & Lentils (dry)	SEU	–	No data available	–	–	–
Sunflower seeds	SEU	–	No data available	–	–	–
Rapeseeds/canola seeds	SEU	–	No data available	–	–	–

Crop	Region/ indoor[a]	Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg)	Recommendations/comments (OECD calculations)	MRL proposals (mg/kg)	HR (mg/kg)[b]	STMR (mg/kg)[c]
Soyabeans	SEU	–	No data available	–	–	–
Hops	NEU	77.5[e]; 160; 220; 245[e]; 430[e]; 581[e]; 620; 629	Overdosed trials compared to GAP (6–7 applications instead of 5 at rates ranging from 2.5–9.5 kg as/ha; PHI 7 days) (Germany, 2016). Residues directly measured in dry cones MRL_{OECD} = 1259	1500 (tentative)[d],[f]	629	338
Sugar beet roots	NEU	0.82; 2.12	Trials compliant with GAP (France, 2016). Two trials are not sufficient to derive a MRL	–	–	–
	SEU	1.19; 1.29	Trials compliant with GAP (France, 2016). Two trials are not sufficient to derive a MRL	–	–	–
Sugar beet tops	NEU	39.2; 111	Trials compliant with GAP (France, 2016). Two trials are not sufficient to derive a MRL	–	–	–
	SEU	40.7	Trial compliant with GAP (France, 2016). One trial is not sufficient to derive a MRL	–	–	–
Turnip tops	NEU	–	No data available for turnip tops	–	–	–
	SEU	–	No data available for turnip tops	–	–	–

GAP: Good Agricultural Practice; OECD: Organisation for Economic Co-operation and Development; MRL: maximum residue level; LOQ: limit of quantification; PHI: preharvest interval.
*: Indicates that the MRL is proposed at the limit of quantification.
(a): NEU: Outdoor trials conducted in northern Europe, SEU: Outdoor trials conducted in southern Europe, Indoor: indoor EU trials or Country code: if non-EU trials.
(b): Highest residue.
(c): Supervised trials median residue.
(d): MRL is derived on tentative basis because the number of trials supporting the GAPs is not compliant with the data requirement.
(e): Higher residue level observed at a longer PHI compared to GAP.
(f): MRL is tentative in the absence of validated analytical method for enforcement in high oil content commodities, dry commodities and hops.

B.1.2.2. Residues in succeeding crops

Confined rotational crop study (quantitative aspect)	No study available and not required
Field rotational crop study	No study available and not required As copper is an essential micronutrient for plants and it is assumed that copper uptake in succeeding crop is auto regulated by the crops. Therefore, the survey on the endogenous copper levels in all plant commodities (France, 2016) was considered as a surrogate to rotational crops studies. These data could allow deriving MRLs and risk assessment values for all plant commodities (see Appendix F.1)

B.1.2.3. Processing factors

Processed commodity	Number of studies[a]	Processing factor (PF)	
		Individual values	Median PF
Robust processing factors (sufficiently supported by data)			
Oranges, peeled	11	0.19; 0.20; 0.20; 0.25; 0.26; 0.31; 0.33; 0.36; 0.38; 0.41; 0.45 (France, 2016)	0.31
Mandarins, peeled	12	0.15; 0.17; 0.22; 0.24; 0.24; 0.29; 0.30; 0.31; 0.35; 0.36; 0.38; 0.41 (France, 2016)	0.30
Oranges, juice	5	0.81; 0.89; 0.94; 1.17; 1.49 (France, 2016)	0.94
Oranges, marmalade	5	0.44; 0.52; 0.53; 0.56; 0.69 (FR, 2016)	0.53
Apples, juice	8	0.32; 0.40; 0.42; 0.51; 0.51; 0.54; 0.60; 0.74 (France, 2016)	0.51
Cherries, canned	8[b]	0.21; 0.24; 0.30; 0.36; 0.36; 0.47; 0.48; 0.51 (France, 2016)	0.36
Peaches, canned	8[b]	0.16; 0.16; 0.16; 0.18; 0.20; 0.24; 0.25; 0.36 (France, 2016)	0.19
Plums, dried (prunes)	8	2.89; 2.93; 3.0; 3.47; 3.76; 4.33; 5.43; 6.42 (France, 2016)	3.62
Table grapes, dried (raisins)	3	2.6; 2.6; 2.9 (France, 2007)	2.60
Wine grapes, juice	9	0.10; < 0.15; 0.17; < 0.21; < 0.39; 0.42; 0.54; 0.65; 0.70 (France, 2007)	0.39
Wine grapes, wet pomace	6	0.8; 1.0; 1.2; 1.2; 6.1; 6.8 (France, 2007)	1.20
Wines grapes, must	14	0.4; 0.6; 0.6; 0.7; 0.7; < 0.8; 0.8; 0.9; 1.5; 1.8; 1.9; 2.5; 2.9; 4.7 (France, 2007)	0.85
Wine grapes, red wine Wine grapes, white wine	20[c]	< 0.01; < 0.01; < 0.01; < 0.01; < 0.01; 0.02; 0.03; 0.03; < 0.03; < 0.04; < 0.04; < 0.07; < 0.07; < 0.08; 0.20; < 0.33; < 0.46; < 0.55; 0.76; 0.78 (France, 2007)	0.04
Strawberries, jam	8	0.60; 0.64; 0.74; 0.78; 0.93; 0.94; 1.14; 1.32 (France, 2016)	0.85
Kiwi fruits, peeled	5	0.15; 0.15; 0.44; 0.44; 0.53 (France, 2016)	0.44
Melons, peeled	5	0.14; 0.28; 0.42; 0.46; 0.92 (France, 2016)	0.42
Peas (without pods), cooked	8	0.71; 0.78; 0.89; 0.93; 0.98; 1.03; 1.15; 1.28 (France, 2016)	0.96
Peas (without pods), canned	8	0.46; 0.48; 0.60; 0.60; 0.71; 0.75; 0.81; 0.89 (France, 2016)	0.66

Processed commodity	Number of studies[a]	Processing factor (PF)	
		Individual values	Median PF
Olives for oil production, virgin oil after cold press	10	< 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10 (France, 2016)	< 0.10[d]
Olives for oil production, press cake	10	0.22; 0.28; 0.37; 0.51; 0.58; 0.84; 0.86; 0.87; 0.88; 0.93 (France, 2016)	0.71
Hops, beer	8	< 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10; < 0.10 (France, 2016)	< 0.10[d]
Indicative processing factors (limited dataset)			
Oranges, wet pomace	1	2.12 (France, 2016)	2.12
Oranges, dry pomace	1	8.61 (France, 2016)	8.61
Apples, wet pomace	2	0.68; 0.78 (France, 2016)	0.73
Olives for oil production, refined oil after warm press	1	< 0.10 (France, 2016)	< 0.10[d]

(a): Studies with residues in the RAC at or close to the LOQ were disregarded (unless concentration may occur).
(b): Processing factor calculated for canned unstoned cherry/peach (=pulp).
(c): PF for wine is derived from a combined dataset of red and white wine studies.
(d): Residues < LOQ in all processed samples of virgin, refined oil and beer.

B.2. Residues in livestock

Relevant groups	Dietary burden expressed in				Most critical diet[a]	Most critical commodity[a]	Trigger exceeded (Y/N)
	mg/kg bw per day		mg/kg DM				
	Med.	Max.	Med.	Max.			
Cattle (all diets)	4.13	4.39	139.8[b]	147.6[b]	Cattle (dairy)	Potatoes (process waste)	Yes
Cattle (dairy only)	4.13	4.39	107.3	114.1	Cattle (dairy)	Potatoes (process waste)	Yes
Sheep (all diets)	4.62	4.80	138.5	143.9	Sheep (ram/ewe)	Potatoes (process waste)	Yes
Sheep (ewe only)	4.62	4.80	138.5	143.9	Sheep (ram/ewe)	Potatoes (process waste)	Yes
Swine (all diets)	1.73	1.88	74.8	81.4	Swine (breeding)	Potatoes (process waste)	Yes
Poultry (all diets)	1.53	1.58	21.7	22.5	Poultry (broiler)	Potatoes (dried pulp)	Yes
Poultry (layer only)	1.20	1.31	17.6	19.1	Poultry (layer)	Potatoes (dried pulp)	Yes

bw: body weight; DM: dry matter.
(a): Calculated for the maximum dietary burden.
(b): The highest dietary burdens expressed in mg/kg DM results from beef cattle.

B.2.1. Nature of residues and methods of analysis in livestock

B.2.1.1. Metabolism studies, methods of analysis and residue definitions in livestock

Livestock (available studies)	Animal	Dose (mg/kg bw per day)	Duration (days)	N rate/comment
	–	–	–	–
	Copper is a monoatomic element and inherently stable. Therefore, it is not expected to metabolise or to form degradation products (EFSA, 2008)			

Time needed to reach a plateau concentration in milk and eggs (days)	Inconclusive
Metabolism in rat and ruminant similar (Yes/No)	Yes
Animal residue definition for monitoring (RD-Mo)	total copper
Animal residue definition for risk assessment (RD-RA)	total copper
Conversion factor (monitoring to risk assessment)	not relevant
Fat soluble residues (Yes/No)	No
Methods of analysis for monitoring of residues (analytical technique, crop groups, LOQs)	AAS – Atomic Absorption Spectrometry (EFSA, 2014): • All animal matrices, LOQ: 0.5–1 mg/kg • Performance characteristic to be validated

LOQ: limit of quantification.

B.2.1.2. Stability of residues in livestock

Animal products (available studies)	**Animal**	**Commodity**	**T (°C)**	**Stability (Months/years)**
Since copper cannot degrade and since the analytical techniques measure total copper content, storage stability studies are not required (EFSA, 2008)				

B.2.2. Magnitude of residues in livestock

B.2.2.1. Summary of the residue data from livestock feeding studies

Not relevant as feeding studies are not required.

MRLs for livestock commodities are derived from the background levels (France, 2016) and/or monitoring data (2009–2015); See Appendix F.2.

B.3. Consumer risk assessment

ADI	0.15 mg/kg bw per day (EFSA, 2018a)
Highest IEDI, according to EFSA PRIMo	**Scenario 1 (without risk mitigation measures):** 109% ADI (WHO Cluster Diet B) **Scenario 2 (with risk mitigation measures):** 93.4 % ADI (WHO Cluster Diet B)
Assumptions made for the calculations	**Scenario 1 (without risk mitigation measures):** The calculation takes into account residues arising from authorised uses as well as from any other sources (background concentrations, uptake from soil, etc.). Therefore, the contribution of commodities where no GAP was reported in the framework of this review was also included in the calculation. For those commodities where MRLs were derived from: — the authorised GAPs, input values are based on the median values of the supporting residue trials; — the monitoring data, input values are based on mean values of the monitoring results; — the background levels data, input values are based on median values of the background levels. For citrus fruits, cucurbits with inedible peel, the relevant peeling factors were applied. For wine grapes, the processing factor of wine juice was applied. For rapeseed and olives for oil production, the processing factor for oil production was applied. For those commodities where data were insufficient to derive an MRL, EFSA considered the existing EU MRL for an indicative calculation.

	Scenario 2 (with risk mitigation measures): Same approach as in scenario 1 was applied, including the following assumptions: — Northern GAP on potatoes will be withdrawn; a fall-back option is identified with the southern GAP (MRL of 4 mg/kg); — The critical GAPs authorised on wine grapes will be withdrawn (no fall-back GAP identified); exposure assessed with the background levels; — The critical GAPs authorised on tomatoes will be withdrawn (no fall-back GAP identified); exposure assessed with the background levels; — The critical GAPs authorised on lettuce will be withdrawn (no fall-back GAP identified); exposure assessed with the background levels.

Consumer exposure through drinking water or from 'water and water-based beverages':

ADI	0.15 mg/kg bw per day (EFSA, 2018a)
Intake of copper (%ADI)	**Calculation 1:** – **Calculation 1a:** 0.62 – 2.80% ADI – **Calculation 1b:** 3.36 – 15.1% ADI – **Calculation 1c:** 9.64 – 43.4% ADI **Calculation 2:** – 0.20 – 5.4% ADI
Assumptions made for the calculations	**Calculation 1:** This calculations are based on the standard consumption data considered in the EC guidance on the assessment of metabolites in groundwater (European Commission, 2003) and on copper occurrence data in tap water, taken from a French database (France, 2016): – **Calculation 1a:** based on the median value – **Calculation 1b:** based on the average value – **Calculation 1c:** based on 95th percentile **Calculation 2:** This calculation was performed in the framework of the scientific opinion on dietary reference values for copper (EFSA NDA Panel, 2015) and considers the contribution of the group of "water and water-based beverages", therefore including tap water, natural mineral water, bottled drinking water, soft drinks, flavoured waters, etc

ARfD	Not needed (EFSA, 2018a)
Highest IESTI, according to EFSA PRIMo	–
Assumptions made for the calculations	–

ADI: acceptable daily intake; IEDI: international estimated daily intake; PRIMo: (EFSA) Pesticide Residues Intake Model; bw: body weight; WHO: World Health Organization; GAP: Good Agricultural Practice; MRL: maximum residue level; ARfD: acute reference dose; IESTI: international estimated short-term intake.

B.4. Proposed MRLs

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
Enforcement residue definition (existing): copper compounds (copper) **Enforcement residue definition (proposed):** total copper				
110010	Grapefruits	20	15	Further consideration needed[a]
110020	Oranges	20	15	Further consideration needed[a]
110030	Lemons	20	15	Further consideration needed[a]
110040	Limes	20	15	Further consideration needed[a]
110050	Mandarins	20	15	Further consideration needed[a]
120010	Almonds	30	40	Further consideration needed[a]
120020	Brazil nuts	30	40	Further consideration needed[a]
120030	Cashew nuts	30	40	Further consideration needed[b]
120040	Chestnuts	30	40	Further consideration needed[a]
120050	Coconuts	30	5	Further consideration needed[b]
120060	Hazelnuts/cobnuts	30	40	Further consideration needed[a]
120070	Macadamias	30	40	Further consideration needed[a]
120080	Pecans	30	40	Further consideration needed[a]
120090	Pine nut kernels	30	40	Further consideration needed[b]
120100	Pistachios	30	40	Further consideration needed[a]
120110	Walnuts	30	40	Further consideration needed[a]
130010	Apples	5	6	Recommended[c]
130020	Pears	5	6	Recommended[c]
130030	Quinces	5	6	Recommended[c]
130040	Medlars	5	6	Recommended[c]
130050	Loquats/Japanese medlars	5	6	Recommended[c]
140010	Apricots	5	3	Recommended[c]
140020	Cherries (sweet)	5	10	Recommended[c]
140030	Peaches	5	8	Recommended[c]
140040	Plums	5	4	Further consideration needed[a]
151010	Table grapes	50	100	Recommended[c]
151020	Wine grapes	50	100/2	Further consideration needed[d]
152000	Strawberries	5	15	Recommended[c]
153010	Blackberries	5	5*	Recommended[c]
153020	Dewberries	5	5*	Recommended[c]
153030	Raspberries (red and yellow)	5	5*	Recommended[c]
154010	Blueberries	5	5*	Recommended[c]
154020	Cranberries	5	5*	Recommended[c]
154030	Currants (black, red and white)	5	5*	Recommended[c]
154040	Gooseberries (green, red and yellow)	5	5*	Recommended[c]
154050	Rose hips	5	5*	Recommended[c]
154060	Mulberries (black and white)	5	5*	Recommended[c]
154070	Azaroles/Mediterranean medlars	5	5*	Recommended[c]
154080	Elderberries	5	5*	Recommended[c]
161010	Dates	20	2*	Further consideration needed[e]
161020	Figs	20	30	Further consideration needed[f]
161030	Table olives	30	20	Further consideration needed[a]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
161040	Kumquats	20	2*	Further consideration needed[e]
161050	Carambolas	20	2*	Further consideration needed[e]
161060	Kaki/Japanese persimmons	20	2*	Further consideration needed[e]
161070	Jambuls/jambolans	20	10	Recommended[c]
162010	Kiwi fruits (green, red, yellow)	20	30	Further consideration needed[a]
162020	Litchis/lychees	20	2*	Further consideration needed[e]
162030	Passionfruits/maracujas	20	4	Further consideration needed[f]
162040	Prickly pears/cactus fruits	20	2*	Further consideration needed[e]
162050	Star apples/cainitos	20	2*	Further consideration needed[e]
162060	American persimmons/ Virginia kaki	20	2*	Further consideration needed[e]
163010	Avocados	20	6	Further consideration needed[e]
163020	Bananas	20	6	Further consideration needed[e]
163030	Mangoes	20	6	Further consideration needed[f]
163040	Papayas	20	6	Further consideration needed[e]
163050	Granate apples/ pomegranates	20	6	Further consideration needed[e]
163060	Cherimoyas	20	6	Further consideration needed[f]
163070	Guavas	20	6	Further consideration needed[e]
163080	Pineapples	20	6	Further consideration needed[e]
163090	Breadfruits	20	6	Further consideration needed[e]
163100	Durians	20	6	Further consideration needed[e]
163110	Soursops/guanabanas	20	6	Further consideration needed[e]
211000	Potatoes	5	7/4	Further consideration needed[d]
212010	Cassava roots/manioc	5	4	Recommended[c]
212020	Sweet potatoes	5	4	Recommended[c]
212030	Yams	5	4	Recommended[c]
212040	Arrowroots	5	4	Recommended[c]
213010	Beetroots	5	3	Further consideration needed[a]
213020	Carrots	5	3	Further consideration needed[a]
213030	Celeriacs/turnip rooted celeries	5	3	Further consideration needed[a]
213040	Horseradishes	5	3	Further consideration needed[a]
213050	Jerusalem artichokes	5	3	Further consideration needed[a]
213060	Parsnips	5	3	Further consideration needed[a]
213070	Parsley roots/Hamburg roots parsley	5	3	Further consideration needed[a]
213080	Radishes	5	3	Further consideration needed[a]
213090	Salsifies	5	3	Further consideration needed[a]
213100	Swedes/rutabagas	5	3	Further consideration needed[a]
213110	Turnips	5	3	Further consideration needed[a]
220010	Garlic	5	4	Further consideration needed[b]
220020	Onions	5	2*	Recommended[c]
220030	Shallots	5	2*	Recommended[c]
220040	Spring onions/green onions and Welsh onions	5	70	Recommended[c]
231010	Tomatoes	5	10/2	Further consideration needed[d]
231020	Sweet peppers/bell peppers	5	20	Recommended[c]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
231030	Aubergines/eggplants	5	10	Recommended[c]
231040	Okra/lady's fingers	5	2*	Further consideration needed[e]
232010	Cucumbers	5	5	Recommended[c]
232020	Gherkins	5	5	Recommended[c]
232030	Courgettes	5	5	Recommended[c]
233010	Melons	5	10	Further consideration needed[a]
233020	Pumpkins	5	10	Further consideration needed[a]
233030	Watermelons	5	10	Further consideration needed[a]
234000	Sweet corn	10	2*	Further consideration needed[e]
241010	Broccoli	20	5	Recommended[c]
241020	Cauliflowers	20	5	Recommended[c]
242010	Brussels sprouts	20	2*	Further consideration needed[e]
242020	Head cabbages	20	2*	Further consideration needed[f]
243010	Chinese cabbages/pe-tsai	20	3	Further consideration needed[e]
243020	Kales	20	3	Further consideration needed[e]
244000	Kohlrabies	20	3	Further consideration needed[e]
251010	Lamb's lettuces/corn salads	100	150	Recommended[c]
251020	Lettuces	100	150/4	Further consideration needed[d]
251030	Escaroles/broad-leaved endives	100	150	Recommended[c]
251040	Cresses and other sprouts and shoots	100	150	Recommended[c]
251050	Land cresses	100	150	Recommended[c]
251060	Roman rocket/rucola	100	150	Recommended[c]
251070	Red mustards	100	150	Recommended[c]
251080	Baby leaf crops (including brassica species)	100	150	Recommended[c]
252010	Spinaches	20	150	Recommended[c]
252020	Purslanes	20	150	Recommended[c]
252030	Chards/beet leaves	20	150	Recommended[c]
253000	Grape leaves and similar species	20	5	Further consideration needed[e]
254000	Watercresses	20	150	Further consideration needed[a]
255000	Witloofs/Belgian endives	20	2*	Further consideration needed[e]
256010	Chervil	20	150	Recommended[c]
256020	Chives	20	150	Recommended[c]
256030	Celery leaves	50	150	Recommended[c]
256040	Parsley	20	150	Recommended[c]
256050	Sage	20	150	Recommended[c]
256060	Rosemary	20	150	Recommended[c]
256070	Thyme	20	150	Recommended[c]
256080	Basil and edible flowers	20	150	Recommended[c]
256090	Laurel/bay leave	20	150	Recommended[c]
256100	Tarragon	20	150	Recommended[c]
260010	Beans (with pods)	20	10	Further consideration needed[a]
260020	Beans (without pods)	20	4	Further consideration needed[f]
260030	Peas (with pods)	20	10	Further consideration needed[a]
260040	Peas (without pods)	20	7	Further consideration needed[a]
260050	Lentils (fresh)	20	4	Further consideration needed[f]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
270010	Asparagus	5	7	Further consideration needed[f]
270020	Cardoons	20	7	Further consideration needed[f]
270030	Celeries	20	7	Further consideration needed[e]
270040	Florence fennels	20	7	Further consideration needed[e]
270050	Globe artichokes	20	30	Recommended[c]
270060	Leeks	20	70	Recommended[c]
270070	Rhubarbs	20	7	Further consideration needed[e]
270080	Bamboo shoots	20	7	Further consideration needed[e]
270090	Palm hearts	20	7	Further consideration needed[e]
280010	Cultivated fungi	20	6	Further consideration needed[e]
280020	Wild fungi	20	6	Further consideration needed[e]
290000	Algae and prokaryotes organisms	20	3	Further consideration needed[e]
300010	Beans (dry)	20	15	Further consideration needed[f]
300020	Lentils (dry)	20	15	Further consideration needed[f]
300030	Peas (dry)	20	15	Further consideration needed[e]
300040	Lupins/lupini beans (dry)	20	15	Further consideration needed[e]
401010	Linseeds	30	30	Further consideration needed[e]
401020	Peanuts/groundnuts	30	30	Further consideration needed[e]
401030	Poppy seeds	30	30	Further consideration needed[e]
401040	Sesame seeds	30	30	Further consideration needed[e]
401050	Sunflower seeds	40	30	Further consideration needed[g]
401060	Rapeseeds/canola seeds	30	30	Further consideration needed[f]
401070	Soyabeans	40	30	Further consideration needed[g]
401080	Mustard seeds	30	30	Further consideration needed[e]
401090	Cotton seeds	30	30	Further consideration needed[e]
401100	Pumpkin seeds	30	30	Further consideration needed[e]
401110	Safflower seeds	30	30	Further consideration needed[e]
401120	Borage seeds	30	30	Further consideration needed[e]
401130	Gold of pleasure seeds	30	30	Further consideration needed[e]
401140	Hemp seeds	30	30	Further consideration needed[e]
401150	Castor beans	30	30	Further consideration needed[e]
402010	Olives for oil production	30	20	Further consideration needed[a]
402020	Oil palms kernels	30	30	Further consideration needed[h]
402030	Oil palms fruits	30	30	Further consideration needed[h]
402040	Kapok	30	30	Further consideration needed[h]
500010	Barley grains	10	10	Further consideration needed[e]
500020	Buckwheat and other pseudo-cereal grains	10	15	Further consideration needed[e]
500030	Maize/corn grains	10	10	Further consideration needed[i]
500040	Common millet/proso millet grains	10	10	Further consideration needed[e]
500050	Oat grains	10	10	Further consideration needed[e]
500060	Rice grains	10	10	Further consideration needed[e]
500070	Rye grains	10	10	Further consideration needed[e]
500080	Sorghum grains	10	10	Further consideration needed[e]
500090	Wheat grains	10	10	Further consideration needed[i]
610000	Teas	40	30	Further consideration needed[e]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
620000	Coffee beans	50	20	Further consideration needed[e]
631000	Herbal infusions from flowers	100	5*	Further consideration needed[e]
632000	Herbal infusions from leaves and herbs	100	5*	Further consideration needed[e]
633000	Herbal infusions from roots	100	5*	Further consideration needed[e]
640000	Cocoa beans	50	5*	Further consideration needed[e]
650000	Carobs/Saint John's breads	20	6	Further consideration needed[e]
700000	Hops	1,000	1,500	Further consideration needed[a]
810000	Seed spices	40	15	Further consideration needed[e]
820000	Fruit spices	40	15	Further consideration needed[e]
830000	Bark spices	40	5*	Further consideration needed[e]
840000	Root and rhizome spices	40	5*	Further consideration needed[e]
850000	Bud spices	40	5*	Further consideration needed[e]
860000	Flower pistil spices	40	5*	Further consideration needed[e]
870000	Aril spices	40	30	Further consideration needed[e]
900010	Sugar beet roots	5	2*	Further consideration needed[f]
900020	Sugar canes	5	2*	Further consideration needed[e]
900030	Chicory roots	5	2*	Further consideration needed[e]
1011010	Swine muscle	5	7	Further consideration needed[j]
1011020	Swine fat tissue	5	2	Further consideration needed[j]
1011030	Swine liver	30	90	Further consideration needed[j]
1011040	Swine kidney	30	10	Further consideration needed[j]
1012010	Bovine muscle	5	3	Further consideration needed[j]
1012020	Bovine fat tissue	5	0.6*	Further consideration needed[j]
1012030	Bovine liver	30	400	Further consideration needed[k]
1012040	Bovine kidney	30	10	Further consideration needed[j]
1013010	Sheep muscle	5	3	Further consideration needed[j]
1013020	Sheep fat tissue	5	0.6*	Further consideration needed[j]
1013030	Sheep liver	30	150	Further consideration needed[j]
1013040	Sheep kidney	30	6	Further consideration needed[j]
1014010	Goat muscle	5	3	Further consideration needed[j]
1014020	Goat fat tissue	5	0.6*	Further consideration needed[j]
1014030	Goat liver	30	150	Further consideration needed[j]
1014040	Goat kidney	30	6	Further consideration needed[j]
1015010	Equine muscle	5	3	Further consideration needed[j]
1015020	Equine fat tissue	5	0.6*	Further consideration needed[j]
1015030	Equine liver	30	400	Further consideration needed[j]
1015040	Equine kidney	30	10	Further consideration needed[j]
1016010	Poultry muscle	5	7	Further consideration needed[j]
1016020	Poultry fat tissue	5	1*	Further consideration needed[j]
1016030	Poultry liver	30	80	Further consideration needed[j]
1020010	Cattle milk	2	1*	Further consideration needed[j]
1020020	Sheep milk	2	1*	Further consideration needed[j]
1020030	Goat milk	2	1*	Further consideration needed[j]
1020040	Horse milk	2	1*	Further consideration needed[j]

Code number	Commodity	Existing EU MRL (mg/kg)	Outcome of the review	
			MRL (mg/kg)	Comment
1030000	Birds eggs	2	1*	Further consideration needed(j)
1070000	Other terrestrial animal products	0.01*	3	Further consideration needed(j)

MRL: maximum residue level.
*: Indicates that the MRL is set at the limit of quantification.
(a): Tentative MRL is derived from a GAP evaluated at EU level, which is not fully supported by data but for which no risk to consumers was identified; no CXL is available (case A2 in the decision tree reported in Appendix E.1).
(b): Tentative MRL is derived from monitoring data and/or background levels; GAP evaluated as EU level is expected to lead to lower residues compared to endogenous levels; no risk to consumers was identified; no CXL is available (case B in the decision tree reported in Appendix E.1).
(c): MRL is derived from a GAP evaluated at EU level, which is fully supported by data and for which no risk to consumers is identified; no CXL is available (case A1 in the decision tree reported in Appendix E.1).
(d): GAP evaluated at EU level is fully supported by data but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available. A lower MRL derived from a fall-back GAP or from the background levels may be considered (equivalent to cases A1/A2 or D1 in the decision tree reported in Appendix E.1).
(e): There are no relevant authorisations or import tolerances reported at EU level but tentative MRL is derived from background levels, for which no risk to consumers is identified; no CXL is available (cases D1 and D2 in the decision tree reported in Appendix E.1).
(f): Tentative MRL is derived from monitoring data and/or background levels; GAP evaluated at EU level is not supported by data; no risk to consumers was identified; no CXL is available (case C in the decision tree reported in Appendix E.1).
(g): GAP evaluated at EU level is not supported by data; a tentative MRL can derived from monitoring data and/or background levels but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available (equivalent to case C in the decision tree reported in Appendix E.1).
(h): There are no relevant authorisations or import tolerances reported at EU level but no risk to consumers was identified for the existing EU MRL; no CXL is available (case E in the decision tree reported in Appendix E.1).
(i): There are no relevant authorisations or import tolerances reported at EU level; tentative MRL can be derived from background levels but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available (equivalent to cases D1/D2 in the decision tree reported in Appendix E.1).
(j): Tentative MRL is derived from monitoring data and/or background levels for all food commodities of animal origin; no risk to consumers was identified for this commodity; no CXL is available (case F in the decision tree reported in Appendix E.2).
(k): Tentative MRL can be derived from monitoring data and/or background levels for all food commodities of animal origin but this commodity is identified as one of the main contributors to the chronic exposure while a chronic risk to consumers cannot be excluded; no CXL is available (equivalent to case F in the decision tree reported in Appendix E.2).

Appendix C – Pesticide Residue Intake Model (PRIMo)

- PRIMo(EU1)

Copper			
Status of the active substance:		Code no.	
LOQ (mg/kg bw):		Proposed LOQ:	
Toxicological end points			
ADI (mg/kg bw per day):	**0.15**	ARfD (mg/kg bw):	**n.n.**
Source of ADI:	**EFSA**	Source of ARfD:	
Year of evaluation:	**2018**	Year of evaluation:	

The risk assessment has been performed on the basis of the MRLs collected from Member States in April 2006. For each pesticide/commodity, the highest national MRL was identified (proposed temporary MRL = pTMRL).
The pTMRLs have been submitted to EFSA in September 2006.

Chronic risk assessment – refined calculations

	TMDI (range) in % of ADI minimum	maximum
	14	109
No of diets exceeding ADI:	1	

Highest calculated TMDI values in % of ADI	MS Diet	Highest contributor to MS diet (in % of ADI)	Commodity/ group of commodities	2nd contributor to MS diet (in % of ADI)	Commodity/ group of commodities	3rd contributor to MS diet (in % of ADI)	Commodity/ group of commodities	pTMRLs at LOQ (in % of ADI)
108.9	WHO Cluster diet B	23.6	Wheat	9.1	Sunflower seed	8.3	Lettuce	
85.7	IE adult	13.6	Sheep: Liver	6.4	Maize	6.4	Maize	
83.8	NL child	13.1	Wheat	8.6	Spinach	7.9	Potatoes	
70.4	DE child	11.4	Wheat	11.3	Apples	7.4	Table grapes	
67.3	FR toddler	16.3	Spinach	7.3	Wheat	7.0	Leek	
61.5	WHO cluster diet E	10.9	Wheat	5.1	Potatoes	4.6	Soya bean	
57.0	DK child	15.2	Wheat	12.2	Rye	7.4	Bovine: Liver	
56.9	UK Toddler	19.1	Sugar beet (root)	10.8	Wheat	4.7	Potatoes	
56.6	WHO cluster diet D	18.0	Wheat	6.1	Sunflower seed	5.4	Potatoes	
53.9	ES child	12.3	Wheat	9.6	Lettuce	3.0	Poultry: Meat	
52.3	WHO Cluster diet F	10.0	Wheat	6.9	Lettuce	5.2	Soya bean	
50.4	WHO regional European diet	8.7	Lettuce	8.2	Wheat	5.4	Potatoes	
48.8	UK Infant	8.4	Sugar beet (root)	7.3	Wheat	6.2	Milk and cream	
44.6	IT kids/toddler	18.4	Wheat	6.7	Lettuce	2.5	Other lettuce and other salad	
44.3	PT General population	10.8	Wheat	7.1	Potatoes	4.2	Wine grapes	
42.5	ES adult	12.3	Lettuce	6.5	Wheat	1.8	Beet leaves (chard)	
41.6	NL general	5.7	Wheat	3.7	Potatoes	3.6	Coffee beans	
41.1	FR all population	9.1	Wheat	6.8	Wine grapes	4.4	Other lettuce and other salad	
40.9	IT adult	11.4	Wheat	8.7	Lettuce	3.6	Other lettuce and other salad	
40.5	FR infant	10.2	Spinach	5.5	Potatoes	4.1	Milk and cream	
32.8	SE general population 90th percentile	8.9	Wheat	5.6	Potatoes	2.0	Milk and cream	
28.6	UK vegetarian	5.7	Wheat	3.2	Lettuce	3.1	Sugar beet (root)	
25.2	UK Adult	4.6	Wheat	3.3	Sugar beet (root)	2.7	Lettuce	
22.1	LT adult	4.2	Potatoes	3.0	Rye	2.9	Wheat	
22.0	DK adult	5.6	Wheat	3.1	Bovine: Liver	2.4	Wine grapes	
17.2	FI adult	2.7	Wheat	2.6	Coffee beans	1.9	Rye	
14.1	PL general population	4.6	Potatoes	1.9	Apples	1.9	Table grapes	

Conclusion:
The estimated Theoretical Maximum Daily Intakes based on MS and WHO diets and pTMRLs were in the range of 14.1% – 109% of the ADI.
For 1 diet, the ADI is exceeded. Further refinements of the dietary intake estimates have not been performed. A public health risk can not be excluded at the moment.

	Acute risk assessment/children – refined calculations				Acute risk assessment/adults/general population – refined calculations			
	Acute risk assessment is not necessary.							
	For each commodity, the calculation is based on the highest reported MS consumption per kg bw and the corresponding unit weight from the MS with the critical consumption. If no data on the unit weight was available from that MS, an average European unit weight was used for the IESTI calculation. In the **IESTI 1** calculation, the variability factors were 10, 7 or 5 (according to JMPR manual 2002); for lettuce, a variability factor of 5 was used. In the **IESTI 2** calculations, the variability factors of 10 and 7 were replaced by 5. For lettuce, the calculation was performed with a variabilty factor of 3. **Threshold MRL** is the calculated residue level which would leads to an exposure equivalent to 100% of the ARfD.							
Unprocessed commodities	**No of commodities for which ARfD/ADI is exceeded (IESTI 1):** ---			**No of commodities for which ARfD/ADI is exceeded (IESTI 2):** ---			**No of commodities for which ARfD/ADI is exceeded (IESTI 1):** ---			**No of commodities for which ARfD/ADI is exceeded (IESTI 2):** ---		
	IESTI 1 *)		**)	**IESTI 2** *)		**)	**IESTI 1** *)		**)	**IESTI 2** *)		**)
	Highest % of ARfD/ADI	Commodities	pTMRL/ threshold MRL (mg/kg)	Highest % of ARfD/ADI	Commodities	pTMRL/ threshold MRL (mg/kg)	Highest % of ARfD/ADI	Commodities	pTMRL/ threshold MRL (mg/kg)	Highest % of ARfD/ADI	Commodities	pTMRL/ threshold MRL (mg/kg)
	No of critical MRLs (IESTI 1) ---						**No of critical MRLs (IESTI 2)** ---					
Processed commodities	**No of commodities for which ARfD/ADI is exceeded:** ---						**No of commodities for which ARfD/ADI is exceeded:** ---					
	***)						***)					
	Highest % of ARfD/ADI	Processed commodities	pTMRL/ threshold MRL (mg/kg)				Highest % of ARfD/ADI	Processed commodities	pTMRL/ threshold MRL (mg/kg)			
	*) The results of the IESTI calculations are reported for at least 5 commodities. If the ARfD is exceeded for more than 5 commodities, all IESTI values > 90% of ARfD are reported. **) pTMRL: provisional temporary MRL. ***) pTMRL: provisional temporary MRL for unprocessed commodity.											
	Conclusion: As no ARfD was considered necessary, it is concluded that the short-term intake of copper residues is unlikely to present a pulbic health concern.											

- PRIMo(EU2)

Copper			
Status of the active substance:		Code no.	
LOQ (mg/kg bw):		Proposed LOQ:	
Toxicological end points			
ADI (mg/kg bw per day):	**0.15**	ARfD (mg/kg bw):	**n.n.**
Source of ADI:	**EFSA**	Source of ARfD:	
Year of evaluation:	**2018**	Year of evaluation:	

The risk assessment has been performed on the basis of the MRLs collected from Member States in April 2006. For each pesticide/commodity the highest national MRL was identified (proposed temporary MRL = pTMRL).
The pTMRLs have been submitted to EFSA in September 2006.

Chronic risk assessment – refined calculations

TMDI (range) in % of ADI minimum – maximum	
11	93
No of diets exceeding ADI:	---

Highest calculated TMDI values in % of ADI	MS Diet	Highest contributor to MS diet (in % of ADI)	Commodity/ group of commodities	2nd contributor to MS diet (in % of ADI)	Commodity/ group of commodities	3rd contributor to MS diet (in % of ADI)	Commodity/ group of commodities	pTMRLs at LOQ (in % of ADI)
93.4	WHO Cluster diet B	23.6	Wheat	9.1	Sunflower seed	6.8	Maize	
80.4	IE adult	13.6	Sheep: Liver	6.4	Maize	6.4	Maize	
78.1	NL child	13.1	Wheat	8.6	Spinach	6.0	Apples	
66.7	DE child	11.4	Wheat	11.3	Apples	7.4	Table grapes	
64.1	FR toddler	16.3	Spinach	7.3	Wheat	7.0	Leek	
54.1	UK Toddler	19.1	Sugar beet (root)	10.8	Wheat	3.7	Beans	
54.0	WHO cluster diet E	10.9	Wheat	4.6	Soya bean	4.3	Sunflower seed	
52.9	WHO cluster diet D	18.0	Wheat	6.1	Sunflower seed	3.5	Potatoes	
52.0	DK child	15.2	Wheat	12.2	Rye	7.4	Bovine: Liver	
46.8	UK Infant	8.4	Sugar beet (root)	7.3	Wheat	6.2	Milk and cream	
42.5	ES child	12.3	Wheat	3.0	Poultry: Meat	2.0	Milk and cream	
42.3	WHO Cluster diet F	10.0	Wheat	5.2	Soya bean	3.3	Coffee beans	
38.5	WHO regional European diet	8.2	Wheat	3.5	Potatoes	2.0	Poultry: Meat	
38.4	FR infant	10.2	Spinach	4.1	Milk and cream	4.1	Leek	
37.1	PT General population	10.8	Wheat	4.6	Potatoes	3.5	Sunflower seed	
36.2	NL general	5.7	Wheat	3.6	Coffee beans	3.3	Spinach	
33.5	IT kids/toddler	18.4	Wheat	1.4	Beet leaves (chard)	1.3	Spinach	
29.9	SE general population 90th percentile	8.9	Wheat	3.6	Potatoes	2.0	Milk and cream	
28.5	ES adult	6.5	Wheat	1.8	Beet leaves (chard)	1.7	Spinach	
27.8	FR all population	9.1	Wheat	4.1	Sunflower seed	1.5	Other oilseeds	
27.1	IT adult	11.4	Wheat	2.2	Spinach	1.5	Other spinach and similar	
22.9	UK vegetarian	5.7	Wheat	3.1	Sugar beet (root)	1.7	Beans	
19.8	UK Adult	4.6	Wheat	3.3	Sugar beet (root)	1.4	HOPS (dried)	
18.8	DK adult	5.6	Wheat	3.1	Bovine: Liver	1.9	Rye	
18.5	LT adult	3.0	Rye	2.9	Wheat	2.8	Potatoes	
13.9	FI adult	2.7	Wheat	2.6	Coffee beans	1.9	Rye	
11.2	PL general population	3.0	Potatoes	1.9	Apples	1.9	Table grapes	

Conclusion:
The estimated Theoretical Maximum Daily Intakes (TMDI), based on pTMRLs were below the ADI.
A long-term intake of residues of copper is unlikely to present a public health concern.

	Acute risk assessment/children – refined calculations			Acute risk assessment/adults/general population – refined calculations		
	Acute risk assessment is not necessary.					
	For each commodity, the calculation is based on the highest reported MS consumption per kg bw and the corresponding unit weight from the MS with the critical consumption. If no data on the unit weight was available from that MS, an average European unit weight was used for the IESTI calculation. In the **IESTI 1** calculation, the variability factors were 10, 7 or 5 (according to JMPR manual 2002); for lettuce, a variability factor of 5 was used. In the **IESTI 2** calculations, the variability factors of 10 and 7 were replaced by 5. For lettuce, the calculation was performed with a variabilty factor of 3. **Threshold MRL** is the calculated residue level which would leads to an exposure equivalent to 100% of the ARfD.					
Unprocessed commodities	**No of commodities for which ARfD/ADI is exceeded (IESTI 1):** ---			**No of commodities for which ARfD/ADI is exceeded (IESTI 2):** ---		
	IESTI 1 *) **)			**IESTI 2** *) **)		
	Highest % of ARfD/ADI	Commodities	pTMRL/ threshold MRL (mg/kg)	Highest % of ARfD/ADI	Commodities	pTMRL/ threshold MRL (mg/kg)
	No of critical MRLs (IESTI 1) ---			**No of critical MRLs (IESTI 2)** ---		
Processed commodities	**No of commodities for which ARfD/ADI is exceeded:** ---					
	***)					
	Highest % of ARfD/ADI	Processed commodities	pTMRL/ threshold MRL (mg/kg)			
	*) The results of the IESTI calculations are reported for at least 5 commodities. If the ARfD is exceeded for more than 5 commodities, all IESTI values > 90% of ARfD are reported. **) pTMRL: provisional temporary MRL. ***) pTMRL: provisional temporary MRL for unprocessed commodity.					
	Conclusion: As no ARfD was considered necessary, it is concluded that the short-term intake of copper residues is unlikely to present a pulbic health concern.					

Appendix D – Input values for the exposure calculations

D.1. Livestock dietary burden calculations

Feed commodity	Median dietary burden		Maximum dietary burden	
	Input value (mg/kg)	Comment	Input value (mg/kg)	Comment
Risk assessment residue definition: total copper				
Grapefruits, dried pulp	33.8	STMR × PF	33.8	STMR × PF
Oranges, dried pulp	33.8	STMR × PF	33.8	STMR × PF
Lemons, dried pulp	33.8	STMR × PF	33.8	STMR × PF
Limes, dried pulp	33.8	STMR × PF	33.8	STMR × PF
Mandarins, dried pulp	33.8	STMR × PF	33.8	STMR × PF
Coconut, meal	6.75	Median background[b] × 1.5[a]	6.75	Median background[b] × 1.5[a]
Apple, pomace, wet	1.03	STMR × PF	1.03	STMR × PF
Potato, culls	2.00	STMR	3.60	HR
Potato, process waste	40	STMR × 20[a]	40	STMR × 20[a]
Potato, dried pulp	76	STMR × 38[a]	76	STMR × 38[a]
Cassava/tapioca, roots	1.30	STMR	2.80	HR
Carrot, culls	0.74	STMR	1.33	HR
Swede, roots	0.74	STMR	1.33	HR
Turnip, roots	0.74	STMR	1.33	HR
Cabbage, heads, leaves	0.26	Mean monitoring[c]	0.65	Max monitoring[c]
Alfalfa, forage (green)	1.46	Median background[b]	1.46	Highest background[b]
Alfalfa, hay (fodder)	3.65	Median background[b] × 2.5[a]	3.65	Median background[b]x 2.5[a]
Alfalfa, meal	3.65	Median background[b] × 2.5[a]	3.65	Highest background[b] × 2.5[a]
Alfalfa, silage	1.61	Median background[b] × 1.1[a]	1.61	Highest background[b] × 1.1[a]
Barley, straw	4.30	Median background[b]	6.02	Highest background[b]
Fodder beets, tops	1.75	Median background[b]	4.42	Highest background[b]
Sugar beets, tops	1.75	Median background[b]	4.42	Highest background[b]
Clover, forage	1.46	Median background[b]	1.46	Highest background[b]
Clover, hay	4.38	Median background[b] × 3[a]	4.38	Highest background[b] × 3[a]
Clover, silage	1.46	Median background[b] × 1[a]	1.46	Highest background[b] × 1[a]
Corn, field, forage/silage	1.52	Median background[b]	1.52	Highest background[b]
Grass, forage (fresh)	1.80	Median background[b]	1.80	Highest background[b]
Grass, hay	6.30	Median background[b] × 3.5[a]	6.30	Highest background[b] × 3.5[a]
Grass, silage	2.88	Median background[b] × 1.6[a]	2.88	Highest background[b] × 1.6[a]
Kale, leaves (forage)	0.56	Median background[b]	2.90	Highest background[b]
Millet, straw (fodder, dry)	4.30	Median background[b]	6.02	Highest background[b]
Oat, straw	4.30	Median background[b]	6.02	Highest background[b]

Feed commodity	Median dietary burden		Maximum dietary burden	
	Input value (mg/kg)	Comment	Input value (mg/kg)	Comment
Rape, forage	1.26	Median background[b]	1.26	Highest background[b]
Rice, straw	4.30	Median background[b]	6.02	Highest background[b]
Rye, straw	4.30	Median background[b]	6.02	Highest background[b]
Triticale, straw	4.30	Median background[b]	6.02	Highest background[b]
Wheat, straw	4.30	Median background[b]	6.02	Highest background[b]
Barley, grain	4.15	Median background[b]	4.15	Median background[b]
Bean, seed (dry)	7.21	Mean monitoring[c]	7.21	Mean monitoring[c]
Corn, field, grain	4.15	Median background[b]	4.15	Median background[b]
Corn, pop, grain	4.15	Median background[b]	4.15	Median background[b]
Cotton, undelinted seed	12.02	Median background[b]	12.02	Median background[b]
Cowpea, seed	7.21	Median background[b]	7.21	Median background[b]
Lupin, seed	7.30	Median background[b]	7.30	Median background[b]
Millet, grain	4.15	Median background[b]	4.15	Median background[b]
Oat, grain	4.15	Median background[b]	4.15	Median background[b]
Field pea, seed (dry)	7.30	Median background[b]	7.30	Median background[b]
Rye, grain	4.15	Median background[b]	4.15	Median background[b]
Sorghum, grain	4.15	Median background[b]	4.15	Median background[b]
Soybean, seed	12.02	Median background[b]	12.02	Median background[b]
Triticale, grain	4.15	Median background[b]	4.15	Median background[b]
Wheat, grain	4.15	Median background[b]	4.15	Median background[b]
Sugar beets, dried pulp	22.5	Median background[b] × 18[a]	22.5	Median background[b] × 18[a]
Sugar beets, ensiled pulp	3.75	Median background[b] × 3[a]	3.75	Median background[b] × 3[a]
Sugar beets, molasses	35	Median background[b] × 28[a]	35	Median background[b] × 28[a]
Brewer's grain, dried	13.70	Median background[b] × 3.3[a]	13.70	Median background[b] × 3.3[a]
Canola, meal	24.04	Median background[b] × 2[a]	24.04	Median background[b] × 2[a]
Corn, field, milled by-pdts	4.15	Median background[b] × 1[a]	4.15	Median background[b] × 1[a]
Corn, field, hominy meal	24.90	Median background[b] × 6[a]	24.90	Median background[b] × 6[a]
Corn, field, gluten feed	10.38	Median background[b] × 2.5[a]	10.38	Median background[b] × 2.5[a]
Corn, field, gluten, meal	4.15	Median background[b] × 1[a]	4.15	Median background[b] × 1[a]
Cotton, meal	15.63	Median background[b] × 1.3[a]	15.63	Median background[b] × 1.3[a]
Distiller's grain, dried	13.70	Median background[b] × 3.3[a]	13.70	Median background[b] × 3.3[a]
Flaxseed/Linseed, meal	24.04	Median background[b] × 2[a]	24.04	Median background[b] × 2[a]
Lupin seed, meal	8.03	Median background[b] × 1.1[a]	8.03	Median background[b] × 1.1[a]
Palm (hearts), kernel meal	1.30	Median background[b] × 2[a]	1.30	Median background[b] × 2[a]
Peanut, meal	24.04	Median background[b] × 2[a]	24.04	Median background[b] × 2[a]
Rape seed, meal	24.04	Median background[b] × 2[a]	24.04	Median background[b] × 2[a]

Feed commodity	Median dietary burden		Maximum dietary burden	
	Input value (mg/kg)	Comment	Input value (mg/kg)	Comment
Rice, bran/pollard	41.50	Median background[(b)] × 10[(a)]	41.50	Median background[(b)] × 10[(a)]
Safflower, meal	24.04	Median background[(b)] × 2[(a)]	24.04	Median background[(b)] × 2[(a)]
Soybean, meal	15.63	Median background[(b)] × 1.3[(a)]	15.63	Median background[(b)] × 1.3[(a)]
Soybean, hulls	156.26	Median background[(b)] × 13[(a)]	156.26	Median background[(b)] × 13[(a)]
Sugarcane, molasses	22.08	Median background[(b)] × 32[(a)]	22.08	Median background[(b)] × 32[(a)]
Sunflower, meal	36.82	Mean monitoring[(c)] × 2[(a)]	36.82	Mean monitoring[(c)] × 2[(a)]
Wheat gluten, meal	7.47	Median background[(b)] × 1.8[(a)]	7.47	Median background[(b)] × 1.8[(a)]
Wheat, milled by-pdts	29.05	Median background[(b)] × 7[(a)]	29.05	Median background[(b)] × 7[(a)]

STMR: supervised trials median residue; HR: highest residue; PF: processing factor.
(a): For all processed feed items where no data were available to support a PF, default PFs were included in the calculation to consider the potential concentration of residues in these commodities.
(b): Median background level estimated from the survey of the RMS (France, 2016), see Annex A for details.
(c): Mean value estimated from the monitoring data (2009–2015); see Annex B for details.

D.2. Consumer risk assessment

Consumer risk assessment Commodity	Chronic risk assessment	
	Input value (mg/kg)	Comment
Risk assessment residue definition: total copper		
Grapefruits	1.22	STMR (tentative) × PF (peeling)
Oranges	1.22	STMR (tentative) × PF (peeling)
Lemons	1.18	STMR (tentative) × PF (peeling)
Limes	1.18	STMR (tentative) × PF (peeling)
Mandarins	1.18	STMR (tentative) × PF (peeling)
Almonds	11.7	STMR (tentative)
Brazil nuts	11.7	STMR (tentative)
Cashew nuts	13.3	Median background levels
Chestnuts	11.7	STMR (tentative)
Coconuts	4.50	Median background levels
Hazelnuts/cobnuts	11.7	STMR (tentative)
Macadamias	11.7	STMR (tentative)
Pecans	11.7	STMR (tentative)
Pine nut kernels	16.0	Mean monitoring data
Pistachios	11.7	STMR (tentative)
Walnuts	11.7	STMR (tentative)
Apples	1.41	STMR
Pears	1.41	STMR
Quinces	1.41	STMR
Medlars	1.41	STMR
Loquats/Japanese medlars	1.41	STMR
Apricots	1.50	STMR
Cherries (sweet)	2.69	STMR
Peaches	2.35	STMR
Plums	1.15	STMR (tentative)

Consumer risk assessment Commodity	Chronic risk assessment	
	Input value (mg/kg)	Comment
Table grapes	8.70	STMR
Wine grapes	2.55	**Scenario 1:** STMR × 0.75 (yield factor for juice) × PF (juice)
	0.35	**Scenario 2:** Median background levels × 0.75 (yield factor for juice) × PF (juice)
Strawberries	2.29	STMR
Blackberries	1.00	STMR
Dewberries	1.00	STMR
Raspberries (red and yellow)	1.00	STMR
Blueberries	1.00	STMR
Cranberries	1.00	STMR
Currants (black, red and white)	1.00	STMR
Gooseberries (green, red and yellow)	1.00	STMR
Rose hips	1.00	STMR
Mulberries (black and white)	1.00	STMR
Azaroles/Mediterranean medlars	1.00	STMR
Elderberries	1.00	STMR
Dates	0.86	Median background levels
Figs	7.85	Mean monitoring data
Table olives	6.23	STMR (tentative)
Kumquats	0.86	Median background levels
Carambolas	0.86	Median background levels
Kaki/Japanese persimmons	0.86	Median background levels
Jambuls/jambolans	2.69	STMR
Kiwi fruits (green, red, yellow)	6.94	STMR (tentative)
Litchis/lychees	1.48	Median background levels
Passionfruits/maracujas	3.55	Mean monitoring data
Prickly pears/cactus fruits	1.48	Median background levels
Star apples/cainitos	1.48	Median background levels
American persimmons/Virginia kaki	1.48	Median background levels
Avocados	0.96	Median background levels
Bananas	0.96	Median background levels
Mangoes	0.96	Median background levels
Papayas	0.96	Median background levels
Granate apples/pomegranates	0.96	Median background levels
Cherimoyas	0.96	Median background levels
Guavas	0.96	Median background levels
Pineapples	0.96	Median background levels
Breadfruits	0.96	Median background levels
Durians	0.96	Median background levels
Soursops/guanabanas	0.96	Median background levels
Potatoes	2.00	**Scenario 1:** STMR
	1.30	**Scenario 2:** STMR (fall-back southern GAP)
Cassava roots/manioc	1.30	STMR
Sweet potatoes	1.30	STMR
Yams	1.30	STMR

Consumer risk assessment Commodity	Chronic risk assessment	
	Input value (mg/kg)	Comment
Arrowroots	1.30	STMR
Beetroots	0.74	STMR (tentative)
Carrots	0.74	STMR (tentative)
Celeriacs/turnip rooted celeries	0.74	STMR (tentative)
Horseradishes	0.74	STMR (tentative)
Jerusalem artichokes	0.74	STMR (tentative)
Parsnips	0.74	STMR (tentative)
Parsley roots/Hamburg roots parsley	0.74	STMR (tentative)
Radishes	0.74	STMR (tentative)
Salsifies	0.74	STMR (tentative)
Swedes/rutabagas	0.74	STMR (tentative)
Turnips	0.74	STMR (tentative)
Garlic	1.93	Mean monitoring data
Onions	0.60	STMR
Shallots	0.60	STMR
Spring onions/green onions and Welsh onions	14.6	STMR
Tomatoes	2.50	**Scenario 1:** STMR
	0.75	**Scenario 2:** STMR (median background levels)
Sweet peppers/bell peppers	3.45	STMR
Aubergines/eggplants	2.50	STMR
Okra/lady's fingers	0.94	Median background levels
Cucumbers	2.00	STMR
Gherkins	2.00	STMR
Courgettes	2.00	STMR
Melons	4.20	STMR (tentative) × PF (peeling)
Pumpkins	4.20	STMR (tentative) × PF (peeling)
Watermelons	4.20	STMR (tentative) × PF (peeling)
Sweet corn	0.48	Median background levels
Broccoli	1.25	STMR
Cauliflowers	1.25	STMR
Brussels sprouts	0.41	Median background levels
Head cabbages	0.26	Mean monitoring data
Chinese cabbages/pe-tsai	0.56	Median background levels
Kales	0.56	Median background levels
Kohlrabies	0.56	Median background levels
Lamb's lettuces/corn salads	34.6	STMR
Lettuces	34.6	**Scenario 1:** STMR
	0.83	**Scenario 2:** Median background levels
Escaroles/broad-leaved endives	34.6	STMR
Cresses and other sprouts and shoots	34.6	STMR
Land cresses	34.6	STMR
Roman rocket/rucola	34.6	STMR
Red mustards	34.6	STMR
Baby leaf crops (including brassica species)	34.6	STMR

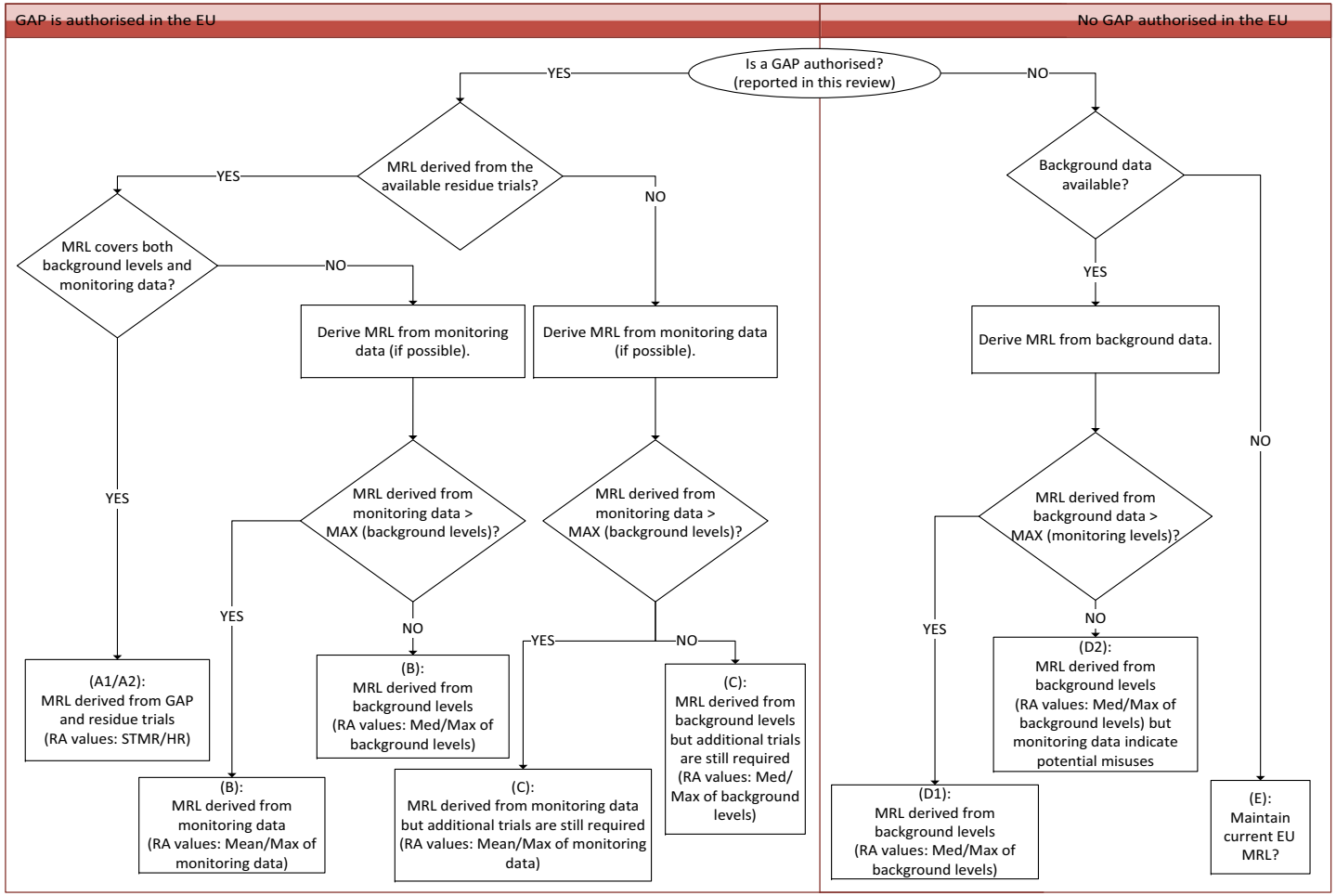
Consumer risk assessment Commodity	Chronic risk assessment	
	Input value (mg/kg)	Comment
Spinaches	34.6	STMR
Purslanes	34.6	STMR
Chards/beet leaves	34.6	STMR
Grape leaves and similar species	4.15	Median background levels
Watercresses	11.7	STMR (tentative)
Witloofs/Belgian endives	0.51	Median background levels
Chervil	34.6	STMR
Chives	34.6	STMR
Celery leaves	34.6	STMR
Parsley	34.6	STMR
Sage	34.6	STMR
Rosemary	34.6	STMR
Thyme	34.6	STMR
Basil and edible flowers	34.6	STMR
Laurel/bay leave	34.6	STMR
Tarragon	34.6	STMR
Beans (with pods)	3.25	STMR (tentative)
Beans (without pods)	3.18	Median background levels
Peas (with pods)	3.25	STMR (tentative)
Peas (without pods)	2.39	STMR (tentative)
Lentils (fresh)	3.18	Median background levels
Asparagus	0.65	Median background levels
Cardoons	0.65	Median background levels
Celeries	0.65	Median background levels
Florence fennels	0.65	Median background levels
Globe artichokes	7.44	STMR
Leeks	14.6	STMR
Rhubarbs	0.65	Median background levels
Bamboo shoots	0.65	Median background levels
Palm hearts	0.65	Median background levels
Cultivated fungi	2.86	Median background levels
Wild fungi	2.86	Median background levels
Algae and prokaryotes organisms	0.44	Median background levels
Beans (dry)	7.21	Mean monitoring data
Lentils (dry)	9.19	Mean monitoring data
Peas (dry)	7.30	Median background levels
Lupins/lupini beans (dry)	7.30	Median background levels
Linseeds	12.0	Median background levels
Peanuts/groundnuts	12.0	Median background levels
Poppy seeds	12.0	Median background levels
Sesame seeds	12.0	Median background levels
Sunflower seeds	18.4	Mean monitoring data
Rapeseeds/canola seeds	1.20	Median background levels × PF (oil)
Soyabeans	12.0	Median background levels
Mustard seeds	12.0	Median background levels
Cotton seeds	12.0	Median background levels
Pumpkin seeds	12.0	Median background levels

Consumer risk assessment Commodity	Chronic risk assessment	
	Input value (mg/kg)	Comment
Safflower seeds	12.0	Median background levels
Borage seeds	12.0	Median background levels
Gold of pleasure seeds	12.0	Median background levels
Hemp seeds	12.0	Median background levels
Castor beans	12.0	Median background levels
Olives for oil production	0.62	STMR (tentative) × PF (oil)
Oil palms kernels	30	EU MRL
Oil palms fruits	30	EU MRL
Kapok	30	EU MRL
Barley grains	4.15	Median background levels
Buckwheat and other pseudo-cereal grains	8.42	Median background levels
Maize/corn grains	4.15	Median background levels
Common millet/proso millet grains	4.15	Median background levels
Oat grains	4.15	Median background levels
Rice grains	4.15	Median background levels
Rye grains	4.15	Median background levels
Sorghum grains	4.15	Median background levels
Wheat grains	4.15	Median background levels
Teas	25.0	Median background levels
Coffee beans	16.3	Median background levels
Herbal infusions from flowers	0.30	Median background levels
Herbal infusions from leaves and herbs	0.30	Median background levels
Herbal infusions from roots	0.95	Median background levels
Cocoa beans	1.50	Median background levels
Carobs/Saint John's breads	5.71	Median background levels
Hops	337.5	STMR (tentative)
Seed spices	9.75	Median background levels
Fruit spices	11.3	Median background levels
Bark spices	3.39	Median background levels
Root and rhizome spices	2.13	Median background levels
Bud spices	3.61	Median background levels
Flower pistil spices	3.28	Median background levels
Aril spices	24.7	Median background levels
Sugar beet roots	1.25	Median background levels
Sugar canes	0.69	Median background levels
Chicory roots	1.09	Median background levels
Swine muscle	0.88	Median background levels
Swine fat tissue	0.41	Median background levels
Swine liver	11.6	Median background levels
Swine kidney	7.28	Median background levels
Bovine muscle	0.90	Median background levels
Bovine fat tissue	0.39	Median background levels
Bovine liver	86.7	Mean monitoring data
Bovine kidney	4.61	Median background levels
Sheep muscle	1.25	Median background levels
Sheep fat tissue	0.30	Median background levels

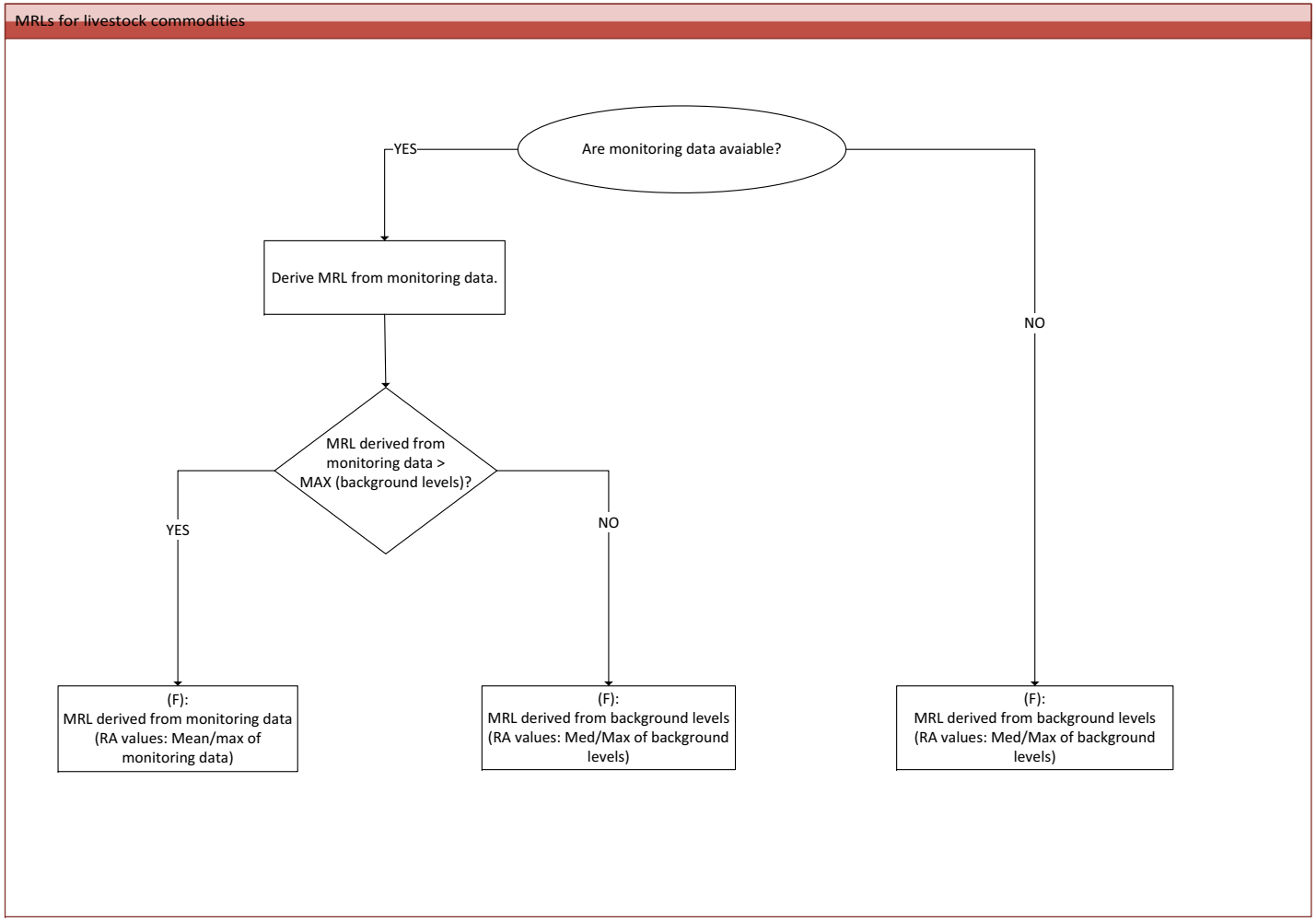
Consumer risk assessment Commodity	Chronic risk assessment	
	Input value (mg/kg)	Comment
Sheep liver	90	Median background levels
Sheep kidney	3.85	Median background levels
Goat muscle	1.25	Median background levels
Goat fat tissue	0.30	Median background levels
Goat liver	90	Median background levels
Goat kidney	3.85	Median background levels
Equine muscle	0.90	Median background levels
Equine fat tissue	0.39	Median background levels
Equine liver	64.3	Median background levels
Equine kidney	4.61	Median background levels
Poultry muscle	3.47	Mean monitoring data
Poultry fat tissue	0.00	Median background levels
Poultry liver	6.90	Median background levels
Cattle milk	0.24	Mean monitoring data
Sheep milk	0.24	Mean monitoring data
Goat milk	0.24	Mean monitoring data
Horse milk	0.24	Mean monitoring data
Birds eggs	0.58	Mean monitoring data
Wild terrestrial animal vertebrate	1.72	Mean monitoring data

Appendix E – Decision trees

E.1. Decision tree for deriving MRLs in plant commodities (ad-hoc methodology proposed for copper)



E.2. Decision tree for deriving MRLs in livestock commodities (ad-hoc methodology proposed for copper)



Appendix F – Comparison of MRL derived from GAPs with other sources of residues

F.1. Plant commodities

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
110010	Grapefruits	Y	15	3.55	n.r.	1.29	15	MRL derived from GAP and trials
110020	Oranges	Y	15	0.59	n.r.	1.29	15	MRL derived from GAP and trials
110030	Lemons	Y	15	0.55	n.r.	1.29	15	MRL derived from GAP and trials
110040	Limes	Y	15	–	–	1.29	15	MRL derived from GAP and trials
110050	Mandarins	Y	15	0.63	n.r.	1.29	15	MRL derived from GAP and trials
120010	Almonds	Y	40	–	–	17.9	40	MRL derived from GAP and trials
120020	Brazil nuts	Y	40	22.2	n.r.	17.9	40	MRL derived from GAP and trials
120030	Cashew nuts	Y	3	–	–	37	40	MRL derived from background data, no monitoring data available (trials supporting the authorised GAP may not reflect the background levels as they were extrapolated from other orchards)
120040	Chestnuts	Y	40	–	–	17.9	40	MRL derived from GAP and trials
120050	Coconuts	Y	3	–	–	4.5	5	MRL derived from background data, no monitoring data available, available (trials supporting the authorised GAP may not reflect the background levels as they were extrapolated from other orchards)
120060	Hazelnuts	Y	40	18.3	n.r.	17.9	40	MRL derived from GAP and trials
120070	Macadamias	Y	40	–	–	17.9	40	MRL derived from GAP and trials
120080	Pecans	Y	40	–	–	17.9	40	MRL derived from GAP and trials
120090	Pine nut kernels	Y	3	35.0	33.6 (34)	37	40	MRL derived from monitoring data, using the 'spices approach'[g], available (trials supporting the authorised GAP may not reflect the background levels as they were extrapolated from other orchards)
120100	Pistachios	Y	40	–	–	37	40	MRL derived from GAP and trials
120110	Walnuts	Y	40	20.4	n.r.	17.9	40	MRL derived from GAP and trials
130010	Apples	Y	6	1.50	n.r.	1.30	6	MRL derived from GAP and trials
130020	Pears	Y	6	4.43	n.r.	1.30	6	MRL derived from GAP and trials

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
130030	Quinces	Y	6	< 2	n.r.	1.30	6	MRL derived from GAP and trials
130040	Medlars	Y	6	–	–	1.30	6	MRL derived from GAP and trials
130050	Loquats	Y	6	–	–	1.30	6	MRL derived from GAP and trials
140010	Apricots	Y	3	1.60	n.r.	1.34	3	MRL derived from GAP and trials
140020	Cherries	Y	10	1.18	n.r.	1.34	10	MRL derived from GAP and trials
140030	Peaches	Y	8	1.45	n.r.	1.34	8	MRL derived from GAP and trials
140040	Plums	Y	4	0.96	n.r.	1.34	4	MRL derived from GAP and trials
151010	Table grapes	Y	100	9.60	n.r.	1.5	100	MRL derived from GAP and trials
151020	Wine grapes	Y	100	1.20	n.r.	1.5	100/2	MRL of 100 mg/kg derived from GAP and trials. A fall-back MRL of 2 mg/kg can be derived based on background data
152000	Strawberries	Y	15	1.20	n.r.	0.48	15	MRL derived from GAP and trials
153010	Blackberries	Y	5	1.40	n.r.	2.2	5*	MRL derived from GAP and trials
153020	Dewberries	Y	5	0.79	n.r.	2.2	5*	MRL derived from GAP and trials
153030	Raspberries	Y	5	1.19	n.r.	2.2	5*	MRL derived from GAP and trials
154010	Blueberries	Y	5	0.97	n.r.	2.2	5*	MRL derived from GAP and trials
154020	Cranberries	Y	5	0	n.r.	2.2	5*	MRL derived from GAP and trials
154030	Currants	Y	5	1.10	n.r.	2.2	5*	MRL derived from GAP and trials
154040	Gooseberries	Y	5	0.82	n.r.	2.2	5*	MRL derived from GAP and trials
154050	Rose hips	Y	5	–	–	2.2	5*	MRL derived from GAP and trials
154060	Mulberries	Y	5	–	–	2.2	5*	MRL derived from GAP and trials
154070	Azaroles	Y	5	–	–	2.2	5*	MRL derived from GAP and trials
154080	Elderberries	Y	5	–	–	2.2	5*	MRL derived from GAP and trials
161010	Dates	N	–	1.73	n.r.	1.37	2*	MRL derived from background data, also covering monitoring data
161020	Figs	Y	–	23.8	n.r.	1.37	30	MRL derived from monitoring data, tentative approach based on the highest value, authorised GAP may not be covered by the proposed MRL
161030	Table olives	Y	20	3.68	n.r.	2.7	20	MRL derived from GAP and trials

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
161040	Kumquats	N	–	< 2	n.r.	1.37	2*	MRL derived from background data, also covering monitoring data
161050	Carambolas	N	–	–	–	1.37	2*	MRL derived from background data, no monitoring data available
161060	Kaki	N	–	0.32	n.r.	1.37	2*	MRL derived from background data, also covering monitoring data
161070	Jambuls	Y	10	–	–	1.37	10	MRL derived from GAP and trials
162010	Kiwi fruits	Y	30	2.15	n.r.	2	30	MRL derived from GAP and trials
162020	Litchis	N	–	3.17	n.r.	2	2*	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
162030	Passion fruits	Y	–	3.55	n.r.	2	4	MRL derived from monitoring data, tentative approach based on the highest value, authorised GAP may not be covered by the proposed MRL
162040	Prickly pears	N	–	–	–	2	2*	MRL derived from background data, no monitoring data available
162050	Star apples	N	–	–	–	2	2*	MRL derived from background data, no monitoring data available
162060	American persimmons	N	–	–	–	2	2*	MRL derived from background data, no monitoring data available
163010	Avocados	N	–	3.22	n.r.	5.3	6	MRL derived from background data, also covering monitoring data
163020	Bananas	N	–	1.63	n.r.	5.3	6	MRL derived from background data, also covering monitoring data
163030	Mangoes	Y	–	1.10	n.r.	5.3	6	MRL derived from background data, also covering monitoring data, authorised GAP may not be covered by the proposed MRL
163040	Papayas	N	–	0.48	n.r.	5.3	6	MRL derived from background data, also covering monitoring data
163050	Granate apples	N	–	1.69	n.r.	5.3	6	MRL derived from background data, also covering monitoring data

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
163060	Cherimoyas	Y	–	–	–	5.3	6	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
163070	Guavas	N	–	0.78	n.r.	5.3	6	MRL derived from background data, also covering monitoring data
163080	Pineapples	N	–	1.30	n.r.	5.3	6	MRL derived from background data, also covering monitoring data
163090	Breadfruits	N	–	–	–	5.3	6	MRL derived from background data, no monitoring data available
163100	Durians	N	–	–	–	5.3	6	MRL derived from background data, no monitoring data available
163110	Soursops	N	–	–	–	5.3	6	MRL derived from background data, no monitoring data available
211000	Potatoes	Y	7	6.32	n.r.	1.34	7/4	MRL of 7 mg/kg derived from the most critical GAP (NEU) and trials. A fall-back MRL of 4 mg/kg can be derived based on a fall-back GAP (SEU).
212010	Cassava roots	Y	4	–	–	1.78	4	MRL derived from GAP and trials
212020	Sweet potatoes	Y	4	0.68	n.r.	1.78	4	MRL derived from GAP and trials
212030	Yams	Y	4	–	–	1.78	4	MRL derived from GAP and trials
212040	Arrowroots	Y	4	–	–	1.78	4	MRL derived from GAP and trials
213010	Beetroots	Y	3	1.13	n.r.	3	3	MRL derived from GAP and trials
213020	Carrots	Y	3	0.82	n.r.	3	3	MRL derived from GAP and trials
213030	Celeriacs	Y	3	2.31	n.r.	3	3	MRL derived from GAP and trials
213040	Horseradishes	Y	3	–	–	3	3	MRL derived from GAP and trials
213050	Jerusalem artichokes	Y	3	–	–	3	3	MRL derived from GAP and trials
213060	Parsnips	Y	3	1.38	n.r.	3	3	MRL derived from GAP and trials
213070	Parsley roots	Y	3	1.46	n.r.	3	3	MRL derived from GAP and trials
213080	Radishes	Y	3	0.67	n.r.	3	3	MRL derived from GAP and trials

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
213090	Salsifies	Y	3	1.90	n.r.	3	3	MRL derived from GAP and trials
213100	Swedes	Y	3	0	n.r.	3	3	MRL derived from GAP and trials
213110	Turnips	Y	3	–	–	3	3	MRL derived from GAP and trials
220010	Garlic	Y	2	3.79	n.r.	2.99	4	MRL derived from monitoring data, tentative approach based on the highest value available (trials supporting the authorised GAP may not reflect the background levels as they were extrapolated from onions).
220020	Onions	Y	2	0.93	n.r.	1.3	2*	MRL derived from GAP and trials
220030	Shallots	Y	2	0	n.r.	0.88	2*	MRL derived from GAP and trials
220040	Spring onions	Y	70	0.52	n.r.	0.83	70	MRL derived from GAP and trials
231010	Tomatoes	Y	10	2.17	n.r.	1.74	10/2	MRL of 10 mg/kg derived from GAP and trials. A fall-back MRL of 2 mg/kg can be derived based on background data
231020	Sweet peppers	Y	20	1.20	n.r.	1.74	20	MRL derived from GAP and trials
231030	Aubergines	Y	10	0.87	n.r.	1.74	10	MRL derived from GAP and trials
231040	Okra	N	–	–	–	1.09	2*	MRL derived from background data, no monitoring data available
232010	Cucumbers	Y	5	1.06	n.r.	1.5	5	MRL derived from GAP and trials
232020	Gherkins	Y	5	–	–	1.5	5	MRL derived from GAP and trials
232030	Courgettes	Y	5	2.00	n.r.	1.5	5	MRL derived from GAP and trials
233010	Melons	Y	10	0.35	n.r.	1.27	10	MRL derived from GAP and trials
233020	Pumpkins	Y	10	0.71	n.r.	1.27	10	MRL derived from GAP and trials
233030	Watermelons	Y	10	2.09	n.r.	1.27	10	MRL derived from GAP and trials
234000	Sweet corn	N	–	2.01	n.r.	0.54	2*	MRL derived from background data, also covering monitoring data
241010	Broccoli	Y	5	0.78	n.r.	0.7	5	MRL derived from GAP and trials
241020	Cauliflowers	Y	5	0.98	n.r.	0.7	5	MRL derived from GAP and trials
242010	Brussels sprouts	N	–	0.72	n.r.	0.7	2*	MRL derived from background data, also covering monitoring data

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
242020	Head cabbages	Y	–	0.65	n.r.	0.7	2*	MRL derived from monitoring data, based on the highest value, authorised GAP may not be covered by the proposed MRL
243010	Chinese cabbages	N	–	0.64	n.r.	2.9	3	MRL derived from background data, also covering monitoring data
243020	Kales	N	–	62.0	n.r.	2.9	3	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
244000	Kohlrabies	N	–	1.32	n.r.	2.9	3	MRL derived from background data, also covering monitoring data
251010	Lamb's lettuces	Y	150	1.30	n.r.	4	150	MRL derived from GAP and trials
251020	Lettuces	Y	150	101	n.r.	4	150/4	MRL of 150 mg/kg derived from GAP and trials. A fall-back MRL of 4 mg/kg can be derived based on background data
251030	Escaroles	Y	150	0.63	n.r.	4	150	MRL derived from GAP and trials
251040	Cresses	Y	150	–	–	4	150	MRL derived from GAP and trials
251050	Land cresses	Y	150	–	–	4	150	MRL derived from GAP and trials
251060	Roman rocket	Y	150	14.2	n.r.	4	150	MRL derived from GAP and trials
251070	Red mustards	Y	150	–	–	4	150	MRL derived from GAP and trials
251080	Baby leaf crops	Y	150	–	–	2.9	150	MRL derived from GAP and trials
252010	Spinaches	Y	150	10.6	n.r.	4	150	MRL derived from GAP and trials
252020	Purslanes	Y	150	–	–	4	150	MRL derived from GAP and trials
252030	Chards	Y	150	< 2	n.r.	4	150	MRL derived from GAP and trials
253000	Grape leaves	N	–	64.0	n.r.	4.15	5	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
254000	Watercresses	Y	150	1.25	n.r.	1.4	150	MRL derived from GAP and trials
255000	Witloofs	N	–	0.64	n.r.	0.51	2*	MRL derived from background data, also covering monitoring data

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
256010	Chervil	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256020	Chives	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256030	Celery leaves	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256040	Parsley	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256050	Sage	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256060	Rosemary	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256070	Thyme	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256080	Basil	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256090	Laurel	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
256100	Tarragon	Y	150	42.1	n.r.	6.77	150	MRL derived from GAP and trials
260010	Beans (with pods)	Y	10	1.52	n.r.	4.4	10	MRL derived from GAP and trials
260020	Beans (without pods)	Y	–	–	–	3.18	4	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
260030	Peas (with pods)	Y	10	1.32	n.r.	6.56	10	MRL derived from GAP and trials
260040	Peas (without pods)	Y	7	1.42	n.r.	1.76	7	MRL derived from GAP and trials
260050	Lentils (fresh)	Y	–	–	–	3.18	4	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
270010	Asparagus	Y	–	1.87	n.r.	6.44	7	MRL derived from background data, also covering monitoring data, authorised GAP may not be covered by the proposed MRL
270020	Cardoons	Y	–	–	–	6.44	7	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
270030	Celeries	N	–	0.24	n.r.	6.44	7	MRL derived from background data, also covering monitoring data

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
270040	Florence fennels	N	–	0.70	n.r.	6.44	7	MRL derived from background data, also covering monitoring data
270050	Globe artichokes	Y	30	–	–	6.44	30	MRL derived from GAP and trials
270060	Leeks	Y	70	0.77	n.r.	6.44	70	MRL derived from GAP and trials
270070	Rhubarbs	N	–	0.50	n.r.	6.44	7	MRL derived from background data, also covering monitoring data
270080	Bamboo shoots	N	–	–	–	6.44	7	MRL derived from background data, no monitoring data available
270090	Palm hearts	N	–	–	–	6.44	7	MRL derived from background data, no monitoring data available
280010	Cultivated fungi	N	–	4.64	n.r.	5.4	6	MRL derived from background data, also covering monitoring data
280020	Wild fungi	N	–	34.7	n.r.	5.4	6	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
290000	Algae	N	–	–	–	2.64	3	MRL derived from background data, no monitoring data available
300010	Beans (dry)	Y	–	17.1	10.8 (13.4)	13.03	15	MRL derived from monitoring data, using the 'spices approach'[g], authorised GAP may not be covered by the proposed MRL
300020	Lentils (dry)	Y	–	15.0	12.2 (13.1)	13.03	15	MRL derived from monitoring data, using the 'spices approach'[g], authorised GAP may not be covered by the proposed MRL
300030	Peas (dry)	N	–	10.9	n.r.	13.03	15	MRL derived from background data, also covering monitoring data
300040	Lupins (dry)	N	–	–	–	13.03	15	MRL derived from background data, no monitoring data available
401010	Linseeds	N	–	18.3	n.r.	21.5	30	MRL derived from background data, also covering monitoring data
401020	Peanuts	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
401030	Poppy seeds	N	–	41.0	n.r.	21.5	30	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
401040	Sesame seeds	N	–	21.3	n.r.	21.5	30	MRL derived from background data, also covering monitoring data
401050	Sunflower seeds	Y	–	24.6	21.9 (24)	21.5	30	MRL derived from monitoring data, using the 'spices approach'[g], authorised GAP may not be covered by the proposed MRL
401060	Rapeseeds	Y	–	–	–	21.5	30	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
401070	Soyabeans	Y	–	–	–	21.5	30	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
401080	Mustard seeds	N	–	18.4	n.r.	21.5	30	MRL derived from background data, also covering monitoring data
401090	Cotton seeds	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available
401100	Pumpkin seeds	N	–	12.3	n.r.	21.5	30	MRL derived from background data, also covering monitoring data
401110	Safflower seeds	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available
401120	Borage seeds	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available
401130	Gold of pleasure seeds	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available
401140	Hemp seeds	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available
401150	Castor beans	N	–	–	–	21.5	30	MRL derived from background data, no monitoring data available

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
402010	Olives for oil production	Y	20	–	–	2.7	20	MRL derived from GAP and trials
402020	Oil palms kernels	N	–	–	–	no data	–	No MRL proposal possible (no GAP authorised, no background data and no monitoring data).
402030	Oil palms fruits	N	–	–	–	no data	–	No MRL proposal possible (no GAP authorised, no background data and no monitoring data).
402040	Kapok	N	–	–	–	no data	–	No MRL proposal possible (no GAP authorised, no background data and no monitoring data).
500010	Barley	N	–	11.9	n.r.	10	10	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
500020	Buckwheat	N	–	7.35	n.r.	11	15	MRL derived from background data, also covering monitoring data
500030	Maize	N	–	–	–	10	10	MRL derived from background data, no monitoring data available
500040	Common millet	N	–	6.73	n.r.	10	10	MRL derived from background data, also covering monitoring data
500050	Oat	N	–	5.64	n.r.	10	10	MRL derived from background data, also covering monitoring data
500060	Rice	N	–	12.2	n.r.	10	10	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
500070	Rye	N	–	8.43	n.r.	10	10	MRL derived from background data, also covering monitoring data
500080	Sorghum	N	–	–	–	10	10	MRL derived from background data, no monitoring data available
500090	Wheat	N	–	10.1	n.r.	10	10	MRL derived from background data, also covering monitoring data
610000	Teas	N	–	21.8	n.r.	25	30	MRL derived from background data, also covering monitoring data

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
620000	Coffee beans	N	–	23.4	n.r.	17	20	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation
631000	Herbal infusions from flowers	N	–	0.63	n.r.	0.49	5*	MRL derived from background data, also covering monitoring data. A default LOQ of 5 mg/kg is considered for complex matrices
632000	Herbal infusions from leaves and herbs	N	–	–	–	0.49	5*	MRL derived from background data, no monitoring data available. A default LOQ of 5 mg/kg is considered for complex matrices
633000	Herbal infusions from roots	N	–	–	–	3	5*	MRL derived from background data, no monitoring data available. A default LOQ of 5 mg/kg is considered for complex matrices
640000	Cocoa beans	N	–	–	–	1.5	5*	MRL derived from background data, no monitoring data available. A default LOQ of 5 mg/kg is considered for complex matrices
650000	Carobs	N	–	–	–	5.71	6	MRL derived from background data, no monitoring data available.
700000	Hops	Y	1500	370	n.r.	No data	1500	MRL derived from GAP and trials
810000	Seed spices	N	–	–	–	13.7	15	MRL derived from background data, no monitoring data available
820000	Fruit spices	N	–	–	–	11.3	15	MRL derived from background data, no monitoring data available
830000	Bark spices	N	–	–	–	3.39	5*	MRL derived from background data, no monitoring data available. A default LOQ of 5 mg/kg is considered for complex matrices
840000	Root and rhizome spices	N	–	10.32	n.r.	2.3	5*	MRL derived from background data. Monitoring data indicate potential higher residues, which cannot be used for MRL calculation. A default LOQ of 5 mg/kg is considered for complex matrices
850000	Bud spices	N	–	–	–	3.74	5*	MRL derived from background data, no monitoring data available. A default LOQ of 5 mg/kg is considered for complex matrices

Code	Commodity	GAP authorised[a]?	MRL derived from GAP[b] (mg/kg)	Monitoring data (mg/kg)		MAX value background data[e] (mg/kg)	MRL proposal[f] (mg/kg)	Comment on MRL proposal
				MAX value[c]	P95 (UCI)[d]			
860000	Flower pistil spices	N	–	–	–	3.28	5*	MRL derived from background data, no monitoring data available. A default LOQ of 5 mg/kg is considered for complex matrices.
870000	Aril spices	N	–	–	–	24.67	30	MRL derived from background data, no monitoring data available
900010	Sugar beets	Y	–	–	–	2	2*	MRL derived from background data, no monitoring data available, authorised GAP may not be covered by the proposed MRL
900020	Sugar canes	N	–	–	–	1.7	2*	MRL derived from background data, no monitoring data available
900030	Chicory roots	N	–	–	–	1.4	2*	MRL derived from background data, no monitoring data available

GAP: Good Agricultural Practice; MRL: maximum residue level; UCI: Upper Confidence Interval; n.r.: not relevant; NEU: northern European Union; SEU: southern European Union; LOQ: limit of quantification.
*: Indicates that the MRL is derived at the limit of quantification.
(a): Is there a GAP authorised in the EU? (see also Appendix A: Summary of authorised uses considered for the review of MRL).
(b): At least one relevant GAP reported during this review is supported by data for this commodity; an (tentative) MRL was derived based on residue trials (reference to Appendix B.1.2.1).
(c): Highest value found in the monitoring data from 2009 to 2015 (see Annex B).
(d): P95: Percentile 95th; when the MRL proposal derived from GAP and trials was lower than the max value of the monitoring data or when no MRL proposals could be derived from the reported GAP, the P95th (and its upper confidence interval) of the monitoring data were calculated (this indicator could only be calculated when more than 58 positive results were available); the UCI of the calculated P95th is reported between bracket.
(e): Highest value from the background levels reported by RMS, considering pooling similar commodities (France, 2016, see Annex A).
(f): Final MRL proposal derived in accordance with decision tree reported in Appendix D.1.
(g): 'Spices approach': MRL proposal is based on the upper confidence interval of the Percentile 95th; this approach is only applicable when more than 58 data are available.

F.2. Animal commodities

Code	Commodity	Monitoring data (mg/kg)		MAX value background data[c] (mg/kg)	MRL proposal[d] (mg/kg)	Comment on MRL proposal
		MAX value[a]	P95 (UCI)[b]			
1011010	Swine muscle	3.55	n.r.	6.85	7	MRL derived from background levels, also covering monitoring data
1011020	Swine fat tissue	–	–	1.06	2	MRL derived from background levels. No monitoring data available
1011030	Swine liver	19.2	n.r.	84.3	90	MRL derived from background levels, also covering monitoring data
1011040	Swine kidney	–	–	9.25	10	MRL derived from background levels. No monitoring data available
1012010	Bovine muscle	2.02	n.r.	2.20	3	MRL derived from background levels, also covering monitoring data
1012020	Bovine fat tissue	–	–	0.50	0.6*	MRL derived from background levels. No monitoring data available
1012030	Bovine liver	374	256 (326)	374	400	MRL derived from monitoring data using the 'spices approach'[e] and covering background levels (the highest value observed in monitoring data and background levels was deemed as an outlier)
1012040	Bovine kidney	3.45	n.r.	10.0	10	MRL derived from background levels, also covering monitoring data
1013010	Sheep muscle	2.95	1.58 (1.96)	2.56	3	MRL derived from background levels, also covering monitoring data
1013020	Sheep fat tissue	–	–	0.57	0.6*	MRL derived from background levels. No monitoring data available
1013030	Sheep liver	–	–	131	150	MRL derived from background levels. No monitoring data available
1013040	Sheep kidney	–	–	5.39	6	MRL derived from background levels. No monitoring data available
1014010	Goat muscle	–	–	2.56	3	MRL derived from background levels. No monitoring data available
1014020	Goat fat tissue	–	–	0.57	0.6*	MRL derived from background levels. No monitoring data available
1014030	Goat liver	–	–	131	150	MRL derived from background levels. No monitoring data available
1014040	Goat kidney	–	–	5.39	6	MRL derived from background levels. No monitoring data available
1015010	Equine muscle	–	–	2.20	3	MRL derived from background levels. No monitoring data available
1015020	Equine fat tissue	–	–	0.50	0.6*	MRL derived from background levels. No monitoring data available
1015030	Equine liver	–	–	374	400	MRL derived from background levels (the highest value observed in the data set was deemed as an outlier). No monitoring data available
1015040	Equine kidney	–	–	10.0	10	MRL derived from background levels. No monitoring data available
1016010	Poultry muscle	7.10	5.94 (6.9)	5.94	7	MRL derived from monitoring data using the 'spices approach'[e], also covering background levels
1016020	Poultry fat tissue	–	–	0.0	1*	MRL derived from background levels. No monitoring data available
1016030	Poultry liver	3.20	n.r.	75.2	80	MRL derived from background levels, also covering monitoring data

Code	Commodity	Monitoring data (mg/kg)		MAX value background data[c] (mg/kg)	MRL proposal[d] (mg/kg)	Comment on MRL proposal
		MAX value[a]	P95 (UCI)[b]			
1020010	Cattle milk	1.10	0.66 (1)	0.65	1*	MRL derived from monitoring data using the 'spices approach'[e], also covering background levels
1020020	Sheep milk	1.10	0.66 (1)	0.65	1*	MRL derived from monitoring data using the 'spices approach'[e], also covering background levels
1020030	Goat milk	1.10	0.66 (1)	0.65	1*	MRL derived from monitoring data using the 'spices approach'[e], also covering background levels
1020040	Horse milk	1.10	0.66 (1)	0.65	1*	MRL derived from monitoring data using the 'spices approach'[e], also covering background levels
1030000	Birds eggs	3.55	0.67 (0.73)	1.10	1*	MRL derived from monitoring data using the 'spices approach'[e], also covering background levels
1070000	Wild terrestrial animal vertebrate	3.9	2.51 (2.98)	–	3	A MRL of 4 mg/kg, based on the MAX value, was derived in a previous opinion (EFSA, 2014). However, considering the 'spices approach'[e], a MRL of 3 mg/kg can be derived from monitoring data

MRL: maximum residue level; GAP: Good Agricultural Practice; UCI: Upper Confidence Interval; n.r.: not relevant.
*: Indicates that the MRL is derived at the limit of quantification.
(a): Highest value found in the monitoring data from 2009 to 2015 (see Annex B).
(b): P95: Percentile 95th; when the MRL proposal derived from GAP and trials was lower than the max value of the monitoring data or when no MRL proposals could be derived from the reported GAP, the P95th (and its upper confidence interval) of the monitoring data were calculated (this indicator could only be calculated when more than 58 positive results were available); the upper confidence interval (UCI)) of the calculated P95th is reported between bracket.
(c): Highest value from the background levels reported by RMS, considering pooling similar commodities (France, 2016, see Annex A).
(d): Final MRL proposal derived in accordance with decision tree reported in Appendix D.2.
(e): 'Spices approach': MRL proposal is based on the upper confidence interval of the Percentile 95th; this approach is only applicable when more than 58 data are available.

Annex A – Report of survey on background levels (plant and animal commodities)

From: France (2016)

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
110010	Grapefruits	0.32; 0.32; 0.32; 0.37; 0.42; 0.44; 0.47; 0.50; 0.56	0.56	Citrus fruits	1.29	0.49	0.44
110020	Oranges	0.37; 0.39; 0.39; 0.40; 0.45; 0.53; 0.57; 0.70	0.7	Citrus fruits	1.29	0.49	0.44
110030	Lemons	0.26; 0.34; 0.37; 0.53; 1.29	1.29	Citrus fruits	1.29	0.49	0.44
110040	Limes	0.65; 0.65; 0.65	0.65	Citrus fruits	1.29	0.49	0.44
110050	Mandarins	0.36; 0.42; 0.55; 0.56	0.56	Citrus fruits	1.29	0.49	0.44
120010	Almonds	7.80; 8.50; 10.7	10.7	Closed nuts	17.9	10.5	10.7
120020	Brazil nuts	13.0; 17.5; 17.6; 17.9	17.9	Closed nuts	17.9	10.5	10.7
120030	Cashew nuts	21.95; 37	37	Open nuts	37	16.4	13.3
120040	Chestnuts	2.30; 2.30; 3.63; 5.62	5.62	Closed nuts	17.9	10.5	10.7
120050	Coconuts	3.20; 3.78; 4.35; 4.50	4.5	–	4.5	3.96	4.50
120060	Hazelnuts	13.0; 14.0; 15.7	15.7	Closed nuts	17.9	10.5	10.7
120070	Macadamias	7.56; 7.56	7.56	Closed nuts	17.9	10.5	10.7
120080	Pecans	11.9	11.9	Closed nuts	17.9	10.5	10.7
120090	Pine nut kernels	12	12	Open nuts	37	16.4	13.3
120100	Pistachios	11.0; 13.0; 13.0; 13.25; 13.25; 13.3	13.3	Open nuts	37	16.4	13.3
120110	Walnuts	8.80; 13.4	13.4	Closed nuts	17.9	10.5	10.7
130010	Apples	0.27; 0.28; 0.31; 0.40; 0.52	0.52	Pome fruits	1.30	0.67	0.77
130020	Pears	0.50; 0.71; 0.72; 0.77; 0.82	0.82	Pome fruits	1.30	0.67	0.77
130030	Quinces	1.01; 1.30; 1.30; 1.30	1.3	Pome fruits	1.30	0.67	0.77
130040	Medlars	–	–	Pome fruits	1.30	0.67	0.77
130050	Loquats	0.40; 0.40; 0.40	0.4	Pome fruits	1.30	0.67	0.77
140010	Apricots	0.66; 0.78; 0.78; 1.34	1.34	Stone fruits	1.34	0.81	1.02
140020	Cherries	0.60; 0.70; 0.81; 0.99; 1.04	1.04	Stone fruits	1.34	0.81	1.02
140030	Peaches	0.67; 0.68; 0.75; 1.30	1.3	Stone fruits	1.34	0.81	1.02
140040	Plums	0.57; 0.63; 0.71; 0.80; 0.80	0.8	Stone fruits	1.34	0.81	1.02

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
151010	Table grapes	0.40; 0.79; 0.94; 0.96; 0.97; 1.1; 1.15; 1.2; 1.2; 1.2; 1.27; 1.5; 1.5; 1.5	1.5	Grapes	1.5	1.11	1.20
151020	Wine grapes	0.40; 0.79; 0.83; 0.94; 0.96; 0.97; 1.1; 1.15; 1.2; 1.2; 1.2; 1.27; 1.5; 1.5; 1.5	1.5	Grapes	1.5	1.11	1.20
152000	Strawberries	0.34; 0.39; 0.46; 0.48	0.48	–	0.48	0.42	0.43
153010	Blackberries	1.08; 1.10; 1.20; 1.65; 2.20	2.2	Cane fruits and other small fruits and berries	2.2	0.99	1.40
153020	Dewberries	0.3	0.3	Cane fruits and other small fruits and berries	2.2	0.99	1.40
153030	Raspberries	0.90; 0.93; 0.97; 1.05; 1.10	1.1	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154010	Blueberries	0.30; 0.57; 0.69; 0.77; 1.7	1.7	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154020	Cranberries	0.61; 0.61; 0.96	0.96	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154030	Currants	0.88; 0.99; 1.03; 1.07; 1.40; 1.40; 1.40	1.4	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154040	Gooseberries	0.56; 0.63; 0.70; 1.63	1.63	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154050	Rose hips	1.13; 1.80	1.8	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154060	Mulberries	0.60; 0.60	0.6	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154070	Azaroles	0.86	0.86	Cane fruits and other small fruits and berries	2.2	0.99	1.40
154080	Elderberries	0.61; 0.62; 0.9	0.9	Cane fruits and other small fruits and berries	2.2	0.99	1.40
161010	Dates	0.62; 0.74; 0.83	0.83	Miscellaneous fruit with edible peel (except olives)	1.37	0.91	0.86
161020	Figs	0.60; 0.70; 0.70; 0.81	0.81	Miscellaneous fruit with edible peel (except olives)	1.37	0.91	0.86
161030	Table olives	1.20; 1.54; 2.10; 2.26; 2.30; 2.30; 2.51; 2.70	2.7	Olives	2.7	2.11	2.28

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
161040	Kumquats	0.95; 0.95	0.95	Miscellaneous fruit with edible peel (except olives)	1.37	0.91	0.86
161050	Carambolas	1.37; 1.37; 1.37	1.37	Miscellaneous fruit with edible peel (except olives)	1.37	0.91	0.86
161060	Kaki	0.20; 1.13; 1.13; 1.13	1.13	Miscellaneous fruit with edible peel (except olives)	1.37	0.91	0.86
161070	Jambuls	0.86	0.86	Miscellaneous fruit with edible peel (except olives)	1.37	0.91	0.86
162010	Kiwi fruits	0.95; 1.30; 1.47; 1.72	1.72	Miscellaneous fruit with inedible peel, small	2	1.33	1.48
162020	Litchis	1.48; 1.48; 1.48; 2.0	2	Miscellaneous fruit with inedible peel, small	2	1.33	1.48
162030	Passionfruits	0.86; 0.86; 1.60	1.6	Miscellaneous fruit with inedible peel, small	2	1.33	1.48
162040	Prickly pears	0.80	0.8	Miscellaneous fruit with inedible peel, small	2	1.33	1.48
162050	Star apples	–	–	Miscellaneous fruit with inedible peel, small	2	1.33	1.48
162060	American persimmons	–	–	Miscellaneous fruit with inedible peel, small	2	1.33	1.48
163010	Avocados	1.70; 1.90; 1.90; 2.31; 3.11; 5.30	5.3	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163020	Bananas	0.78; 1.02; 1.10; 1.11	1.11	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163030	Mangoes	0.64; 1.10; 1.10; 1.20	1.2	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163040	Papayas	0.16; 0.16; 0.31; 0.32	0.32	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163050	Granate apples	0.70; 1.20; 1.40; 1.58	1.58	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163060	Cherimoyas	0.73; 0.87	0.87	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
163070	Guavas	0.40; 0.40; 0.60; 2.3; 2.30	2.3	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163080	Pineapples	0.61; 0.76; 0.81; 0.90; 1.10; 1.13	1.13	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163090	Breadfruits	0.70; 0.84	0.84	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163100	Durians	2.07	2.07	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
163110	Soursops	0.40; 0.86	0.86	Miscellaneous fruit with inedible peel, large	5.3	1.20	0.96
211000	Potatoes	0.52; 0.91; 1.03; 1.08; 1.16; 1.34	1.34	–	1.34	1.01	1.06
212010	Cassava roots	1.0; 1.0; 1.60	1.6	Tropical roots and vegetables	1.78	1.43	1.51
212020	Sweet potatoes	1.27; 1.33; 1.51; 1.51	1.51	Tropical roots and vegetables	1.78	1.43	1.51
212030	Yams	1.70; 1.78; 1.78	1.78	Tropical roots and vegetables	1.78	1.43	1.51
212040	Arrowroots	1.21	1.21	Tropical roots and vegetables	1.78	1.43	1.51
213010	Beetroots	0.75; 0.84; 1.2	1.2	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213020	Carrots	0.36; 0.39; 0.45; 0.50	0.5	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213030	Celeriacs	0.70; 0.80; 1.15; 1.16	1.16	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213040	Horseradishes	1.44; 1.55; 2.0; 2.30	2.3	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213050	Jerusalem artichokes	1.20; 1.20; 1.40	1.4	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213060	Parsnips	1.20; 1.32; 1.40	1.4	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213070	Parsley roots	2.30	2.3	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213080	Radishes	0.26; 0.40; 0.50; 1.0; 1.15; 1.15; 1.79	1.79	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213090	Salsifies	0.10; 0.89; 1.20; 3.0	3	Other roots and tuber vegetables except sugar beet	3	1.01	0.95

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
213100	Swedes	0.30; 0.40; 0.80	0.8	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
213110	Turnips	0.23; 0.40; 0.56; 0.85	0.85	Other roots and tuber vegetables except sugar beet	3	1.01	0.95
220010	Garlic	0.85; 1.49; 2.99; 2.99	2.99	–	2.99	2.08	2.24
220020	Onions	0.39; 0.44; 0.56; 0.61; 1.30	1.3	–	1.3	0.66	0.56
220030	Shallots	0.88; 0.88	0.88	–	0.88	0.88	0.88
220040	Spring onions	0.83; 0.83	0.83	–	0.83	0.83	0.83
231010	Tomatoes	0.33; 0.39; 0.39; 0.39; 0.42; 0.50; 0.58; 0.59; 0.60; 0.62; 0.66; 0.85; 0.90; 0.90; 1; 1.01	1.01	Solanacea	1.74	0.79	0.75
231020	Sweet peppers	0.17; 0.45; 0.53; 0.66; 0.70; 0.80; 0.94; 1.07; 1.15; 1.29; 1.33; 1.74; 1.74	1.74	Solanacea	1.74	0.79	0.75
231030	Aubergines	0.80; 0.82; 0.90	0.9	Solanacea	1.74	0.79	0.75
231040	Okra	0.14; 0.94; 1.09	1.09	–	1.09	0.72	0.94
232010	Cucumbers	0.21; 0.21; 0.25; 0.25; 0.26; 0.26; 0.26; 0.28; 0.28; 0.28; 0.29; 0.3; 0.3; 0.3; 0.3; 0.31; 0.31; 0.31; 0.31; 0.33; 0.33; 0.33; 0.35; 0.35; 0.37; 0.37; 0.37; 0.37; 0.39; 0.39; 0.4; 0.4; 0.41; 0.43; 0.44; 0.45; 0.47; 0.48; 0.51; 0.58; 0.71	0.71	Cucurbits with edible peel	1.5	0.42	0.37
232020	Gherkins	0.28; 0.57; 0.85; 1.05; 1.5	1.5	Cucurbits with edible peel	1.5	0.42	0.37
232030	Courgettes	0.45; 0.51; 0.51; 0.51; 0.53	0.53	Cucurbits with edible peel	1.5	0.42	0.37
233010	Melons	0.41; 0.41; 0.41; 0.41; 0.46; 0.60	0.6	Cucurbits with inedible peel	1.27	0.55	0.42
233020	Pumpkins	0.80; 0.80; 1.27	1.27	Cucurbits with inedible peel	1.27	0.55	0.42
233030	Watermelons	0.29; 0.30; 0.42; 0.61	0.61	Cucurbits with inedible peel	1.27	0.55	0.42
234000	Sweet corn	0.40; 0.45; 0.50; 0.54	0.54	–	0.54	0.47	0.48
241010	Broccoli	0.49; 0.56; 0.70	0.7	Flowering brassica	0.7	0.42	0.41
241020	Cauliflowers	0.38; 0.39; 0.42; 0.45	0.45	Flowering brassica	0.7	0.42	0.41
242010	Brussels sprouts	0.53; 0.65; 0.70	0.7	Head brassica	0.7	0.42	0.41
242020	Head cabbages	0.10; 0.17; 0.19; 0.19; 0.19; 0.31; 0.33; 0.35; 0.41; 0.62; 0.62	0.62	Head brassica	0.7	0.42	0.41

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
243010	Chinese cabbages	0.21; 0.36; 0.53	0.53	Leafy brassica & kohlrabi	2.9	0.95	0.56
243020	Kales	0.56; 0.91; 2.90	2.9	Leafy brassica & kohlrabi	2.9	0.95	0.56
244000	Kohlrabies	0.47; 1.29; 1.29	1.29	Leafy brassica & kohlrabi	2.9	0.95	0.56
251010	Lamb's lettuces	1.10; 1.34; 4.0	4	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251020	Lettuces	0.16; 0.20; 0.25; 0.25; 0.28; 0.29; 0.30; 0.30; 0.37; 0.40; 0.48; 0.48; 0.49	0.49	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251030	Escaroles	0.44; 0.52; 0.99; 0.99; 0.99	0.99	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251040	Cresses	0.90; 1.70	1.7	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251050	Land cresses	–	–	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251060	Roman rocket	0.76	0.76	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251070	Red mustards	1.47	1.47	Lettuces & other salads plants and Spinaches & similars	4	0.90	0.83
251080	Baby leaf crops	–	–	Leafy brassica & kohlrabi	2.9	0.95	0.56
252010	Spinaches	0.73; 0.97; 1.04; 1.30	1.3	Lettuces & other salads plants and Spinaches & similar	4	0.90	0.83
252020	Purslanes	1.13; 1.13; 1.31	1.31	Lettuces & other salads plants and Spinaches & similar	4	0.90	0.83
252030	Chards	79; 1.79	1.79	Lettuces & other salads plants and Spinaches & similar	4	0.90	0.83
253000	Grape leaves	4.15	4.15	–	4.15	4.15	4.15
254000	Watercresses	0.10; 0.77; 1.4	1.4	–	1.4	0.76	0.10
255000	Witloofs	0.51	0.51	–	0.51	0.51	0.51
256010	Chervil	0.73; 0.73	0.73	Fresh herbs	6.77	2.27	1.20
256020	Chives	0.59; 0.85; 0.90; 1.57	1.57	Fresh herbs	6.77	2.27	1.20
256030	Celery leaves	–	–	Fresh herbs	6.77	2.27	1.20
256040	Parsley	0.59; 0.85; 0.90; 1.49	1.49	Fresh herbs	6.77	2.27	1.20
256050	Sage	–	–	Fresh herbs	6.77	2.27	1.20

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
256060	Rosemary	3.01	3.01	Fresh herbs	6.77	2.27	1.20
256070	Thyme	5.55	5.55	Fresh herbs	6.77	2.27	1.20
256080	Basil	3.85; 3.85	3.85	Fresh herbs	6.77	2.27	1.20
256090	Laurel	4.16	4.16	Fresh herbs	6.77	2.27	1.20
256100	Tarragon	6.77	6.77	Fresh herbs	6.77	2.27	1.20
260010	Beans (with pods)	0.48; 0.57; 0.70; 0.80; 2.52; 4.40	4.4	–	4.4	1.58	0.48
260020	Beans (without pods)	3.18	3.18	Beans (without pods) & lentils	3.18	3.18	3.18
260030	Peas (with pods)	1.34; 2.46; 6.56	6.56	–	6.56	3.45	1.34
260040	Peas (without pods)	1.76	1.76	–	1.76	1.76	1.76
260050	Lentils (fresh)	0.72; 1.03; 1.13; 2.05	2.05	Beans (without pods) & lentils	3.18	3.18	3.18
270010	Asparagus	0.55; 1.53; 1.89	1.89	Stem vegetables	6.44	1.27	0.65
270020	Cardoons	0.70; 2.31	2.31	Stem vegetables	6.44	1.27	0.65
270030	Celeries	0.20; 0.35; 0.38; 1.10	1.1	Stem vegetables	6.44	1.27	0.65
270040	Florence fennels	0.20; 0.59	0.59	Stem vegetables	6.44	1.27	0.65
270050	Globe artichokes	0.75; 2.31; 3.20	3.2	Stem vegetables	6.44	1.27	0.65
270060	Leeks	0.45; 0.53; 0.53; 1.89	1.89	Stem vegetables	6.44	1.27	0.65
270070	Rhubarbs	0.21; 0.42; 0.56	0.56	Stem vegetables	6.44	1.27	0.65
270080	Bamboo shoots	1.9	1.9	Stem vegetables	6.44	1.27	0.65
270090	Palm hearts	1.60; 6.44	6.44	Stem vegetables	6.44	1.27	0.65
280010	Cultivated fungi	0.91; 1.18; 2.86; 3.18; 3.67; 5.40	5.4	Fungi	5.4	2.72	2.86
280020	Wild fungi	0.91; 1.19; 2.44; 2.77; 2.86; 3.73; 4.20	4.2	Fungi	5.4	2.72	2.86
290000	Algae	0.13; 0.15; 0.28; 0.60; 0.60; 2.64	2.64	–	2.64	0.73	0.44
300010	Beans (dry)	6.35; 8.04; 11.0	11	Dry pulses	13.03	8.04	7.30
300020	Lentils (dry)	5.19; 6.70; 7.38; 13.03	13.03	Dry pulses	13.03	8.04	7.30
300030	Peas (dry)	7.22; 10.37	10.37	Dry pulses	13.03	8.04	7.30
300040	Lupins (dry)	5.16	5.16	Dry pulses	13.03	8.04	7.30
401010	Linseeds	10.32; 12.0; 13.76	13.76	Oilseeds	21.5	12.1	12.0
401020	Peanuts	6.75; 7.64	7.64	Oilseeds	21.5	12.1	12.0
401030	Poppy seeds	10	10	Oilseeds	21.5	12.1	12.0
401040	Sesame seeds	15.8	15.8	Oilseeds	21.5	12.1	12.0

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
401050	Sunflower seeds	15.0; 17.0; 18.3; 21.5	21.5	Oilseeds	21.5	12.1	12.0
401060	Rapeseeds	6.02	6.02	Oilseeds	21.5	12.1	12.0
401070	Soyabeans	10.32; 10.32; 12.9	12.9	Oilseeds	21.5	12.1	12.0
401080	Mustard seeds	6.45	6.45	Oilseeds	21.5	12.1	12.0
401090	Cotton seeds	12.04	12.04	Oilseeds	21.5	12.1	12.0
401100	Pumpkin seeds	–	–	Oilseeds	21.5	12.1	12.0
401110	Safflower seeds	17.33; 17.47	17.47	Oilseeds	21.5	12.1	12.0
401120	Borage seeds	1.30	1.3	Oilseeds	21.5	12.1	12.0
401130	Gold of pleasure seeds	–	–	Oilseeds	21.5	12.1	12.0
401140	Hemp seeds	–	–	Oilseeds	21.5	12.1	12.0
401150	Castor beans	–	–	Oilseeds	21.5	12.1	12.0
402010	Olives for oil production	1.20; 1.54; 2.10; 2.26; 2.30; 2.30; 2.51; 2.70	2.7	Olives	2.7	2.11	2.28
402020	Oil palms kernels	–	No data	–	No data	No data	No data
402030	Oil palms fruits	–	No data	–	No data	No data	No data
402040	Kapok	–	No data	–	No data	No data	No data
500010	Barley	3.01; 4.19; 4.98; 6.02	6.02	Cereals (except buckwheat)	10	4.40	4.15
500020	Buckwheat	5.84; 11.0	11	–	11	8.42	8.42
500030	Maize	1.63; 2.40; 2.84	2.84	Cereals (except buckwheat)	10	4.40	4.15
500040	Common millet	6.10	6.1	Cereals (except buckwheat)	10	4.40	4.15
500050	Oat	2.41; 4.22; 4.30; 6.26	6.26	Cereals (except buckwheat)	10	4.40	4.15
500060	Rice	1.10; 1.80; 2.10; 2.20; 2.77; 2.77; 2.88; 4.63; 5.24; 10.0; 10.0	10	Cereals (except buckwheat)	10	4.40	4.15
500070	Rye	3.20; 3.44; 3.92; 4.50; 5.16	5.16	Cereals (except buckwheat)	10	4.40	4.15
500080	Sorghum	2.32; 7.35; 8.60	8.6	Cereals (except buckwheat)	10	4.40	4.15
500090	Wheat	3.18; 3.61; 3.63; 3.69; 4.10; 4.26; 4.34; 4.50; 5.53; 6.88; 8.60	8.6	Cereals (except buckwheat)	10	4.40	4.15
610000	Teas	0.25; 0.25	25	–	25	25.0	25.0
620000	Coffee beans	15.5; 17.0	17	–	17	16.3	16.3

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
631000	Herbal infusions from flowers	–	–	Extrapolation from lettuce	0.49	0.33	0.30
632000	Herbal infusions from leaves and herbs	–	–	Extrapolation from lettuce	0.49	0.33	0.30
633000	Herbal infusions from roots	–	–	Extrapolation from other root and tuber vegetables	3	1.01	0.95
640000	Cocoa beans	1.5	1.5	–	1.5	1.50	1.50
650000	Carobs	5.71	5.71	–	5.71	5.71	5.71
700000	Hops	–	No data	Data only available on beer	no data	no data	no data
810000	Seed spices	7.8; 8.67; 8.67; 9.1; 9.1; 9.75; 9.75; 10.3; 10.67; 11.1; 13.7	13.7	Data on several different seed spices (anise, black caraway, celery seed, coriander seed, cumin, dill seed, fennel, fenugreek and nutmeg)	13.7	9.87	9.75
820000	Fruit spices	3.83; 9.10; 11.27; 11.3; 11.3	11.3	Data on cardamom and pepper	11.3	9.36	11.3
830000	Bark spices	3.39; 3.39; 3.39	3.39	Data on cinnamon	3.39	3.39	3.39
840000	Root and rhizome spices	1.44; 1.55; 2.0; 2.26; 2.26; 2.3	2.3	Data on ginger and and horseradish (root spices)	2.3	1.97	2.13
850000	Bud spices	3.47; 3.74	3.74	Data on cloves and capers	3.74	3.61	3.61
860000	Flower pistil spices	3.28	3.28	Data on saffron	3.28	3.28	3.28
870000	Aril spices	24.67	24.67	Data on mace	24.7	24.7	24.7
900010	Sugar beets roots	0.64; 0.82; 1.25; 1.36; 2.0	2	–	2	1.21	1.25
900020	Sugar canes	0.50; 0.54; 0.83; 1.70	1.70	–	1.7	0.89	0.69
900030	Chicory roots	0.77; 1.40	1.40	–	1.4	1.09	1.09
–	Grasses	1.80	1.80	–	1.80	1.80	1.80
–	Alfalfa/clover	1.46	1.46	–	1.46	1.46	1.46
–	Rapeseed forage	1.26	1.26	–	1.26	1.26	1.26
–	Maize silage	1.52	1.52	–	1.52	1.52	1.52
–	Cereals straws	1.46; 4.3; 6.02	6.02	Cereals straws	6.02	6.02	6.02

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
–	Sugar beet leaves/ tops	0.78; 1.75; 4.42	4.42	–	4.42	2.31	1.75
1011010	Swine muscle	0.36; 0.4; 0.41; 0.5; 0.5; 0.68; 0.70; 0.70; 0.70; 0.75; 0.87; 0.87; 0.88; 0.9; 0.92; 0.93; 0.98; 1.08; 1.1; 1.13; 1.16; 1.25; 1.5; 2.25; 6.85	6.85	–	6.85	1.13	0.88
1011020	Swine fat tissue	0.0; 0.13; 0.18; 0.20; 0.20; 0.37; 0.41; 0.45; 0.47; 0.54; 1.0; 1.0; 1.06	1.06	–	1.06	0.46	0.41
1011030	Swine liver	4.5; 5.70; 5.76; 5.8; 6.2; 6.49; 6.60; 6.77; 6.8; 6.83; 6.92; 7.06; 7.1; 7.65; 8.19; 8.4; 8.5; 8.7; 8.89; 9.0; 9.48; 10.1; 10.8; 10.8; 11.1; 11.6; 12.0; 12.2; 12.6; 13.0; 13.2; 13.5; 14.2; 14.4; 14.9; 15.3; 16.0; 16.8; 17.7; 18.3; 19.2; 20.7; 23.7; 24.0; 24.0; 27.3; 33.3; 35.1; 60.5; 76.8; 84.3	84.3	–	84.3	16.5	11.6
1011040	Swine kidney	3.57; 5.63; 6.0; 6.1; 6.2; 6.25; 6.65; 6.73; 6.75; 7.15; 7.25; 7.25; 7.3; 7.58; 7.74; 7.75; 7.9; 8.4; 8.50; 8.5; 8.75; 9.25; 14; 25	25.0	–	25.0	8.18	7.28
1012010	Bovine muscle	0.3; 0.375; 0.4; 0.498; 0.564; 0.677; 0.75; 0.75; 0.765; 0.775; 0.87; 0.87; 0.90; 0.9; 0.9; 0.9; 0.9; 0.9; 1.05; 1.05; 1.25; 1.41; 1.50; 1.56; 1.6; 1.60; 1.7; 1.77; 2.2	2.2	Bovine and horse muscle	2.2	1.02	0.9
1012020	Bovine fat tissue	0.175; 0.28; 0.39; 0.425; 0.50	0.5	Bovine and horse fat tissue	0.50	0.35	0.39

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
1012030	Bovine liver	1.2; 1.44; 1.82; 2.2; 2.77; 3.41; 5.3; 6.17; 6.25; 6.78; 11.9; 13.4; 13.7; 15.0; 18.7; 19.2; 20.4; 20.4; 21.0; 23.5; 25.0; 27.6; 28.0; 28.0; 30.3; 30.6; 32.0; 32.0; 33.7; 36.9; 37.0; 37.8; 38.0; 39.0; 39.0; 39.2; 40.0; 40.0; 41.5; 43.7; 44.0; 44.4; 45.9; 46.0; 46.1; 46.7; 53.0; 53.0; 54.0; 54.3; 55.0; 57.0; 58.5; 59.0; 60.0; 60.9; 64.0; 64.6; 72.6; 74.0; 80.0; 80.1; 85.0; 87.0; 89.6; 91.0; 92.7; 93.0; 97.5; 97.55; 106; 107; 108; 109; 112; 114; 118.65; 120; 122; 126; 127; 130; 130; 133; 138; 141; 143; 151; 153; 156; 157; 157.4; 157.83; 158; 168; 169; 176; 186; 190; 195; 198; 199; 214; 216; 222; 246; 246; 256; 257; 264; 273; 288; 303; 312; 326; 345; 359; 374; (454)[b]	374	Bovine and horse liver	374	101	64.3
1012040	Bovine kidney	0.875; 3.70; 3.70; 3.85; 3.89; 4.26; 4.34; 4.40; 4.61; 4.65; 4.94; 4.97; 5.10; 5.31; 6.34; 8.15; 10.0	10	Bovine and horse kidney	10	4.89	4.61
1013010	Sheep muscle	0.90; 1.0; 1.1; 1.22; 1.25; 1.25; 1.32; 1.47; 1.70; 2.32	2.3	Sheep and goat muscle	2.56	1.35	1.25
1013020	Sheep fat tissue	0.0; 0.175; 0.425; 0.57	0.57	Sheep and goat fat tissue	0.57	0.29	0.30
1013030	Sheep liver	69.79; 76.0; 89.8; 90.0; 96.7; 100; 131.4	131	Sheep and goat liver	131	84	90
1013040	Sheep kidney	3.52; 3.75; 3.95; 4.46; 5.39	5.4	Sheep and goat kidney	5.39	3.85	3.85
1014010	Goat muscle	1.0; 0.45; 2.56	2.6	Sheep and goat muscle	2.56	1.35	1.25
1014020	Goat fat tissue	–	–	Sheep and goat fat tissue	0.57	0.29	0.30
1014030	Goat liver	30.0; 33; 94.5; 117	117	Sheep and goat liver	131	84	90
1014040	Goat kidney	2.0	2.0	Sheep and goat kidney	5.39	3.85	3.85
1015010	Equine muscle	–	–	Bovine and horse muscle	2.2	1.02	0.9
1015020	Equine fat tissue	–	–	Bovine and horse fat tissue	0.50	0.35	0.39
1015030	Equine liver	5.3; 5.6; 6.0; 6.4; 6.7	6.7	Bovine and horse liver	374	101	64.3
1015040	Equine kidney	–	–	Bovine and horse kidney	10	4.89	4.61

Code	Commodity	Individual values (mg/kg)	Max for the commodity (mg/kg)	Comment (e.g. grouping or extrapolation)	Max for the group (mg/kg)[a]	Mean for the group (mg/kg)[a]	Median for the group (mg/kg)[a]
1016010	Poultry muscle	0.003; 0.048; 0.176; 0.176; 0.20; 0.20; 0.30; 0.31; 0.36; 0.4; 0.40; 0.42; 0.42; 0.43; 0.44; 0.44; 0.5; 0.53; 0.55; 0.57; 0.6; 0.63; 0.63; 0.63; 0.67; 0.67; 0.70; 0.8; 0.83; 0.85; 0.89; 0.9; 1.0; 1.07; 1.1; 1.10; 1.2; 1.36; 1.40; 1.60; 1.60; 2.42; 2.53; 3.03; 3.06; 3.06; 3.30; 5.94; 5.94; 5.94	5.9	–	5.9	1.11	0.65
1016020	Poultry fat tissue	0; 0; 0	0	–	0	0	0
1016030	Poultry liver	3.22; 3.78; 4.07; 4.08; 4.42; 4.6; 4.92; 5.10; 5.10; 6.90; 6.90; 7.14; 12; 13.4; 59.60; 59.62; 66.7; 75.20; 75.22	75.2	–	75.2	22.2	6.90
1020010	Cattle milk	0.10; 0.10; 0.10; 0.10; 0.10; 0.10; 0.10; 0.10; 0.10; 0.10; 0.10; 0.13; 0.23; 0.65	0.65	Ruminants and horse milks	0.65	0.22	0.10
1020020	Sheep milk	0.26; 0.46; 0.60	0.60	Ruminants and horse milks	0.65	0.22	0.10
1020030	Goat milk	0.11; 0.46	0.46	Ruminants and horse milks	0.65	0.22	0.10
1020040	Horse milk	0.30	0.30	Ruminants and horse milks	0.65	0.22	0.10
1030000	Birds eggs	0.17; 0.55; 0.58; 0.59; 0.62; 0.62; 0.62; 0.65; 0.70; 0.99; 1.04; 1.10	1.1	Including data on hens, duck, goose and quail eggs	1.1	0.69	0.62

(a): Max, mean and median values were calculated for the relevant groups as defined in column 'comment'.
(b): The maximal value of 454 mg/kg retrieved in this survey is extremely high compared to the rest of the data set. Furthermore, this single value was also found in the European monitoring data where the distribution of the results also implies that it is abnormally high. Therefore, this values was disregarded from the assessment.

Annex B – Summary of monitoring data

Code	Commodity	n = [a]	n = [b] (> LOQ)	Mean[c] (mg/kg)	Percentile (mg/kg)[d]				Max[e] (mg/kg)	Samples origin[f]
					90	95	97.5	99		
Plant commodities										
110010	Grapefruits	98	89	0.49	0.69	0.77	0.90	1.23	3.55	CN, ES, FR, IL, MX, PE, SZ, TR, US, ZA, Unknown
110020	Oranges	10	5	0.51	n.r.	n.r.	n.r.	n.r.	0.59	ES, GR, UY, ZA, Unknown
110030	Lemons	7	3	0.53	n.r.	n.r.	n.r.	n.r.	0.55	ES, IT, TR
110050	Mandarins	8	4	0.59	n.r.	n.r.	n.r.	n.r.	0.63	ES, TR
120020	Brazil nuts	60	60	18.92	20.73	21.24	21.95	22.08	22.2	BO, BR, Unknown
120060	Hazelnuts/cobnuts	10	10	15.13	15.60	16.95	17.63	18.03	18.3	TR, Unknown
120090	Pine nut kernels	103	103	15.96	32.41	33.58	33.81	34.00	34.96	CN, IT, PK, TR, Unknown
120110	Walnuts	55	55	12.64	15.76	16.13	17.24	19.00	20.4	CL, DE, FR, HU, MD, US, Unknown
130010	Apples	128	64	0.5	n.r.	n.r.	n.r.	n.r.	1.5	AR, BR, CL, DE, FR, IT, NZ, ZA, Unknown
130020	Pears	52	36	0.8	2.00	2.00	2.00	3.19	4.43	AR, CL, CN, DE, ES, IT, NL, PT, ZA, Unknown
130030	Quinces	1	0	< 2	n.r.	n.r.	n.r.	n.r.	< 2	DE
140010	Apricots	45	30	0.76	n.r.	n.r.	n.r.	n.r.	1.6	DE, ES, FR, GR, IT, TR
140020	Cherries (sweet)	65	48	0.77	n.r.	n.r.	n.r.	n.r.	1.18	DE, ES, GR, IT, PL, TR, US, Unknown
140030	Peaches	36	30	0.89	n.r.	n.r.	n.r.	n.r.	1.45	CL, DE, ES, IT, SK
140040	Plums	52	38	0.62	n.r.	n.r.	n.r.	n.r.	0.96	BA, CL, DE, ES, GR, HU, IT, ZA
151010	Table grapes	258	207	1.28	2.38	3.65	6.24	7.81	9.6	AR, BR, CL, CY, DE, EG, ES, GR, IN, IT, MA, NA, PE, TR, ZA, Unknown
151020	Wine grapes	10	10	0.26	n.r.	n.r.	n.r.	n.r.	1.2	DE
152000	Strawberries	193	68	0.37	n.r.	n.r.	n.r.	n.r.	1.2	BE, DE, ES, GR, MA, NL, PL, US
153010	Blackberries	3	2	0.95	n.r.	n.r.	n.r.	n.r.	1.4	DE, IT, MX
153020	Dewberries	1	1	0.79	n.r.	n.r.	n.r.	n.r.	0.79	DE
153030	Raspberries (red and yellow)	32	19	0.61	n.r.	n.r.	n.r.	n.r.	1.19	DE, ES, FR, IT, MX, NL, PT
154010	Blueberries	31	5	0.6	n.r.	n.r.	n.r.	n.r.	0.97	AT, CL, DE, ES, MA, PL
154020	Cranberries	2	0	< 2	n.r.	n.r.	n.r.	n.r.	< 2	US
154030	Currants (black, red and white)	21	8	0.78	n.r.	n.r.	n.r.	n.r.	1.1	DE, PL
154040	Gooseberries (green, red and yellow)	6	2	0.77	n.r.	n.r.	n.r.	n.r.	0.82	DE

Code	Commodity	n = [a]	n = [b] (> LOQ)	Mean[c] (mg/kg)	Percentile (mg/kg)[d]				Max[e] (mg/kg)	Samples origin[f]
					90	95	97.5	99		
161010	Dates	1	1	1.73	n.r.	n.r.	n.r.	n.r.	1.73	TN
161020	Figs	8	6	7.85	18.48	21.14	22.47	23.27	23.8	BR, IT, TR
161030	Table olives	2	2	2.95	n.r.	n.r.	n.r.	n.r.	3.68	ES, GR
161040	Kumquats	1	0	< 2	n.r.	n.r.	n.r.	n.r.	< 2	ZA
161060	Kaki/Japanese persimmons	10	4	0.22	n.r.	n.r.	n.r.	n.r.	0.32	ES, IL
162010	Kiwi fruits (green, red, yellow)	13	11	1.54	2.11	2.14	2.15	2.15	2.15	ES, FR, GR, IT, NZ
162020	Litchis/lychees	3	3	2.73	3.06	3.11	3.14	3.16	3.17	MG
162030	Passionfruits/ maracujas	1	1	3.55	n.r.	n.r.	n.r.	n.r.	3.55	CO
163010	Avocados	3	3	2.9	3.14	3.18	3.20	3.21	3.22	CL, IL
163020	Bananas	25	23	1.08	n.r.	n.r.	n.r.	n.r.	1.63	CO, CR, DO, EC, PE, Unknown
163030	Mangoes	29	29	0.6	n.r.	n.r.	n.r.	n.r.	1.1	BR, CI, EC, IL, ML, PE
163040	Papayas	6	6	0.39	n.r.	n.r.	n.r.	n.r.	0.48	BR, EC
163050	Granate apples/ pomegranates	2	2	1.44	n.r.	n.r.	n.r.	n.r.	1.69	IL
163070	Guavas	2	2	0.74	n.r.	n.r.	n.r.	n.r.	0.78	VN
163080	Pineapples	18	17	0.88	n.r.	n.r.	n.r.	n.r.	1.3	CR, EC, PA, Unknown
211000	Potatoes	572	273	0.86	2.00	2.00	2.00	2.00	6.32	AT, BE, CY, DE, EG, ES, FR, GB
212020	Sweet potatoes	3	1	0.68	n.r.	n.r.	n.r.	n.r.	0.68	HN, SN, US
213010	Beetroots	20	9	0.77	n.r.	n.r.	n.r.	n.r.	1.13	DE, PL, Unknown
213020	Carrots	125	73	0.46	n.r.	n.r.	n.r.	n.r.	0.82	BE, DE, DK, ES, FR, IL, IT, NL, PT
213030	Celeriacs/turnip rooted celeries	41	30	1.16	2.00	2.00	2.00	2.19	2.31	DE, NL, PL, Unknown
213060	Parsnips	5	2	1.02	n.r.	n.r.	n.r.	n.r.	1.38	DE, NL
213070	Parsley roots/ Hamburg roots parsley	3	1	1.46	n.r.	n.r.	n.r.	n.r.	1.46	DE, NL
213080	Radishes	76	59	0.17	n.r.	n.r.	n.r.	n.r.	0.67	DE, IT, MA, NL, Unknown
213090	Salsifies	9	8	1.3	n.r.	n.r.	n.r.	n.r.	1.9	DE, Unknown

Code	Commodity	n = [a]	n = [b] (> LOQ)	Mean[c] (mg/kg)	Percentile (mg/kg)[d]				Max[e] (mg/kg)	Samples origin[f]
					90	95	97.5	99		
213100	Swedes/rutabagas	3	0	< 2	n.r.	n.r.	n.r.	n.r.	< 2	DE
220010	Garlic	56	56	1.93	2.65	2.81	3.04	3.42	3.79	CN, DE, EG, ES, FR, IT, NL, ZW, Unknown
220020	Onions	68	38	0.55	n.r.	n.r.	n.r.	n.r.	0.93	AU, DE, EG, ES, NL, NZ, PL
220030	Shallots	2	0	< 2	n.r.	n.r.	n.r.	n.r.	< 2	DE, FR
220040	Spring onions/green onions and Welsh onions	11	3	0.51	n.r.	n.r.	n.r.	n.r.	0.52	DE, IT, NL
231010	Tomatoes	87	52	0.37	2.00	2.00	2.00	2.02	2.17	BE, DE, ES, IL, IT, MA, NL, PT
231020	Sweet peppers/bell peppers	68	40	0.56	n.r.	n.r.	n.r.	n.r.	1.2	BE, DE, ES, FR, GR, HU, IL, IT, MA, NL, TR, VN
231030	Aubergines/eggplants	43	29	0.46	n.r.	n.r.	n.r.	n.r.	0.87	DE, ES, IT, NL, TR, Unknown
232010	Cucumbers	119	39	0.31	n.r.	n.r.	n.r.	n.r.	1.06	AT, BE, BG, DE, ES, GR, NL, PL, TR
232030	Courgettes	65	35	0.71	n.r.	n.r.	n.r.	n.r.	2	BE, DE, ES, IT, MA, NL, PT, TR, Unknown
233010	Melons	13	12	0.19	n.r.	n.r.	n.r.	n.r.	0.35	BR, ES, HU, Unknown
233020	Pumpkins	14	10	0.51	n.r.	n.r.	n.r.	n.r.	0.71	DE, FR
233030	Watermelons	98	79	0.47	0.66	0.95	1.58	2.00	2.09	BR, CR, ES, GR, HU, IR, IT, MK, PA, RS, TR, Unknown
234000	Sweet corn	84	82	0.88	1.15	1.25	1.41	1.55	2.01	DE, ES, FR, MA, NL, SN, Unknown
241010	Broccoli	31	21	0.52	n.r.	n.r.	n.r.	n.r.	0.78	DE, ES, IT, NL
241020	Cauliflowers	47	35	0.28	n.r.	n.r.	n.r.	n.r.	0.98	DE, ES, FR, IT, NL, Unknown
242010	Brussels sprouts	162	102	0.42	n.r.	n.r.	n.r.	n.r.	0.72	BE, DE, GB, IT, NL, Unknown
242020	Head cabbages	81	41	0.26	n.r.	n.r.	n.r.	n.r.	0.65	DE, EG, ES, NL, PL, PT, Unknown
243010	Chinese cabbages/ pe-tsai	16	13	0.37	n.r.	n.r.	n.r.	n.r.	0.64	DE, Unknown
243020	Kales	127	112	1.24	1.10	1.91	2.34	3.69	62	BE, DE, Unknown
244000	Kohlrabies	71	26	0.28	n.r.	n.r.	n.r.	n.r.	1.32	DE, ES, IT, PL, Unknown
251010	Lamb's lettuces/corn salads	31	21	0.93	n.r.	n.r.	n.r.	n.r.	1.3	DE, FR, IT
251020	Lettuces	166	90	2.57	2.00	2.00	2.00	32.80	101	BE, DE, ES, IT, Unknown
251030	Escaroles/broad-leaved endives	13	11	0.44	n.r.	n.r.	n.r.	n.r.	0.63	DE, IT
251060	Roman rocket/rucola	61	53	0.81	2.00	2.00	2.13	7.03	14.2	DE, FR, IT, Unknown
252010	Spinaches	95	57	1.59	2.00	3.29	6.92	7.87	10.6	BE, DE, ES, IT, TR, ZA, Unknown

Code	Commodity	n = [a]	n = [b] (> LOQ)	Mean[c] (mg/kg)	Percentile (mg/kg)[d]				Max[e] (mg/kg)	Samples origin[f]
					90	95	97.5	99		
252030	Chards/beet leaves	3	0	< 2	n.r.	n.r.	n.r.	n.r.	< 2	DE, IT
253000	Grape leaves and similar species	1	1	64	n.r.	n.r.	n.r.	n.r.	64	TR
254000	Watercresses	1	1	1.25	n.r.	n.r.	n.r.	n.r.	1.25	CZ
255000	Witloofs/Belgian endives	30	17	0.51	n.r.	n.r.	n.r.	n.r.	0.64	BE, DE, FR, NL
256010	Fresh herbs	530	514	1.85	3.01	5.49	8.88	16.96	42.1	BE, DE, EG, ES, ET, FR, IL, IN, IT
260010	Beans (with pods)	80	53	0.78	n.r.	n.r.	n.r.	n.r.	1.52	DE, EG, ES, ET, IT, KE, MA, NL, PL, SN, TR
260030	Peas (with pods)	4	2	1.14	n.r.	n.r.	n.r.	n.r.	1.32	DE, TR, ZW
260040	Peas (without pods)	2	1	1.42	n.r.	n.r.	n.r.	n.r.	1.42	DE, Unknown
270010	Asparagus	73	39	0.79	n.r.	n.r.	n.r.	n.r.	1.87	DE, ES, GR, IT, PE, PL
270030	Celeries	5	1	0.24	n.r.	n.r.	n.r.	n.r.	0.24	ES
270040	Florence fennels	7	1	0.7	n.r.	n.r.	n.r.	n.r.	0.7	DE, IT
270060	Leeks	47	21	0.38	n.r.	n.r.	n.r.	n.r.	0.77	DE, ES, NL, Unknown
270070	Rhubarbs	31	9	0.35	n.r.	n.r.	n.r.	n.r.	0.5	DE, NL, Unknown
280010	Cultivated fungi	229	207	2.2	3.10	3.50	3.96	4.14	4.64	BE, CN, DE, HU, KR, NL, PL, Unknown
280020	Wild fungi	29	26	5.39	6.14	7.11	15.74	27.12	34.7	CN, DE, LT, MK, PL, RU, Unknown
300010	Beans (dry)	100	100	7.21	9.30	10.83	11.82	13.46	17.08	AR, CN, DE, ES, GR, KG, NL, TH, TR, Unknown
300020	Lentils (dry)	211	211	9.19	11.60	12.18	13.00	13.79	14.96	CA, DE, ES, IT, LB, NL, SY, TR, US, Unknown
300030	Peas (dry)	117	115	6.11	7.63	7.96	8.32	9.71	10.87	AE, AR, BE, CA, DE, IT, PL, SK, TR, TZ, US, Unknown
401010	Linseeds	96	96	12.96	15.20	15.98	16.49	18.11	18.3	AR, CA, DE, HU, KZ, RO, RU, Unknown
401030	Poppy seeds	80	80	16.05	20.01	20.63	22.80	26.64	41	AT, CZ, DE, NL, TR, Unknown
401040	Sesame seeds	18	18	16.11	18.92	21.10	21.20	21.26	21.3	IN, SD, UG, Unknown
401050	Sunflower seeds	101	101	18.41	21.10	21.90	23.25	24.00	24.6	AR, BG, CN, DE, HU, RO, SK, TR, Unknown
401080	Mustard seeds	14	14	6.17	6.18	10.47	14.44	16.81	18.4	CA, DE, Unknown
401100	Pumpkin seeds	2	2	11.35	n.r.	n.r.	n.r.	n.r.	12.3	DE
500010	Barley	83	83	4.09	5.22	6.17	7.98	9.19	11.86	AT, DE, Unknown
500020	Buckwheat and other pseudo-cereals	2	2	6.68	n.r.	n.r.	n.r.	n.r.	7.35	DE, RU
500040	Common millet/proso millet	1	1	6.73	n.r.	n.r.	n.r.	n.r.	6.73	DE

Code	Commodity	n = [a]	n = [b] (> LOQ)	Mean[c] (mg/kg)	Percentile (mg/kg)[d]				Max[e] (mg/kg)	Samples origin[f]
					90	95	97.5	99		
500050	Oat	3	3	5.09	5.54	5.59	5.62	5.63	5.64	DE
500060	Rice	264	262	2.54	4.07	7.24	9.01	10.34	12.2	FR, IN, IT, KH, LA, LK, PK, TH, US, Unknown
500070	Rye	157	157	3.57	4.30	5.40	7.48	7.92	8.43	DE, PL, Unknown
500090	Wheat	351	351	4.13	5.47	5.93	6.65	7.26	10.1	AT, CA, CZ, DE, HR, LV, TR, Unknown
610000	Teas	176	130	2.46	10.70	15.68	17.93	19.05	21.8	CN, IN, JP, LK, TR, TW, Unknown
620000	Coffee beans	115	115	14.03	15.96	17.71	18.78	20.12	23.4	BR, CR, GT, PA, PG, VN, Unknown
631000	Herbal infusions, dried	74	48	0.17	n.r.	n.r.	n.r.	n.r.	0.63	BG, DE, EG, HR, HU, PL, RO, UY, Unknown
700000	Hops, dried	8	8	149.81	272	321	346	360	370	CZ, DE, GB
840000	Root and rhizome spices (Ginger, Turmeric/ curcuma)	58	58	4.86	5.97	8.56	8.97	9.65	10.32	CN, IN, Unknown
Animal commodities										
1011010	Swine muscle	18	18	0.68	n.r.	n.r.	n.r.	n.r.	1.26	DE, DK, GB, Unknown
1011030	Swine liver	14	14	9.71	16.65	18.23	18.71	19.01	19.2	BE, DE, Unknown
–	Bovine meat	89	61	2.03	1.41	1.62	17.40	24.20	33	AT, DE, NL, Unknown
1012010	Bovine muscle	23	23	0.84	1.63	1.75	1.88	1.96	2.02	DE, FR, NL
1012030	Bovine liver	206	206	86.68	196	256	320	358	454	DE, NL, Unknown
1012040	Bovine kidney	1	1	3.45	n.r.	n.r.	n.r.	n.r.	3.45	DE
1013010	Sheep muscle	124	119	1.03	1.44	1.57	1.76	1.94	2.95	AR, AU, BE, DE, GB, NL, NZ, Unknown
–	Goat meat	57	35	1.03	1.10	1.12	1.38	3.26	5.5	DE, Unknown
–	Horses, asses, mules or hinnies meat	1	1	2.1	n.r.	n.r.	n.r.	n.r.	2.1	DE
1016010	Poultry muscle	144	144	3.47	5.43	5.94	6.62	6.92	7.1	DE, FR, GB, HU, NL, PL, Unknown
1016030	Poultry liver	1	1	3.2	n.r.	n.r.	n.r.	n.r.	3.2	DE
–	Other farm animals meat	392	386	1.84	2.42	2.70	3.32	4.27	8.9	AT, DE, FR, HU, NL, NZ, PL, Unknown
1017010	Other farm animals muscle	77	73	1.68	2.28	2.66	2.77	2.85	3	DE, ES, FR, NZ, Unknown
1020000	Milk and milk products	433	184	0.24	n.r.	n.r.	n.r.	n.r.	1.1	AT, DE, Unknown

Code	Commodity	n = [a]	n = [b] (> LOQ)	Mean[c] (mg/kg)	Percentile (mg/kg)[d]				Max[e] (mg/kg)	Samples origin[f]
					90	95	97.5	99		
1030000	Bird's eggs	145	131	0.58	0.91	1.00	1.00	1.00	3.55	DE, NL
1070000	Wild terrestrial animal vertebrate	184	181	1.72	2.28	2.51	2.88	3.22	3.9	DE (further details in EFSA, 2014)

LOQ: limit of quantification; n.r.: not relevant (Percentile were only calculated if n > 2 and MAX value > LOQ for enforcement; i.e. MAX > 2 mg/kg).
(a): Number of monitoring results available (from year 2009 to 2015).
(b): Number of results above the LOQ.
(c): Average value considering only results above LOQ.
(d): Percentiles 90th, 95th, 97.5th and 99th calculated considering all results. Values below the LOQ were interpreted as positive values; these values were substituted by the LOQ of the measurement.
(e): Highest value considering all monitoring results.
(f): Country codes indicating the origin of the samples.