CONCLUSION ON PESTICIDES PEER REVIEW

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Peer review of the pesticide risk assessment for bees for the active substance clothianidin considering the uses as seed treatments and granules

European Food Safety Authority (EFSA)

Abstract

EFSA was asked by the European Commission to perform an updated risk assessment of neonicotinoids, including clothianidin, as regards the risk to bees, as a follow up of previous mandates received from the European Commission on neonicotinoids. The context of the evaluation was that required by the European Commission in accordance with Article 21 of Regulation (EC) No 1107/2009 to review the approval of active substances in light of new scientific and technical knowledge and monitoring data. In this context and in accordance with Article 31 of Regulation (EC) No 178/2002, EFSA has been previously asked by European Commission to organise an open call for data in order to collect new scientific information as regards the risk to bees from the neonicotinoid pesticide active substances clothianidin, thiamethoxam and imidacloprid applied as seed treatments and granules in the EU. The conclusions were reached on the basis of the evaluation of the supported uses as an insecticide of clothianidin applied as seed treatments and granules, on the new relevant data collected in the framework of the open call organised by EFSA and on the updated literature search performed by EFSA. The reliable endpoints, appropriate for use in regulatory risk assessment derived from the submitted studies and literature data as well as any other relevant data available at national level and made available to EFSA, are presented. Concerns are identified.

Keywords: neonicotinoid, clothianidin, peer review, risk assessment, pesticide, insecticide

Requestor: European Commission

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Summary

Clothianidin was included in Annex I to Directive 91/414/EEC on 1 August 2006 by Commission Directive 2006/41/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 and 1136/2013. A specific conclusion has been issued by the European Food Safety Authority (EFSA) on the risk assessment for bees as regards the authorised uses applied as seed treatments and granules in 2013.

The specific provisions of the approval were amended by Commission Implementing Regulation (EU) No 485/2013, to restrict the uses of clothianidin, thiamethoxam and imidacloprid, to provide for specific risk mitigation measures for the protection of bees and to limit the use of the plant protection products containing these active substances to professional users. In particular, the uses as seed treatment and soil treatment of plant protection products containing clothianidin, thiamethoxam or imidacloprid have been prohibited for crops attractive to bees and for cereals except for uses in greenhouses and for winter cereals. Foliar treatments with plant protection products containing these active substances have been prohibited for crops attractive to bees and for cereals with the exception of uses in greenhouses and uses after flowering. Furthermore, the European Commission requested EFSA to provide conclusions concerning an updated risk assessment for bees for clothianidin, thiamethoxam and imidacloprid, taking into account all uses other than seed treatments and granules, including foliar spray uses as mentioned in recital 7 of Commission Implementing Regulation (EU) No 485/2013. EFSA finalised its conclusion on the risk assessment for bees as regards all uses other than seed treatments and granules in July 2015.

It was a specific provision of the Commission Implementing Regulation (EU) No 485/2013 that the applicant was also required to submit to the European Commission further ecotoxicological studies by 31 December 2014. The outcome of the peer review of the confirmatory data assessment was reported in a Technical Report and a conclusion published in 2016.

Furthermore, according to recital 16 of Regulation (EU) No 485/2013, within 2 years from the date of entry into force of that Regulation, the European Commission foresees to initiate without undue delay a review of the new scientific information available.

For this purpose, with reference to Article 31 of Regulation (EC) No 178/2002 and in accordance with Article 21 of Regulation (EC) No 1107/2009 the European Commission requested EFSA to organise an open call for data in order to collect new scientific information as regards the risk to bees from the neonicotinoid pesticide active substances clothianidin, thiamethoxam and imidacloprid applied as seed treatments and granules in the European Union (EU).

The European Commission requested EFSA to provide conclusions concerning an updated risk assessment for bees for the three neonicotinoids (namely clothianidin, imidacloprid and thiamethoxam), taking into account:

- the new relevant data collected in the framework of the specific open call for data;
- any other new data from studies, research and monitoring activities that are relevant to the uses under consideration;
- the EFSA Guidance Document on the risk assessment of plant protection products on bees (*Apis mellifera, Bombus* spp. and solitary bees);

EFSA also considered the data available from a systematic literature review performed in June 2016, in order to collect all published scientific literature relevant for the current evaluation.

Risk assessments were performed according to EFSA (2013c) for honeybees, bumblebees and solitary bees. For exposure via residues in pollen and nectar a low risk was concluded for some bee groups/use/scenario combinations, while a high risk was concluded in other cases. In the majority of cases where a higher tier (Tier 3) risk assessment could be performed, the available data did not allow a low risk to be demonstrated, despite not indicating a clear high risk.

For the exposure via residues from dust drift during the sowing/application of the treated seeds, a low risk to honeybees for the use to sugar and fodder beet was concluded, whereas for bumblebees and solitary bees a low risk was not demonstrated with a screening assessment. For all other outdoor uses, a high risk to honeybees and bumblebees was concluded. Again, for solitary bees a low risk was not demonstrated with a screening assessment.

For exposure via water consumption, a low risk to honeybees was concluded for all uses via residues in puddles. A low risk to honeybees was concluded for residues in guttation fluid for the uses

to winter cereals, sugar beet and potatoes. A high risk was concluded for all other uses. A risk assessment for honeybees from exposure via surface water could not be performed.

A low risk to honeybees, bumblebees and solitary bees was concluded for the use to maize and sweet maize, which will be sown and maintained in permanent greenhouses. A risk assessment for the granular use to forestry nursery could not be performed with the available information.

Refer to Table 34 in the main text of the conclusion for crop-specific conclusion achieved at each assessment tier.

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Background

Clothianidin was included in Annex I to Directive 91/414/EEC[1] on 1 August 2006 by Commission Directive 2006/41/EC[2], and has been deemed to be approved under Regulation (EC) No 1107/2009[3], in accordance with Commission Implementing Regulation (EU) No 540/2011[4], as amended by Commission Implementing Regulations (EU) No 541/2011[5] and 1136/2013[6]. A specific conclusion has been issued by the European Food Safety Authority (EFSA) on the risk assessment for bees as regards the authorised uses applied as seed treatments and granules in 2013 (EFSA, 2013a).

The specific provisions of the approval were amended by Commission Implementing Regulation (EU) No 485/2013[7], to restrict the uses of clothianidin, thiamethoxam and imidacloprid, to provide for specific risk mitigation measures for the protection of bees and to limit the use of the plant protection products containing these active substances to professional users. In particular, the uses as seed treatment and soil treatment of plant protection products containing clothianidin, thiamethoxam or imidacloprid have been prohibited for crops attractive to bees and for cereals except for uses in greenhouses and for winter cereals. Foliar treatments with plant protection products containing these active substances have been prohibited for crops attractive to bees and for cereals with the exception of uses in greenhouses and uses after flowering. Furthermore, the European Commission requested EFSA to provide conclusions concerning an updated risk assessment for bees for clothianidin, thiamethoxam and imidacloprid, taking into account all uses other than seed treatments and granules, including foliar spray uses as mentioned in recital 7 of Commission Implementing Regulation (EU) No 485/2013. EFSA finalised its conclusion on the risk assessment for bees as regards all uses other than seed treatments and granules in July 2015 (EFSA, 2015a).

It was a specific provision of the Commission Implementing Regulation (EU) No 485/2013 that the applicant was also required to submit to the European Commission further ecotoxicological studies by 31 December 2014. The outcome of the peer review of the confirmatory data assessment was reported in a Technical Report and a conclusion published in 2016 (2016a,b).

Furthermore according to recital 16 of Regulation (EU) No 485/2013, within 2 years from the date of entry into force of that Regulation, the European Commission foresees to initiate without undue delay a review of the new scientific information available.

For this purpose, with reference to Article 31 of Regulation (EC) No 178/2002[8] and in accordance with Article 21 of Regulation (EC) No 1107/2009, in February 2015, the European Commission requested EFSA to organise an open call to collect new scientific information as regards the risk to bees from the neonicotinoid pesticide active substances clothianidin, thiamethoxam and imidacloprid applied as seed treatments and granules in the European Union (EU) (EFSA, 2015b) and then, following a second mandate received in November 2015, EFSA was requested to provide conclusions concerning an updated risk assessment for bees for the three neonicotinoids (namely clothianidin, imidacloprid and thiamethoxam).

The new relevant data collected in the framework of the open call for data and any other new data from studies, research and monitoring activities relevant for the uses under consideration were taken

[1] 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, as last amended.

[2] Commission Directive 2006/41/EC of 7 July 2006 amending Council Directive 91/414/EEC to include clothianidin and pethoxamid as active substances. OJ L 187, 8.7.2006, p. 24–27.

[3] 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 No L 309, 24.11.2009, p. 1–50.

[4] 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

[5] 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.

[6] Commission Implementing Regulation (EU) No 1136/2013 of 12 November 2013 amending Implementing Regulation (EU) No 540/2011 as regards the extension of the approval periods of the active substances clothianidin, dimoxystrobin, oxamyl and pethoxamid. OJ L 302, 13.11.2013, p. 34–35.

[7] Commission Implementing Regulation (EU) No 485/2013 of 24 May 2013 amending Implementing Regulation (EU) No 540/2011, as regards the conditions of approval of the active substances clothianidin, thiamethoxam and imidacloprid, and prohibiting the use and sale of seeds treated with plant protection products containing those active substances. OJ L 139, 25.5.2013, p. 12–26.

[8] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, p. 1–24.

into account. To address the mandate, EFSA also considered the data available from a previous systematic literature review, outsourced in 2013 (Fryday et al., 2015). Furthermore, an update of this systematic review was performed in June 2016, in order to collect all published scientific literature relevant for the current evaluation (EFSA, 2018a). The EFSA guidance document on the risk assessment of plant protection products on bees (EFSA, 2013c) was used for the current evaluation.

A consultation on the evaluation and preliminary conclusions of EFSA on the risk assessment for bees was conducted with Member States via a written procedure in September 2017. The draft conclusions drawn by EFSA, together with the points that required further consideration in the assessment, as well as the specific issues raised by Member States following the consultation, were discussed at the Pesticides Peer Review Experts' Meeting 166 on ecotoxicology in October 2017. Details of the issues discussed, together with the outcome of these discussions were recorded in the meeting report. After the expert meeting EFSA finalised the conclusions and launched a second written procedure on the final draft in December 2017–January 2018 in order to provide their comments on those parts of the Conclusions and supporting documents that have been amended following the Peer Review Meeting. The compiled comments were considered by EFSA and are published as part of the background documents to the Conclusions.

In addition, key supporting documents to this conclusion are the Technical Report on the evaluation of data (2018a) and the Peer Review Report (EFSA, 2018b).

The Technical Report provides the methodology developed by EFSA relating to the evaluation of the available data for what concern their relevance for the current risk assessment and their scientific reliability. It is composed as follows:

- Technical Report on the evaluation of data (EFSA, 2018a)
- Study Evaluation Notes (Appendices D–O) to the Technical Report (EFSA, 2018a).

The Peer Review Report is a compilation of the documentation developed to evaluate and address all issues raised in the peer review; it comprises the following documents, in which all views expressed during the course of the peer review, including minority views where applicable, can be found:

- the comments received on the preliminary draft EFSA conclusion,
- the report of the scientific consultation with Member State experts,
- the comments received on the final draft conclusions.

It is recommended that this conclusion report and its background documents would not be accepted to support any registration outside the EU for which the applicant has not demonstrated that it has regulatory access to the information on which this conclusion report is based.

The active substance and its metabolites

Clothianidin is the ISO common name for (*E*)-1-(2-chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine (IUPAC). Clothianidin belongs to the group of neonicotinoid compounds which are used as insecticides. They interact with the receptor protein of nicotinic acetyl choline receptors in the nerve fibre membrane of insects. The risk to bees from several metabolites of clothianidin (TZNG, TMG, TZMU) has previously been identified to require consideration (EFSA, 2015a). These metabolites are several orders of magnitude less toxic to honeybees than the parent substance, clothianidin. Consequently, no formal risk assessment for bees from metabolites of clothianidin in pollen and nectar is required.

Assessment

1. Uses assessed

In accordance with the mandate received in February 2015, EFSA liaised with applicants in order to collect feedback on the uses they would like to support for the EU market. During the open call for data, the applicants were requested to submit information on the uses of clothianidin (Good Agricultural Practices), applied as a seed treatment or granule that they wish to support. In a second step, in December 2015, Member States were requested to validate the consolidated Good Agricultural Practices (GAPs) from applicants, providing feedback on the authorised uses in their respective countries. However, the risk assessment was performed for all uses supported by the applicants. Full details of the GAPs are given in Appendix A. Tables 1 and 2 provide a brief summary of the critical

GAPs relevant to the risk assessment for bees. Only the highest and lowest of the maximum application and seed treatment rates are given in Tables 1 and 2.

Several of the crops (carrot, chicory, fodder beet and sugar beet) under consideration are normally harvested before flowering except when they are grown for production of seed. The applicant confirmed that the GAPs for clothianidin include situations where the crop is grown for seed production; therefore, a Tier-1 risk assessment was performed.

Table 1: Summary of the seed treatment uses considered in this conclusion

Crop	Lowest seed treatment rate (mg a.s./seed)	Highest seed treatment rate (mg a.s./seed)	Lowest application rate (g a.s./ha)	Highest application rate (g a.s./ha)	Notes
Alfalfa (seed production)	0.0017	0.0017	80	100	Single product also containing beta-cyfluthrin
Carrot	0.07	0.07	120	120	–
Winter cereals	0.015	0.028	48	100	Three products, two also containing other active substances(a)
Spring cereals	0.028	0.028	75	90	Single product also containing prothioconazole
Chicory	0.3	0.3	33	75	Single product also containing beta-cyfluthrin
Clover (seed production)	0.013	0.013	60	105	Single product also containing beta-cyfluthrin
Maize	0.5	1.25	35	125	–
Mustard	0.035	0.07	25	50	Single product also containing beta-cyfluthrin
Poppy	0.004	0.013	7	22	Two products, one also containing beta-cyfluthrin
Spring rape	0.025	0.05	20	60	Single product also containing beta-cyfluthrin
Winter rape	0.025	0.05	20	60	Single product also containing beta-cyfluthrin
Sugar and fodder beet	0.1	0.6	13	78	Five products, four containing other active substances(b)
Sunflower	0.5	0.5	27	27	–

a.s.: active substance.
(a): 'FS 300' contains prothioconazole in addition to clothianidin. 'FS 373.4' contains imidacloprid, prothioconazole and tebuconazole in addition to clothianidin.
(b): 'FS 180', 'FS 380' and 'FS 453' all contain beta-cyfluthrin in addition to clothianidin. 'FS 280' contains imidacloprid and beta-cyfluthrin in addition to clothianidin.

Table 2: Summary of the granular uses considered in this conclusion

Crop	BBCH at time of application	Lowest application rate (g a.s./ha)	Highest application rate (g a.s./ha)	Notes
Forestry nursery	00	–	–	1–2 g/plant 4 g/m^2
Maize	00	50	110	–
Maize in a greenhouse	00	50	50	Greenhouse use. Crop remains in the greenhouse until harvest
Potato	00	70	70	–
Sorghum	00	50	50	–

Crop	BBCH at time of application	Lowest application rate (g a.s./ha)	Highest application rate (g a.s./ha)	Notes
Sweet maize	00	50	110	–
Sweet maize in a greenhouse	00	50	50	Greenhouse use. Crop remains in the greenhouse until harvest

BBCH: growth stages of mono- and dicotyledonous plants; a.s.: active substance.

2. Summary of the data considered in this conclusion

Concerning the effect and exposure data, the present conclusion makes use of different sources.

The first source of data was the open call for data for new scientific information as regards the risk to bees from the use of the three neonicotinoid pesticide active substances clothianidin, imidacloprid and thiamethoxam applied as seed treatments and granules in the EU. EFSA launched this call from May 2015 to September 2015. More details on the open call for data are available in a dedicated Technical Report (EFSA, 2015b).

Other sources of data were the systematic literature search on the neonicotinoids and the risks to bees that EFSA outsourced in 2013 (Fryday et al., 2015) and the related update, performed by EFSA in June 2016 (Appendix B to EFSA, 2018a).

The first systematic literature search comprised 546 (already screened) documents, while the update of the literature search retrieved 874 documents. In addition, there were 376 contributions were received during the open call for data. After duplicate removal, the overall initial list included 1,599 documents. A title and abstract screening step identified 680 potentially relevant documents which were then subject to full text screening. During the full-text screening, all experiments within the available documents were identified and totalled 968. Of these experiments, 588 were critically apprised and the data extracted.

Finally, in accordance with the European Commission mandate, Member States were also further requested to provide any monitoring data not yet available during the open call data. The data submitted were already included in the data set.

Full details on the collection of the available data investigating the effects of clothianidin to bees, together with their assessment for, their reliability and relevance, are given in the Technical Report on the evaluation of data and related appendices (EFSA, 2018a).

Furthermore, for what concern the exposure data in pollen and nectar, data already used in previous assessments (EFSA 2013a, 2015a) were also considered, as information on residue levels was already systematically collected and organised by EFSA during such previous assessments.

3. Principles and assessment criteria

3.1. Aim of the assessment

The current EU agreed level of protection for bees is to ensure that effects on colonies/populations are negligible. This means that the exposure of the colonies/populations at the edge of the treated fields should not exceed a level which results in an effect greater than negligible.

As requested by the European Commission mandate, to perform the risk assessment of the three active substances the EFSA Guidance Document on the risk assessment of plant protection products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees), hereafter referred to as EFSA (2013c) was followed. The basis of the risk assessment according to EFSA (2013c) is to ensure that the specific protection goals (SPG) for honeybees, bumblebees and solitary bees are met.

Namely:

- For honeybees, to ensure that there is not a greater than 7% effect on colony strength, including after overwintering, and the level of forager mortality does not breach the tolerable level, for honeybee colonies located at the edge of treated fields which are exposed to the 90th percentile predicted exposure or less.
- For bumblebees, to ensure that there is not a greater than 7% impact on the colony for bumblebee colonies located at the edge of treated fields which are exposed to the 90th percentile predicted exposure or less.

- For solitary bees, to ensure that there is not a greater than 7% effect on the population of bees located at the edge of treated fields which are exposed to the 90th percentile predicted exposure or less.

These SPGs define the problem formulation for the present assessment.

3.2. Tier-1

According to EFSA (2013c), depending on the product formulation and the application method under evaluation, different routes of exposure need to be considered to perform the risk assessment to bees. The exposure from seed treatments and granular formulations in the 'treated crop' and the 'succeeding crop' scenarios derives from residues in pollen and nectar following translocation from below ground (seeds or soil). The same route of exposure is considered relevant for the 'weeds' scenario in the case of granules application.

Concerning the surrounding area ('field margin' and 'adjacent crop' scenarios), the most relevant exposure is due to dust drift at the sowing (treated seeds)/application (granules).

Furthermore, a separate risk assessment for exposure via consumption of contaminated water should be carried out for honeybees.

Details about the entire Tier-1 risk assessment scheme can be found in EFSA (2013c).

The Tier-1 risk assessment was carried out using default exposure values in accordance with EFSA (2013c), while the selection of the toxicity endpoints is described in Section 3.2.1. Whenever suitable toxicity data for bumblebees and solitary bees were lacking, a surrogate endpoint was extrapolated from the related honeybee data (assuming the endpoint is a factor of 10 lower). In this case, throughout the present conclusion, we refer to the Tier-1 as 'screening Tier-1'.

3.2.1. Selection of the endpoints

Several endpoints from laboratory studies were obtained from the data considered in this conclusion and which had not been considered in previous EU assessments. These newer endpoints have been considered to amend the previously agreed EU endpoints (EFSA, 2015a) provided that the following criteria were fulfilled:

- The endpoint was considered as relevant for a risk assessment according to EFSA (2013c) and for the GAPs under consideration (e.g. the endpoint type, the test species and the test item).
- The endpoint was assessed to be 'Fully reliable' or 'Reliable with minor restrictions' during the appraisal exercise (EFSA, 2018a).
- The endpoint, from a study with technical active substance, indicated higher toxicity than the previously agreed EU endpoint for the technical active substance.

Moreover, for endpoints from formulation studies, the following criteria were considered:

- The previously agreed EU endpoint from a formulation study was replaced only if it was less relevant (e.g. study with a spray formulation) than the newer formulation endpoint.
- The previously agreed EU endpoint is a surrogate extrapolated endpoint.

Where no new endpoints were available, or the criteria above were not fulfilled, the previously agreed EU endpoints were selected for risk assessment.

The data available and final selection of the endpoints used for the current risk assessment is presented in Section 4.

3.3. Refinement of the exposure assessment

Within EFSA (2013c), no specific stepwise approach is offered for higher tier risk assessment. Nevertheless, among the options listed in the guidance, one possibility is to refine the exposure estimate, i.e. replace the default values with specific values. Within the scope of this conclusion, the risk assessment carried out with refined exposure estimates is referred to as 'Tier-2'. A further refinement option given in EFSA (2013c) is to refine the assessment by use of higher tier effect studies performed in the field or under semifield conditions (see Section 3.4). Specific exposure assessment goals need to be determined in order to use such effect studies in a refined risk assessment, referred to as 'Tier-3'.

3.3.1. Residues in pollen and nectar

3.3.1.1. Data evaluation and selection

The newly available higher tier studies, reporting information on exposure, were evaluated in line with the validity criteria set in the literature evaluation protocol (EFSA, 2018a) and the protocol proposed in Appendix G of EFSA (2013c). The valid data on the residue levels occurring in nectar and pollen for the exposure scenarios for the treated field and the succeeding crops in line with these protocols were collated in a table. Residue determinations in available field studies were assessed for their reliability both in relation to their field and laboratory phases. For the field phase in order to refine the exposure, higher tier studies from at least five randomly selected locations in the area of use of the substance should be conducted. This minimum of five randomly selected locations in the area of use is prescribed by the guidance, to ensure that an estimate can be made of the distribution of residues that might really be encountered. This has the aim of accounting for the different temporal and spatial variability that occurs. In relation to the laboratory phase, the analytical methods were examined for their adequacy for determining residues at the low levels required. In some instances, the size of the samples collected in the field phase were lower than the sample size for which the method had been validated, in such cases appropriate correction on the method validated limit of quantification (LOQ) (for the target sample size) was applied, i.e. the LOQ was increased to account for smaller than ideal sample availability of individual sampling events.

Measured residue levels of pollen and nectar were reported for each type of sampling matrix (i.e. samples from the plant, from the bee, from the bee via pollen traps, from the comb and from soil). In general, the sampling scheme which aimed to determine residues in the same matrix (either in plant matrices or bee matrices) during the field studies was not exhaustive enough to guarantee that the time dependence of the residue over the period of interest could be captured. This prevents any analysis aimed to determine a mathematically rigorous percentile exposure value over time. Therefore, the maximum observed in the available samples was retained as representative of the exposure in each particular field experiment. This does not imply that the overall risk assessment has to be regarded as overly conservative, since the sampling frequency pattern in the studies does not guarantee that the actual maximum occurrence was picked up by the maximum measured in the samples taken. Nevertheless, it is expected that the assessment based on these principles may still be considered to represent a realistic worst-case exposure for the different substances and uses assessed.

Treated crop scenario

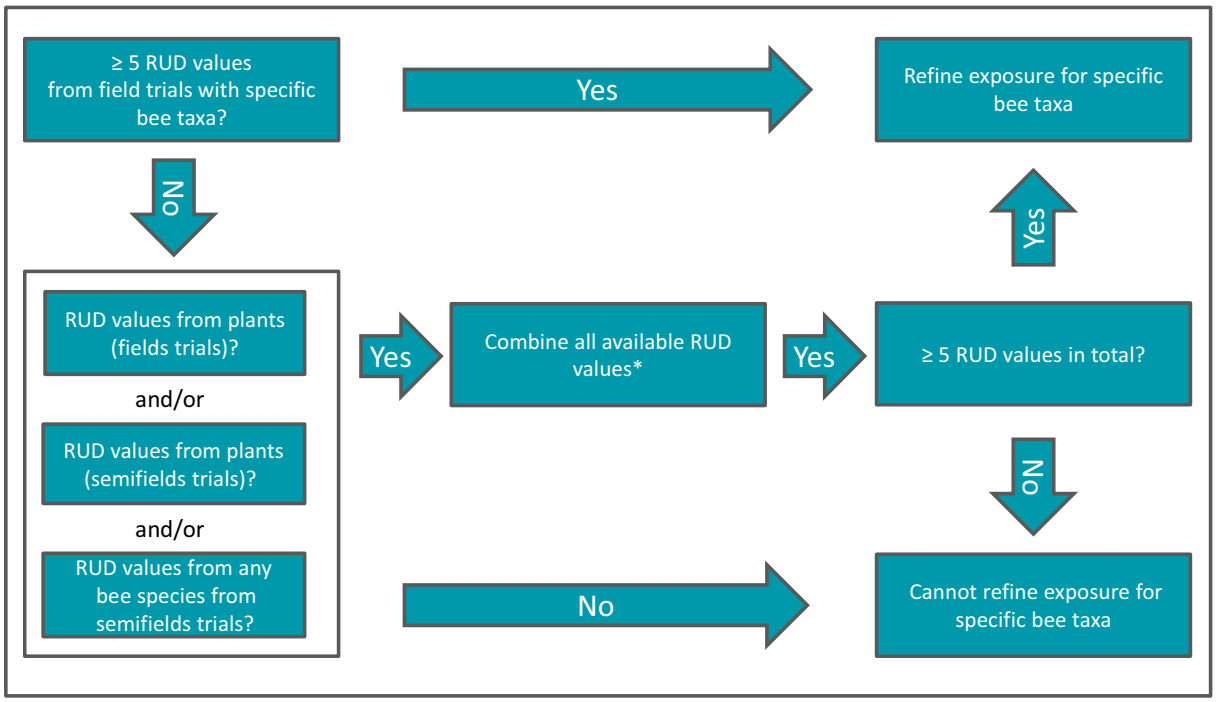
Regarding the field phases, the directly treated crop needed to be the crop being assessed. Appendix R of EFSA (2013c) indicates that extrapolation between the residue values from different crops is inappropriate when substances are systemic, which is interpreted to relate to seed treatment uses or when granules are placed with seed at the time of drilling. This is because the different physiology of different crops, including the time from emergence to flowering leads to different translocation and levels of residues in different crops. When assessing the field phases of the available experiments, the most critical issues encountered were cross-contamination from fields in the vicinity and/or due to historical uses in the same field, i.e. not resulting from the treated seeds of known application rates. Only data from studies for which there was a sufficient certainty that the residues observed were resulting from the application being investigated as prescribed in the study design, were retained for the exposure assessment. The presence or absence of residues measured in control plots was not part of the decision on retention.

For the exposure assessment, the measured residue values (mg analyte/kg pollen or nectar) were normalised for the seed loading (mg a.s./seed) to give residue per unit dose (RUD) (where the unit dose is 1 mg a.s./seed) to make the residues independent from the application rate used in the studies. From one study, sometimes more than one RUD value was calculated and included in the collation table when more than one trial was conducted within the study. A standalone trial was defined when one or more of the following factors were different from other trials: type of formulation, plant species, application rate, test site, period of the trial, pretreatment of the soil and test category (i.e. field and semifield trials, where semifield means bees used to obtain samples were restricted to foraging on treated plots).

According to EFSA (2013c), in order to refine the exposure, higher tier studies from at least five randomly selected locations in the area of use of the substance should be conducted. Therefore, a minimum of five RUD values for pollen and nectar were considered necessary to perform a refined exposure assessment for each exposure scenario for each use under consideration.

Where the residue detected in a trial was reported to be lower than the LOQ but greater than the limit of detection (LOD), as a worst-case assumption, the residue was considered to be equal to the LOQ for the RUD calculation. In the cases that no residues were detected, the residue was considered to be equal to the LOD for the RUD calculation.

According to EFSA (2013c), in order to perform an exposure assessment, it is preferable to use measured RUD values for pollen and nectar collected from bees (specific for honeybees, bumblebees and solitary bees), e.g. using pollen traps attached to honeybee hives or sampling nectar by extracting the honey stomach from forager bees. Using the RUD values for pollen and nectar directly from the bees aims to give a better representation of the likely exposure to bees and bee colonies by accounting for dilution by non-contaminated pollen and nectar. Considering each bee taxon separately is needed to account for differences in their foraging behaviour that would be expected to mean that dilution was different between the categories. Alternatively, RUD values for pollen and nectar taken directly from the plant can be used in the exposure assessment. However, RUD values for plant pollen and nectar are considered to be an overestimation of the exposure to bees as dilution is not accounted for. Therefore, if there are a sufficient number of RUD values for bee nectar and/or pollen from field trials, only these values were used for the exposure assessment. RUD values for pollen and nectar from bees taken from semifield studies were considered to be representative of situations where there was no dilution and therefore were considered together with the RUD values for plant pollen and nectar. In the cases where RUD values were available on both bee pollen/nectar and plant pollen/nectar from the same semifield study, the values for bees only were retained. Where less than five RUD values for bee pollen/nectar were available these were combined with the RUD values for plant pollen/nectar and bee pollen/nectar from semifield, i.e. to obtain sufficient data to perform the exposure assessment. Figure 1 summarises the process for selecting the RUD values for the refined exposure assessment for the treated crop scenario.



*If RUD values from both plants and bees are available from the same semi field trial, only retain RUDs from bees to avoid double counting

Figure 1: A summary of the selection process for RUD values for the refined exposure assessment

Succeeding crop scenario

A different approach from the treated crop scenario was used for the succeeding crop scenario. This is because the residues in the succeeding crop scenario are less dependent on the physiology of the treated crop, but are instead mainly driven by the active substance concentration in soil and by the physiology of the successive crop. For this reason, in the residue trials, residues in the topsoil/root zone had to have been measured before the planting of succeeding plant species. For trials to be

retained in the assessment, these residues in soil needed to be roughly equivalent to or higher than that estimated to occur (predicted environmental concentrations (PEC)) in soil from the uses being assessed. How such PECs were calculated is outlined in Sections 5.1.1.2 and 5.2.1.4.

Maximum residues in pollen and nectar from the retained trial sites were used to estimate exposure in the risk characterisation, while following the approach for the selection of residues directly from bees (either in open field or semifield trials) or via plant sampling as already discussed above for the treated crop scenario. As the residues trial site selection was based just on measured soil residues, it was not necessary for the agricultural practice or product formulation type that had been used at any individual trial to match the uses being assessed. As measured residues in soil ensured that the trials covered the GAPs without necessarily being linked to a specific use, RUD values were not calculated.

Once again, in order to refine the exposure assessment, residues from at least five trials are needed.

3.3.1.2. Calculation of refined shortcut values

The residue values selected for the refined exposure assessment for the treated crop scenario and the succeeding crop scenario were used to calculate new shortcut values (SVs), which represent active substance intake per day (adults) or per developmental period (larvae). Such calculation was performed by means of the SHVAL tool (EFSA, 2013c, 2014). This R-based tool fits theoretical distributions to the available data (e.g. residue levels, consumption rates, sugar concentration in nectar) and then it runs Monte Carlo simulations with 1,000 iterations (see EFSA, 2014 for details). The result of such simulation is a distribution of intake values per day (or per developmental period for larvae). Finally, the 90th percentile of this distribution is selected as the relevant crop/substance specific SV. Separate simulations were carried out for each caste of each bee group (honeybee, bumblebee and solitary bees).

No data were available to refine consumption rates or sugar concentration in nectar. Hence, for these variables, default values as presented in Appendix J of EFSA (2013c) were used in the simulations.

3.3.1.3. Estimation of the exposure assessment goal

Treated crop scenario

To consider the higher tier effect studies in the context of the risk assessment, the exposure within those effects studies were compared to the expected exposure for the GAPs under consideration. For the treated crop scenario, specific 'exposure assessment goals' were estimated by transforming the refined SVs used in the Tier-2 assessment. To transform the refined SVs to an exposure assessment goal, the SVs were multiplied by the seed loading rate (in terms of mg a.s./seed) for each use.

Figure 2 presents a general overview of the stepwise approach followed for the refinement of exposure assessment for the treated crop scenario.

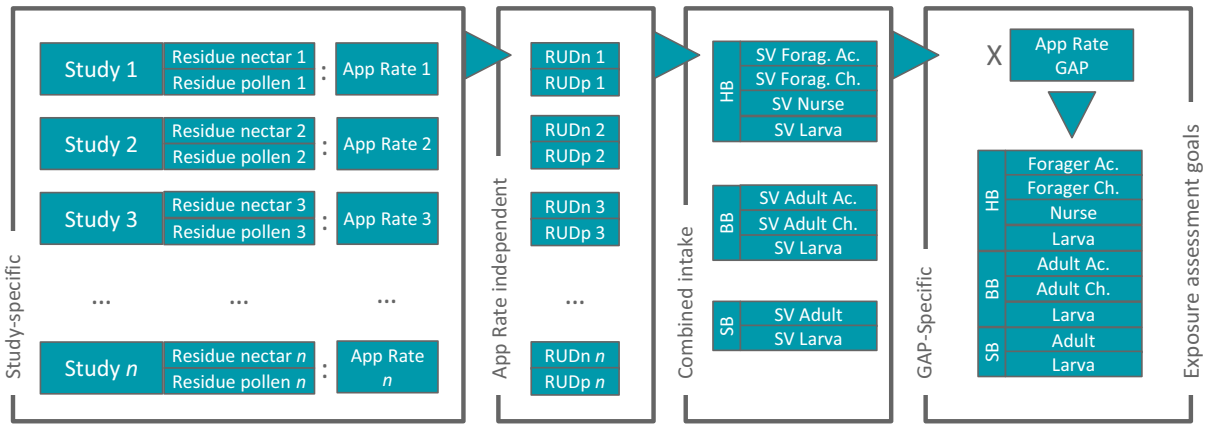


Figure 2: General overview of the refined of exposure assessment for the treated crop scenario

Succeeding crop scenario

For the succeeding crop scenario, refined SV were calculated by using actual residue values, without any further normalisation for the application rate. As such, the refined SVs obtained as described in Section 3.3.1.2 represent as well the exposure assessment goals.

Figure 3 presents a general overview of the stepwise approach followed for the refinement of exposure assessment for the succeeding crop scenario.

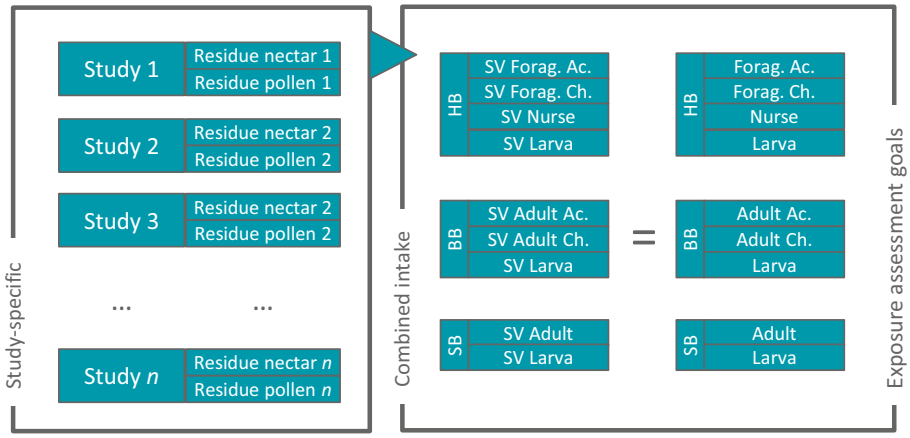


Figure 3: General overview of the refined of exposure assessment for the succeeding crop scenario

3.3.2. Dust drift and deposition

According to EFSA (2013c), exposure to dust drift in the field margin or in adjacent crops are considered relevant for seed treatment uses and granular formulations.

Field experiments measuring dust deposition to the horizontal ground outside the treated area at the time of drilling seed were considered reliable when: the quality of the treated seed (in terms of dust content and active substance in the dust) had been measured, the drilling machinery used was adequately described, the application rate in terms of mass of active substance per unit treated area was adequately measured, dust deposition at different distances downwind of the treated area was adequately determined and wind speed and direction measurements were available. In many of these experiments, dust drift outside the boundary of the treated field was also measured using vertical gauze netting. These vertical gauze results were not used further, as it was not clear how the results reported as g a.s/ha were derived and what they represented. Also agreed methodology is not available to how to use or interpret such values that may have utility in estimating exposure to field margin vegetation or adjacent crops when measured at the individual trial sites.

3.3.3. Weeds in the field

According to EFSA (2013c), exposures to residues in pollen and nectar of flowering weeds within the treated field are only considered relevant for uses applied as granules (and sprays). Several options to refine the exposure to bees from residues in weeds are given in EFSA (2013c) (e.g. considering the proportion of the treated field which is covered by flowering weeds, considering measured residues from crops exposed to dust from granular uses). In the current assessment, no additional higher tier data were considered.

3.3.4. Residues in water sources

In accordance with the recommendation of EFSA (2013c), measured residue in the guttation fluids exuded from the treated plant were considered for refining the assessment related to this route of exposure relevant for honeybees. EFSA (2013c) specifies that the guttation concentration used in the risk assessment needs to cover the 90th percentile in guttation fluid for the crop of concern (considering location, growth stage and environmental conditions). For seed treatments and granules buried with seeds, it is proposed to refine the exposure estimate by conducting (at least) five field studies and to measure the concentrations in guttation water.

Therefore, in principle, a refinement of the exposure can be performed if at least five field studies are available for the same crop. For acute risk assessment, the relevant concentration within each experiment is the maximum measured residue value. For chronic risk assessment (both for adult and larva), if a decline of the active substance concentrations in guttation fluids was observed, a time-weighted average (TWA) concentration was estimated (10-day TWA for adult, 5-day TWA for larva) and considered the relevant value.

A refined surface water exposure assessment could not be performed as agreed input parameters for FOCUS surface water modelling are not available.

3.4. Refinement with higher tier experiments

3.4.1. Building up the lines of evidence

Another approach offered by EFSA (2013c) to refine the risk assessment is to perform higher tier effect experiments. These experiments are normally carried out under field or semifields conditions, and aim at a higher environmental realism when compared to standard laboratory tests.

These experiments present a wide variety of set-ups, designs and investigated endpoints. Therefore, a weight of evidence (WoE) scheme has been developed to integrate the relevant information from all available experiments. In order to perform a WoE risk assessment, it is first necessary to set the problem formulation and then identify the lines of evidence which address the problem. In the case of honeybee, bumblebee and solitary bee risk assessments performed in accordance with EFSA (2013c), the problem formulation is already defined by the specific protection goals.

Within the WoE, it was considered that each 'line of evidence' corresponds to the whole set of homogeneous endpoints measured in all available experiments. An endpoint in this context is defined as a parameter which could be informative of a potential effect caused by an exposure to an active substance (and its metabolites).

Within each experiment, the endpoint is identified by four dimensions:

- The **magnitude** of the observed deviation from the control. For endpoints measured as time series, the extremes of such deviation were recorded in both directions, together with a mean deviation. In case of such endpoints like forager mortality, this dimension should also account for the duration of a consistent deviation (e.g. increase of X% in forager mortality observed for Y consecutive days). Deviations in both directions were classified as: no deviation, negligible, small, medium and large deviation relative to the control. For this classification, the scales presented in Table 3 were used. These scales were adapted from Appendix B of EFSA (2013c) (Protection goals), except the scale for homing success, where the categories were arbitrarily chosen. An example for using these scales: if the average colony strengths in a honeybee study at an observation time was 6% less in the treated group compared to the control, this was classified as a negative negligible deviation. If at another observation day the colony strengths in the treated group was 16% more than in the control, this was classified as a positive medium deviation. It has to be noted that pending on the availability of the data on the relevant endpoints (i.e. reported details), the deviation from the control was either calculated or only estimated (e.g. when only graphical presentation was available for the endpoint).

Table 3: Scale of deviations from the control used for the weight of evidence exercise

Deviation class	All endpoints except mortality and homing success	Forager mortality and mortality in front of the hive	Homing success
No deviation	0%	0%	0%
Negligible	> 0–< 7%	See examples in Table B1 of Appendix B of EFSA (2013c)	> 0–< 10%
Small	7–< 15%	See examples in Table B1 of Appendix B of EFSA (2013c)	10–< 20%
Medium	15–< 35%	See examples in Table B1 of Appendix B of EFSA (2013c)	20–< 50%
Large	≥ 35%	See examples in Table B1 of Appendix B of EFSA (2013c)	≥ 50%

- **The reliability of the endpoint:** this was established on the basis of the appraisal exercise (EFSA, 2018a) and giving a score to each endpoint from 0 (not reliable) to 3 (fully reliable). The reliability was used to weigh the results obtained in different experiments, and to estimate, together with the level of consistency of the results, the level of certainty associated with the line of evidence.
- **The level of exposure:** this information is necessary to check where the level of exposure in the experiment stands compared to the exposure assessment goal(s). Furthermore, this information can be used to check whether a sort of exposure–response relationship can be identified. For oral exposure to residues in pollen and nectar, residue intake values were calculated for each caste of bee using the mean residue value on nectar and/or pollen obtained in the effects study. A sugar content of 15% was assumed for nectar for honeybees and bumblebees whereas for solitary bees a sugar content of 10% was used (EFSA 2013c). In case of colony-feeder studies, the sugar content of the sugar solution specified in the study was used. If this was not available, then a sugar content of 50% was assumed. The daily consumption values, for pollen and nectar, for each bee caste were taken from EFSA (2013c). Where a range of consumption values were available, a range of residue intake values were obtained.
- **The length of exposure:** this is defined as the time period in which there could have been exposure to residues of the active substance. It is noted, that the 'length of exposure' referred to in this conclusion does not account for the subsequent consumption of food stores within colonies/nests. In field and semifield studies, this corresponds to the time period the bees could be exposed to the crop during flowering. For colony-feeder studies, the length of exposure is defined by the time period in which the spiked sugar solution or pollen was given to the bees. This information is needed to check whether the length of exposure is realistic to that expected for the GAPs under consideration.

In order to visually illustrate these four dimensions of the endpoints and in order to help the interpretation of a 'line of evidence', graphical representations were prepared. A graphical representation of a 'dummy' example (invented example for illustrative purpose) is included in Figure 4 below with an explanation of each element of the figure.

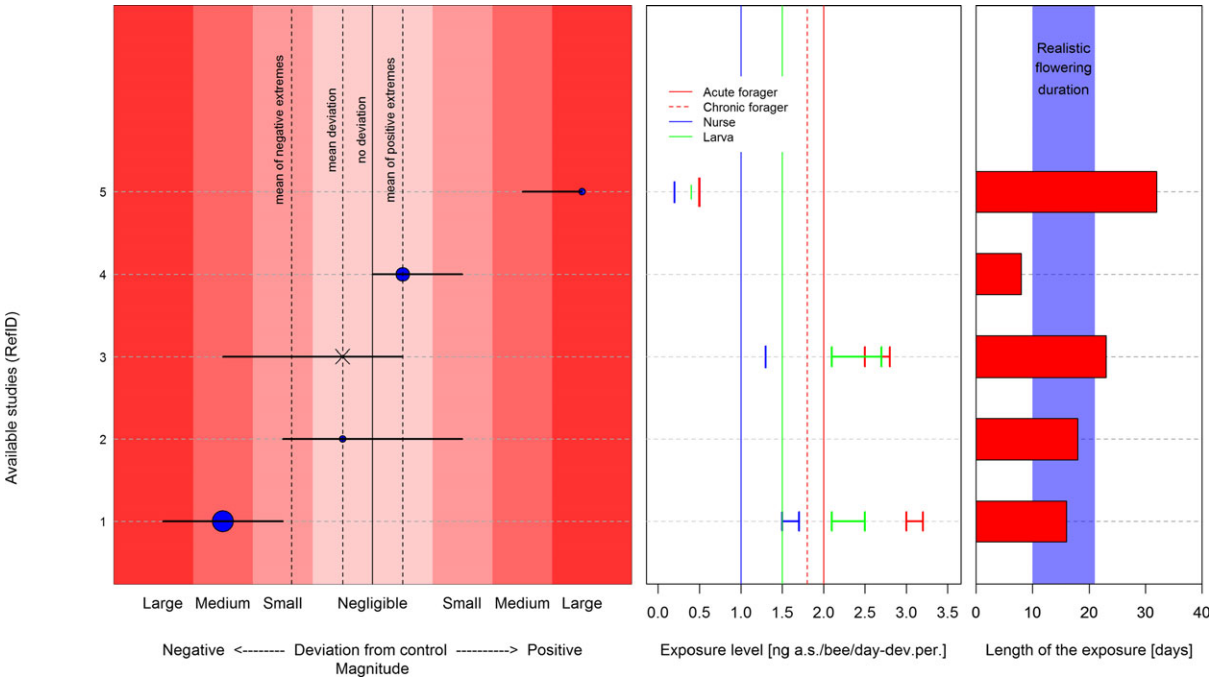


Figure 4: Lines of evidence for a 'dummy' example: colony strength of honeybees

The figures include the following information:

- Each row in the figure represents a higher tier effects study. The numbers given on the left-hand side are the reference identification codes which can be traced back to the reliability assessment provided in the Technical Report on evaluation of data and related Appendices from D to O (EFSA, 2018a) A full list of the reference identification codes considered in the conclusion and the related studies (study evaluation notes) is provided in Appendix H. A summary of the reference identification codes according to the different assessment streams identified during the evaluation of the data is summarised below. Note that several studies investigated a number of exposure levels and therefore these studies maybe listed more than once (e.g. the highest exposure level that caused no or small deviation from the control and the lowest exposure level with apparent deviation from the control).

Assessment stream	Reference identification code
All* (with interaction)	All*
All+(no interaction)	All+
Clothianidin	C.
Imidacloprid	I.
Thiamethoxam	T.
Clothianidin * Imidacloprid (with interaction)	C * I.
Clothianidin + Imidacloprid (no interaction)	C + I.
Clothianidin * Thiamethoxam (with interaction)	C * T.
Clothianidin + Thiamethoxam (no interaction)	C + T.
Imidacloprid * Thiamethoxam (with interaction)	I * T.
Imidacloprid + Thiamethoxam (no interaction)	I + T.
Not substance-specific	NS

- The left hand panel relates to the biological observations while the centre and right hand panel relates to exposure.
- For each experiment, the black solid horizontal line represents the range of the observed deviations from the control (i.e. both negative and positive deviations). The magnitude of these deviations are categorised as negligible, small, medium or large. When this is not indicated, the endpoint was measured only once during the study or it was measured multiple times, but insufficient details were reported to evaluate the variability of the endpoint in time (e.g. only averages for the entire study duration were reported).
- The position of the blue circle gives an estimation of the overall deviation (mean) from the control for the entire duration of the study or during the year of use for those studies which extend over the winter.
- The size of the blue circle is an indication of the reliability score of the specific endpoint. A 'fully reliable' endpoint gives a large circle, an endpoint which was 'reliable with minor restrictions' gives a medium sized circle and an endpoint which was 'reliable with major restrictions' gives a small circle.
- For transparency, the experiment giving endpoints which were assessed as 'not reliable' have also been included in the figure but the overall deviation is represented by an X.
- To help interpret the figure, vertical dotted lines have been added to indicate the mean overall deviation, the mean negative deviation (if it could be calculated) and the mean positive deviation (if it could be calculated) across all of the reliable experiment (weighted for the reliability score of the endpoint).
- In the centre panel of the figure, a representation of the estimated level of exposure achieved in the experiment is given for each bee caste (e.g. ng a.s./bee per day for adult bees and ng a.s./larvae per development period for larvae). When this is not indicated, reliable information on the exposure level achieved in the study was not available.
- The vertical lines in the centre panel of the figure represent the exposure assessment goal, for each bee caste, for the GAP under consideration (see Section 3.3.1.3).

- On the right-hand side of the figure, the length of exposure (in days) in the experiment is represented by the red bars. The vertical purple column is the expected range of exposure (e.g. the flowering period) for the crop under consideration.[9]

In order to conclude that the observed deviations are actual representations of a true effect caused by the exposure to the active substance (and its metabolites), several aspects were considered for each line of evidence.

- The presence/absence of a general trend, giving more weight to results with higher reliability.
- The level of consistency among experiments (similar results, exposure–response relationship, etc.).
- The level of precision offered by the available experiments (width of the effect size ranges).

In principle, each line of evidence should provide a piece of information characterised by a certain degree of strength (consistency), precision (degree of variability) and reliability.

Furthermore, in order to use the available information to conclude on the risk assessment, it is pivotal to check the level of the exposure in the effect experiments relative to the specific exposure assessment goals and to check whether the length of potential exposure in the effect study is within the realistic flowering period for the crop (or succeeding crop) under consideration.

3.4.2. Integrating the lines of evidence

In accordance to EFSA (2013c) and the newly available EFSA guidance document on the WoE (EFSA Scientific Committee et al., 2017), the overall process should account for the relevance of the single lines of evidence, before performing any integration.

In the current scheme, there are endpoints (lines of evidence) that are directly linked to the protection goals, and have the potential to provide a straightforward response to the main issue reported in the problem formulation (see Section 3.1). For this reason, they are considered to be the higher class of endpoints in terms of relevance (Class 1). These are colony/population size (valid for all species); forager mortality (honeybees only) and all endpoints related to the reproductive output (bumblebees and solitary bees).

Other endpoints have a rather clear conceptual link with one of the previous two (e.g. brood/cocoon production can clearly influence colony/population strength), even if this link cannot be explicitly quantified. These endpoints (lines of evidence) belong to Class 2 for relevance.

Other endpoints, on the contrary, may play a role in the colony/population health, but such link is not immediate in conceptual terms (e.g. average duration of foraging trips). These endpoints (lines of evidence) belong to Class 3.

Finally, there are endpoints that do not offer any explicit link with the protection goals (e.g. measurement of enzymatic levels at subindividual level). These endpoints are considered not relevant (Class 4) for addressing the protection goal according to EFSA (2013c).

A full list of all endpoints considered in this assessment and a detailed description of their relationship with the specific protection goals (relevance) is available in Appendix B. A less detailed summary is reported in Table 4.

[9] A crop-specific time window for a reasonable flowering period was estimating by considering: (i) feedback from Member States; (ii) assumptions within the FOCUS scenarios; (iii) collating information reported in the present data set.
For winter oilseed rape, a reasonable flowering period was estimated to last between 10 and 42 days. The selected maximum is longer than the assumptions contained in the FOCUS scenarios (maximum 28 days). During the expert meeting 166, some experts pointed out that 6 weeks of flowering may happen, but only in exceptional years. Nevertheless, within the present dataset, flowering between 35 and 43 days were recorded in several experiments carried out in France, the United Kingdom, Germany and Hungary.
For spring oilseed rape, a reasonable flowering period was estimated to last between 10 and 28 days. This was rather consistently reported by Member States, FOCUS, and the available experiments in the data set.
For maize, a reasonable flowering period was estimated to last between 10 and 21 days. Once again, this was rather consistently reported from all sources used for this estimation.
The succeeding crop scenario is not represented by any specific crop. Therefore, on the basis of all of the available information on the flowering period of agricultural crops, it was decided that a reasonable flowering period would range from 5 to 42 days.

Table 4: Summary of the endpoint types and the related relevance class assigned within the scope of the present risk assessment

Bee group	Relevance class	Family of endpoint
Honeybees	1	Colony strength
		Forager mortality
		Overwintering assessment
	2	General mortality of individuals
		Brood production
		Homing success[(a)]
	3	Behavioural endpoints
		Comb building
		Weight of the hive
		Disease
		Food storage
		Queen
	4	Behaviour influencing exposure
		Subindividual mass
		Suborganism endpoints
		Thermoregulation capacity
Bumblebees	1	Reproductive output
		Colony strength
	2	Indirect reproduction
	3	Behaviour
		Weight of the nest (colony)
		Food storage
		General mortality
		Individual mass
		Homing success
	4	Behaviour influencing exposure
Solitary bees	1	Reproductive output[(b)]
	2	Indirect reproductive output
	3	Behaviour
		General mortality

(a): For the purposes of this conclusion, the endpoint 'homing success' is defined as the proportion of bees returning to the hive/colony after they were captured and subsequently released at a distance from the hive/colony.
(b): The number of solitary bee offspring emerging after winter was considered to represent the accumulation of several preceding endpoints related to reproductive success (e.g. number of completed nests, tubes with brood, cocoon production). Therefore, the weight of evidence focussed primarily on the number of off-spring emerging after the winter.

In order to account for this hierarchical structure within the current risk assessment scheme, a stepwise procedure was followed.

As already mentioned, the first step will focus on endpoints belonging to Class 1. If the available data are sufficient to provide a conclusive answer to the main risk assessment question, the assessment could stop. If, on the contrary, the available information is not sufficient and/or appropriate to provide a conclusive answer, the WoE will be extended to other levels of relevance, in order to get a more comprehensive picture of the available data.

If the evidence in the first two levels of relevance (Classes 1 and 2) is not sufficient/appropriate to reach a conclusion, it is considered unlikely that less relevant endpoints will help achieving a conclusive assessment.

4. Outcome of the assessment: toxicity endpoints

4.1. Standard endpoints

In the data set considered, there were several available laboratory studies, assessing the effects of clothianidin, or formulated products containing clothianidin, on honeybees, bumblebees and solitary bees. Following the selection procedure given in Section 3.2.1, it was considered whether any of the newly available data should replace the previously EU agreed endpoints (EFSA, 2016b) and be used for the Tier-1 and Tier-2 risk assessments.

One reliable acute contact toxicity endpoint for honeybees performed with the technical active substance was available and resulted in LD_{50} value which was slightly less than the previously agreed endpoint. Furthermore, there were four additional studies performed with formulated products containing clothianidin. The lowest of the available endpoints, from study ALL+.2024, was selected for risk assessment (25.8 ng a.s./bee). This endpoint was slightly lower than the previously EU agreed endpoint (27.5 ng a.s./bee). In ALL+.2024, the LD_{50} was only reported for an observation period of 120 h, which is longer than the time window recommended in the OECD 214. Nevertheless, both validity criteria reported in OECD 214 were considered respected: the mortality in the control was still 2.1% after 120 h, and the toxicity of other tested substances (i.e. λ-cyhalothrin, deltamethrin, esfenvalerate) was in the expected range, providing an indication that sensitivity of the system was appropriate, in lack of a formal positive control. Therefore, the LD_{50} was considered suitable for being used in the risk assessment. This issue was discussed and agreed during the expert meeting 166.

In the data set considered, there were no newly available reliable endpoints from experiments investigating the acute oral to honeybees performed with the technical active substance but two endpoints were available from studies performed with formulated products. The endpoints from these studies were within a factor of 5 of the previously agreed acute oral honeybee endpoint and therefore this value was retained for risk assessment. There was a single chronic oral toxicity study for honeybees (C.52) and the endpoint from this study (0.95 ng a.s./bee) was marginally less that the previously agreed endpoint (1.38 ng a.s./bee) and was therefore selected for risk assessment. Study C.1025 investigated effects of exposure to clothianidin to honeybee larvae after a single dose. The endpoint was only expressed in terms of the concentration in the diet and not expressed in a dose per larvae as required by the risk assessment scheme according to EFSA (2013c). Furthermore, exposure in this study was a single dose whereas an endpoint following 4 days of exposure is needed for risk assessment in accordance with EFSA (2013c). Therefore, the previously agreed endpoint for honeybee larvae was selected for risk assessment. No reliable laboratory data were available to derive a NOEL for the development of hypopharyngeal glands (HPG) in honeybees. Therefore, a Tier-1 and Tier-2 risk assessment could not be performed. No data were available to be able to assess whether clothianidin results in accumulative effects in honeybees.

There were three acute contact toxicity endpoints for bumblebees performed with formulated products but none performed with the technical active substance. The endpoints from these studies were with a factor of 5 of the previously agreed endpoint and therefore this endpoint was retained for risk assessment. There was a single study (C.537) giving an acute oral LD_{50} value for bumblebees for the technical active substance. This study was also evaluated under the confirmatory data assessment (EFSA, 2016c) and the endpoint was used for risk assessment. Consequently, this endpoint was retained for the risk assessment. There was no reliable toxicity data available for solitary bees. No data giving the chronic oral toxicity to bumblebees or toxicity to bumblebee larvae were available. In accordance with EFSA (2013c), where data are missing, surrogate endpoints can be calculated using toxicity data for honeybees divided by 10. Surrogate endpoints were therefore calculated for the acute contact and oral toxicity to solitary bees and for the chronic oral toxicity to bumblebees and solitary bees. As the available honeybee larvae endpoint was derived following 3 days of exposure rather than 5 days (required according to EFSA 2013c), it was previously concluded that this endpoint should only be considered as 'provisional' (EFSA, 2016b). Therefore, it was not considered appropriate to use this endpoint to derive surrogate endpoints for bumblebee and solitary bee larvae. On the basis of the above consideration, Table 5 summarises the toxicity endpoints selected for the Tier-1 and Tier-2 risk assessment.

Table 5: Toxicity endpoints selected for lower tier risk assessments

Risk assessment type	Endpoint	Honeybee	Bumblebee	Solitary bee
Acute contact	LD_{50} (µg a.s./bee)	0.0258	0.1483	0.00258[(a)]
Acute oral	LD_{50} (µg a.s./bee)	0.00379	0.001911	0.000379[(a)]
Chronic oral	10-day LDD_{50} (µg a.s./bee per day)	0.00095	0.000095[(a)]	0.000095[(a)]
Larval	NOEL (µg a.s./larva per developmental period)	0.00528[(b)]	No endpoint available	No endpoint available
HPG	NOEC (µg a.s./bee)	No endpoint available	Not applicable	Not applicable

LD_{50}: lethal dose, median; a.s.: active substance; LDD_{50}: lethal dietary dose; median; NOEL: no observed effect level; NOEC: no observed effect concentration; HPG: hypopharyngeal glands.
(a): Surrogate endpoint by using the honeybee toxicity endpoint divided by a factor of 10.
(b): Endpoint determined at 7 days but only 3-day exposure during the study. Endpoint is the highest dose tested. Endpoint is based on nominal amount of food offered to the larvae.
Note: relative to the previously EU agreed endpoints changes were made to the acute contact endpoint for honeybees, the acute contact endpoint for solitary bees and the chronic oral toxicity endpoint for honeybees, bumblebees and solitary bees.

4.2. Additional sublethal laboratory data

Several laboratory experiments testing sublethal effects clothianidin on bees were available in the data set. The endpoints investigated encompassed a wide variety of sublethal effects. A summary of the effects considered in the whole data set is reported in Table 6.

Table 6: Sublethal endpoints for honeybees, bumblebees and solitary bees investigated in the available data set

Organism	Effect
Apis mellifera	Intoxication symptoms
	Food attractiveness
	Behaviour
	Bee weight
	Protein content in head
	AChE activity
	Total haemocyte count
	Encapsulation response
	Antimicrobial activity of the haemolymph
	Homing flight after contact exposure in lab
	Learning acquisition
	Learning (PER assay)
	Memory (PER assay)
	Sugar water collection
	Sucrose responsiveness
	Olfactory learning
	Habituation of proboscis extension
	Kenyon cell depolarisation
	Gene expression
	Deformed wing virus replication
Bombus terrestris	Food attractiveness
	Learning acquisition
	Learning (PER assay)
	Memory (PER assay)
	Sugar water collection
Osmia cornuta	Navigation ability

Organism	Effect
Megachile rotundata	Time to emerge
	Time to finish darkening a cocoon
	Cocoon weight

AChE: acetylcholinesterase; PER: Proboscis Extension Reflex.

As discussed in Appendix W of EFSA (2013c), in order to be able to usefully use sublethal endpoints observed in laboratory studies in a quantitative risk assessment, a link between the observed sublethal effect and the SPG needs to be established. Information to determine this link was not available during the writing of EFSA (2013c) and therefore no Tier-1 risk assessment scheme was proposed (with the exception of the HPG endpoint for honeybees). Consequently, no sublethal risk assessment was performed.

The individual endpoints listed in Table 6 were only studied in one or two experiments. Therefore, it is not possible to provide a meaningful assessment of the consistency of the observed effects within the studies.

In several studies, it was discussed that the investigated sublethal effects at individual or subindividual level may result in a colony/population level effect. It is acknowledged that an evident linkage (direct or indirect) between certain sublethal endpoints and colony/population level effects might exist. However, no appropriate information was available to establish or further describe these links. Therefore, these endpoints could not be linked to the protection goal and they were not considered further in the risk assessments.

5. Outcome of the risk assessment

5.1. Risk assessments for seed dressing products

5.1.1. Risk via systemic translocation in plants – residues in nectar and pollen (treated crop scenario and succeeding crop scenario)

5.1.1.1. Tier-1 risk assessment

The Tier-1 risk assessment for the representative GAPs were performed by using the EFSA's BeeTool (v.3.) (Appendix Y to EFSA, 2013c) for honeybees and bumblebees, where suitable toxicity data were available. A screening assessment was carried out for solitary bees and for the chronic adult assessment for bumblebees as only surrogate endpoints were available. Only a provisional risk assessment could be performed for honeybee larvae due to uncertainties with the toxicity endpoint. Since no toxicity data was available for honeybee HPG development or bumblebee and solitary bee larvae, no assessment was performed for these scenarios. The outcome of these calculations is summarised in Table 7 and the detailed results are included in Appendix C.

A high risk is indicated for all cases where one or more combinations (categories of acute, chronic and larva combined with the treated crop scenario and succeeding crop scenarios) indicated a high risk or that a low risk could not be demonstrated (screening with surrogate data). The detailed results are included in Appendix C.

Several of the crops (carrot, chicory, fodder beet and sugar beet) under consideration are normally harvested before flowering except when they are grown for production of seed. In these cases, the risk to bees for the treated crop scenario is low. The applicant confirmed that the GAPs for clothianidin include situations where the crop is grown for seed production; therefore, a Tier-1 risk assessment was performed.

Table 7: Summary of the outcome of the Tier-1 risk assessment for the treated crop and succeeding crop scenarios for the seed treatment uses of clothianidin (only for acute, chronic, honeybee larvae; no toxicity data for bumblebee and solitary bee larvae and honeybee HPG)

Crop	Honeybee		Bumblebee		Solitary bee	
	Lowest 'maximum application rate'	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**
Alfalfa (seed production) Carrot Winter cereals Spring cereals Chicory Clover (seed production) Maize Mustard Poppy Spring rape Winter rape Sunflower Sugar and fodder beet	High risk	High risk	High risk	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening

As presented in the above table, the first-tier oral risk assessment for the treated crop and succeeding crop scenario for all seed treatment uses under consideration indicated a high risk to honeybees and bumblebees. The screening assessment for solitary bees indicated that a risk cannot be excluded. No risk assessment could be performed for honeybee HPG development or bumblebee and solitary bee larvae.

5.1.1.2. Refined exposure assessment for the treated and succeeding crop scenarios

Treated crop scenario

Several reliable studies giving measured residue values in nectar and pollen originating from crops grown from seeds treated with clothianidin were newly available. Of the seed treatment uses under consideration, relevant data for the exposure assessment for the treated crop scenarios were available for maize (14 field studies and 4 semifield studies), spring oilseed rape (6 semifield studies), winter oilseed rape (4 field studies and 3 semifield studies) and sunflowers (1 semifield study). The newly available measured residue values and those collated from previous EFSA assessments were normalised for the seed loading (mg a.s./seed) and RUD values calculated. These values were then considered for the determination of the exposure assessment goals.

For **maize,** there were seven RUD values for honeybee pollen taken from field studies; therefore, these were used to perform the honeybee exposure assessment. There were no RUD values for bumblebee and solitary bee pollen. There were 25 RUD values in plant pollen from field studies and semifield and a further 4 RUD on honeybee pollen taken from semifield studies. This gives a total of 29 RUD values in maize pollen which were used for the exposure assessment of bumble and solitary bees (Appendix D).

For **winter oilseed rape**, there was an only one RUD value for honeybee nectar and two RUD values for pollen collected from honeybees in field studies. There were an additional three RUD values for honeybee nectar and honeybee pollen from semifield studies and a further one RUD value for plant nectar from a semifield study. This gives a total of five RUD values for each pollen and nectar which were used for the honeybee exposure assessment in winter oilseed rape (See Appendix D).

For bumblebees, there were no RUD values for bumblebee nectar. There were only four RUD values on either plant nectar or honeybee nectar from semifield studies. For the bumblebee pollen, there was only one RUD value for bumblebee pollen from a field study. There were a further three semifield studies giving RUD values on honeybee pollen. As four RUD values for pollen and nectar are not sufficient to perform an exposure assessment according to EFSA (2013c), the relevant RUD values

from semifield studies performed with spring oilseed rape (5 RUD value for pollen and 6 RUD values for nectar) were combined with data for winter oilseed rape giving a total of 9 values for pollen and 10 values for nectar. These RUD values were used for the bumblebee exposure assessment (Appendix D). It is acknowledged that it is likely that RUD values for spring oilseed rape are conservative relative to those for winter oilseed rape owing to the longer period between sowing and flowering of the crop.

For solitary bees, there was one value for solitary bee pollen from a field study but there were no RUD values for solitary bee nectar. The pollen RUD value was combined with the same data used for the bumblebee exposure assessment discussed in the previous paragraph (with the exception of the bumblebee pollen value) (Appendix D).

For **spring oilseed rape**, there were no RUD values for honeybee, bumblebee or solitary bee pollen or nectar available from field studies. There were five RUD values from honeybee nectar and one RUD value for plant nectar from semifield studies. There were also four RUD values for honeybee pollen and one RUD value for plant pollen from semifield studies. These values were used for the honeybee, bumblebee and solitary bee exposure assessment (Appendix D).

For **sunflowers**, only two RUD values in plant pollen from one semifield study were obtained and therefore not enough information was available to perform a refined exposure assessment.

The selected RUD values were Log-transformed before being used as input for the EFSA SHVAL tool (EFSA, 2014). A 90th percentile SV for exposure, in terms of residue intake, is given as output of this tool. Simulations were run for each bee species and each caste. Tier-1 data for pollen and nectar consumption and sugar content in nectar were assumed. To transform the refined SVs to an exposure assessment goal, the SVs are multiplied by the seed loading rate (in terms of mg a.s./kg seed) for each use listed in the GAPs.

Presented in Table 8 are the revised SVs and in Table 9 the resulting exposure assessment for the GAPs for maize, spring oilseed rape and winter oilseed rape.

Table 8: Revised shortcut values for honeybees, bumblebees and solitary bees for the treated crop scenario for maize, spring oilseed rape and winter oilseed rape applied as seed treatments

	Revised shortcut values		
	Maize	**Spring oilseed rape**	**Winter oilseed rape**
Honeybee			
Acute forager (μg/bee per day)	0[(a)]	0.16	0.042
Chronic forager (μg/bee per day)	0[(a)]	0.123	0.033
Nurse (μg/bee per day)	0.000147	0.066	0.018
Larva (μg/larva per 5 days)	0.000025	0.092	0.024
Bumblebee			
Acute adult (μg/bee per day)	0.000322	0.204	0.141
Chronic adult (μg/bee per day)	0.000322	0.175	0.121
Larva (μg/larva per day)	0.000419	0.042	0.029
Solitary bee			
Acute adult (μg/bee per day)	0.000108	0.111	0.077
Chronic adult (μg/bee per day)	0.000108	0.111	0.077
Larva (μg/larva per 30 days)	0.004108	0.191	0.128

(a): Shortcut value for foragers for maize is 0 as forager bees do not consume pollen and maize does not produce nectar.

Table 9: Exposure assessment goals for honeybees, bumblebees and solitary bees for the treated crop scenario for maize, spring oilseed rape and winter oilseed rape applied as seed treatments

	Exposure assessment goals					
	Maize		Spring oilseed rape		Winter oilseed rape	
	0.5 mg a.s./seed	1.25 mg a.s./seed	0.025 mg a.s./seed	0.05 mg a.s./seed	0.025 mg a.s./seed	0.05 mg a.s./seed
Honeybee						
Acute forager (ng/bee per day)	0	0	4.000	8.000	1.050	2.100
Chronic forager (ng/bee per day)	0	0	3.075	6.150	0.825	1.650
Nurse (ng/bee per day)	0.074	0.184	1.650	3.300	0.450	0.900
Larva (ng/larva per 5 days)	0.012	0.031	2.30	4.60	0.600	1.200
Bumblebee						
Acute adult (ng/bee per day)	0.161	0.402	5.100	10.200	3.525	7.050
Chronic adult (ng/bee per day)	0.161	0.402	4.375	8.750	3.025	6.050
Larva (ng/larva per 10 days)	2.096[(a)]	5.241[(a)]	10.50[(a)]	21.00[(a)]	7.25[(a)]	14.50[(a)]
Solitary bee						
Acute adult (ng/bee per day)	0.054	0.135	2.775	5.550	1.925	3.850
Chronic adult (ng/bee per day)	0.054	0.135	2.775	5.550	1.925	3.850
Larva (ng/larva per 30 days)	2.054	5.135	4.775	9.550	3.200	6.400

a.s.: active substance.
(a): To calculate the exposure assessment goal for bumblebee larvae an additional factor of 10 was applied to the calculation in order to transform the shortcut value expressed in terms of µg/larva per day to be in terms of a 10 day developmental period.

Succeeding crop scenario

Of the seed treatment uses under consideration, relevant data for the exposure assessment for the succeeding crop were available when the succeeding crops were maize (5 field studies and 2 semifield studies), *Phacelia* (5 semifield study), mustard (2 semifield studies) and spring oilseed rape (1 semifield study).

In these studies, the potential exposure of bees to residues in succeeding crops were investigated based on two different approaches. In a series of studies, concentration of clothianidin in nectar and pollen of bee attractive crops were measured under conditions of 'forced' soil residues, i.e. succeeding crops grown on soils treated over their complete area with clothianidin to obtain a theoretical plateau concentration of clothianidin in soil. In other field studies, the untreated succeeding crops were sown in soil with a history of several years of use of clothianidin, and thus exposed to 'natural' residues in the soil. Apart from three new 'forced' studies, the data set available for this conclusion was identical to the confirmatory data package evaluated in the EFSA conclusion in 2016 (EFSA, 2016b). In this previous peer review assessment in 2016 (Pesticides Peer Review Meeting 145; EFSA, 2016c), it was concluded that the 'forced exposure' is less representative of the exposure situation under field conditions, where the clothianidin residues in soil had already undergone natural ageing processes, making them potentially less available for plant uptake. Therefore, studies with 'forced' soil residues of clothianidin in soil were not considered further and the highest residue values measured for pollen and nectar from the 'natural aged' soil residue studies were used to refine the risk assessment. The residue value for pollen was determined in maize pollen taken directly from the plant in the field whereas the

residue value for nectar was from forager bees confined to tunnels with *Phacelia*. This approach was also used in this conclusion.

In the 'natural aged' soil residue experiments where the highest residue values of pollen (1.5 μg/kg) and nectar (0.6 μg/kg) were detected, the measured soil concentrations of clothianidin (from 59 to 80 μg/kg) were higher than the calculated accumulated soil predicted environmental concentration ($PEC_{plateau}$) for all the GAPs considered in this conclusion (from 15 to 32 μg/kg; see details of PEC calculations in Appendix G). These values cover all of the uses being assessed. It is noted that soil residues are independent of the GAPs for the primary crop(s) and can be used for any GAP, provided that the crop rotation and the ageing processes are leading to soil residue levels comparable to the calculated $PEC_{plateau}$ values.

The above residues values in pollen and nectar for the succeeding crop were Log-transformed before being used as input for the EFSA SHVAL tool (EFSA, 2014). The resulting revised SVs are presented in Table 10. The values reported in Table 10 are identical to those reported in the confirmatory data conclusion (EFSA, 2016b) except that SVs are also included for bumblebee and solitary bee larvae. As these SVs are independent of the GAP, they also represent the exposure assessment goal for the succeeding crop scenario.

Table 10: Revised shortcut values and exposure assessment goals for honeybees, bumblebees and solitary bees for the succeeding crop scenario (all GAPs)

	Revised shortcut values (μg/bee per day or μg/larva per developmental period)	Exposure assessment goals (ng/bee per day or ng/larva per developmental period)
Honeybee		
Acute forager	0.00042	0.42
Chronic forager	0.00032	0.32
Nurse	0.00019	0.19
Larva	0.00024	0.24
Bumblebee		
Acute adult	0.00057	0.57
Chronic adult	0.00049	0.49
Larva	0.00015	1.5[(a)]
Solitary bee		
Acute adult	0.00030	0.30
Chronic adult	0.00030	0.30
Larva	0.00090	0.90

(a): To calculate the exposure assessment goal for bumblebee larvae an additional factor of 10 was applied to the calculation in order to transform the shortcut value expressed in terms of μg/larva per day to be in terms of a 10 day developmental period.

5.1.1.3. Tier-2 risk assessment

Treated crop scenario

Tier-2 risk assessment could only be performed for the GAPs for which revised SVs are available (Section 5.1.1.2). Consequently, Tier-2 risk assessments for the maize, spring oilseed rape and winter oilseed rape were performed for honeybees, bumblebees and solitary bees. In these calculations, the Tier-1 SVs were replaced by the refined Tier-2 SVs (Table 8). A screening assessment was carried out for solitary bees and for the chronic adult assessment for bumblebees as only surrogate endpoints were available. Only a provisional risk assessment could be performed for honeybee larvae due to uncertainties with the toxicity endpoint. Since no toxicity data was available for honeybee HPG development or bumblebee and solitary bee larvae, no assessment was performed for these scenarios. The outcomes of these calculations are summarised in Table 11.

Table 11: Tier-2 risk assessment for honeybees for the treated crop scenario for maize, spring oilseed rape and winter oilseed rape applied as seed treatments

Crop	Category	Honeybee		Bumblebee		Solitary bee	
		ETR	Trigger	ETR	Trigger	ETR	Trigger
Maize, low application rate	Acute	0.019	0.2	**0.084**	0.036	**0.143**	0.040
	Chronic	**0.155**	0.03	**3.386**	0.0048	**1.140**	0.0054
	Larvae	0.007[(a)]	0.2	n/c	0.2	n/c	0.2
Maize, high application rate	Acute	0.048	0.2	**0.210**	0.036	**0.357**	0.040
	Chronic	**0.387**	0.03	**8.464**	0.0048	**2.849**	0.0054
	Larvae	0.018[(a)]	0.2	n/c	0.2	n/c	0.2
Spring oilseed rape low application rate	Acute	**1.055**	0.2	**2.669**	0.036	**7.322**	0.04
	Chronic	**6.474**	0.03	**92.105**	0.0048	**7.322**	0.0054
	Larvae	**1.307**[(a)]	0.2	n/c	0.2	n/c	0.2
Spring oilseed rape high application rate	Acute	**2.111**	0.2	**5.338**	0.036	**14.644**	0.04
	Chronic	**12.947**	0.03	**184.211**	0.0048	**116.842**	0.0054
	Larvae	**2.614**[(a)]	0.2	n/c	0.2	n/c	0.2
Winter oilseed rape low application rate	Acute	**0.277**	0.2	**1.845**	0.036	**5.079**	0.04
	Chronic	**1.737**	0.03	**63.684**	0.0048	**40.526**	0.0054
	Larvae	**0.341**[(a)]	0.2	n/c	0.2	n/c	0.2
Winter oilseed rape high application rate	Acute	**0.554**	0.2	**3.689**	0.036	**10.158**	0.04
	Chronic	**3.474**	0.03	**127.368**	0.0048	**81.053**	0.0054
	Larvae	**0.682**[(a)]	0.2	n/c	0.2	n/c	0.2

ETR: exposure toxicity ratio; n/c: not calculated due to lack of reliable endpoint.
(a): Honeybee ETR values for larvae are only provisional as the NOEC value was from a study with 3 days of exposure only.

As presented in Table 11, a high risk was indicated for both honeybees and bumblebees whereas for solitary bees a low risk could not be demonstrated with the screening level assessment. No risk assessment could be performed for honeybee HPG development or bumblebee and solitary bee larvae.

Succeeding crop scenario

The Tier-2 risk assessments for the succeeding crop scenario are presented in Table 12.

Table 12: Tier-2 risk assessment for honeybees for the succeeding crop scenario

Scenario	Category	Honeybee		Bumblebee		Solitary bee	
		ETR	Trigger	ETR	Trigger	ETR	Trigger
Succeeding crop	Acute	0.111	0.2	**0.298**	0.036	**0.792**	0.040
	Chronic	**0.337**	0.03	**5.158**	0.0048	**3.158**	0.0054
	Larvae	0.045[(a)]	0.2	n/c	0.2	n/c	0.2

ETR: exposure toxicity ratio; n/c: not calculated due to lack of reliable endpoint.
(a): Honeybee ETR values for larvae are only provisional as the NOEC value was from a study with 3 days of exposure only.

As presented in Table 12, a high risk was indicated for both honeybees (chronic only) and bumblebees whereas for solitary bees a low risk could not be demonstrated with the screening level assessment. No risk assessment could be performed for honeybee HPG development or bumblebee and solitary bee larvae. The acute and larvae ETRs presented in Table 12 are identical to those reported in the Confirmatory Data Conclusion (EFSA, 2016b) whereas as the resulting ETR values for the chronic assessment are slightly higher owing to the revised toxicity endpoint (see Section 4).

5.1.1.4. Tier-3 risk assessment (weight of evidence)

As discussed in Section 3.4, a WoE approach was developed to utilise the information from the diverse range of higher tier effect experiments that were available.

The WoE risk assessment could only be performed for the GAPs for which an exposure assessment goal was calculated (Section 5.1.1.2). For the use of clothianidin as a seed treatment, exposure assessment goals have been determined for the treated crop scenario for winter oilseed rape, spring

oilseed rape and maize. In addition, an exposure assessment goal has also been determined for the succeeding crop scenario for all uses of clothianidin under consideration (Section 5.1.1.2). Therefore, a WoE approach was applied to these scenario crop combinations and for honeybee, bumblebee and solitary bees. As previously discussed, the WoE exercise has two fundamental steps: firstly the identification/consideration of the lines of evidence and secondly the integration of the lines of evidence.

5.1.1.4.1. Weight of evidence higher tier risk assessment for honeybees

Lines of evidence

The Class 1 endpoints giving lines of evidence identified for the WoE assessment for honeybees are colony strength, overwinter assessments (which is based mainly on colony strength measurements after overwintering, but also considers information on overwintering colony survival) and forager mortality. The Class 2 endpoints are mortality in front of the hive, brood abundance, homing success and worker longevity. There were no reliable endpoints available for forager mortality and therefore this line of evidence could not be considered further.

The lines of evidence for honeybees were considered against the exposure protection goal for the treated crop scenario for winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario. Where useful, a visual representation of the identified lines of evidence was performed, as described in Section 3.4.1 and Figure 3. Owing the high volume of data, the results are presented in Appendix F (Section 1, Figures 5–47). For each type of endpoint, a figure is presented summarising the observations in the available higher tier effect studies. The general interpretation of the biological observations for each endpoint (e.g. number of reliable endpoints, general trend, etc.) is also presented in the Appendix F along with a final interpretation, which takes into account the GAP/scenario specific exposure assessment goal and expected duration of exposure.

Integration of the lines of evidence

The second step of the WoE exercise is the integration of the lines of evidence. The following section presents the integration of the evidence for the treated crop scenario for winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario.

Table 13: Integration of the lines of evidence for honeybees for the treated crop scenario for winter oilseed rape (low dose)

Honeybee	Treated crop scenario for winter oilseed rape (low dose)
Class 1	
Colony strength	Refer to Appendix F, Section 1.1, Figures 5 and 6 All endpoints were of low reliability and few endpoints came from experiments where there was sufficient information to estimate the exposure in the experiment. There were three endpoints indicating a greater than negligible negative deviation where the level of exposure was notably lower than the assessment goal. In addition, there are several studies performed using winter oilseed rape which also indicate a greater than negligible deviation. It is acknowledged that there is a lack of exposure–dose trend; however, there are only a few of the studies where the exposure could be estimated. Overall, there is weak evidence to suggest a greater than negligible effect on colony strength for the low dose application to winter oilseed rape **Weak evidence for greater than negligible effect**
Overwintering assessments	Refer to Appendix F, Section 1.2, Figure 15 and 16 All endpoints were of low reliability and half of the endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. On the basis of the information available, there was weak evidence to suggest a greater than negligible level of effect **Weak evidence for greater than negligible effect**

Honeybee	Treated crop scenario for winter oilseed rape (low dose)	
Class 2		
Mortality at the hive	Refer to Appendix F, Section 1.3, Figures 25 and 26 All endpoints were of low reliability and more than half of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There is a clear and consistent trend of negligible deviation of mortality in front of the hive across all of the studies. However, as none of the endpoints are from studies where the estimated exposure met the exposure assessment goal, this line of evidence is inconclusive **Line of evidence inconclusive**	
Brood	Refer to Appendix F, Section 1.4, Figures 35 and 36 All endpoints were of low reliability and many of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There was very high variability both between and within the studies. It is acknowledged that some evidence was contradictory; however, overall the data are considered to indicate weak evidence for negligible effects on honeybee brood **Weak evidence for negligible effect**	
Homing success	Refer to Appendix F, Section 1.5, Figure 45 All endpoints were of low reliability but the level of exposure in the experiment was available for all studies. The available data indicate contradictory information on the magnitude of effect on the homing success of honeybees. This may be due to different study designs or other confounding factors. When considering the exposure assessment goal for the low dose application winter oilseed rape, this line of evidence is considered to be inconclusive **Line of evidence inconclusive**	
Worker longevity	Refer to Appendix F, Section 1.6 Only a single endpoint was available which was assessed to be of low reliability. Furthermore, it was not possible to estimate the exposure to honeybees in the experiment. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence	For the lines of evidence for the Class 1 endpoints, colony strength and overwintering assessments, there was weak evidence suggesting that effects may exceed a negligible level. There was no evidence available for the Class 1 endpoint forager mortality The line of evidence for the Class 2 endpoint brood abundance there was weak evidence to suggest negligible effects. Although there is information available for the lines of evidence for mortality in front of the hive, homing success and worker longevity was inconclusive Overall, the available evidence does not give a clear picture and only provides weak evidence that effects on honeybees which breach the SPG for honeybees may occur	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore, the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+

Honeybee	Treated crop scenario for winter oilseed rape (low dose)	
	For some experiments, pre-exposure assessments were lacking and therefore it is not possible to understand whether the observed deviations were due to initial differences	– –/+ +
	Within some experiments, pre-exposure measurements revealed that some endpoints did not start at comparable level. This initial difference was accounted for in the derivation of the deviation from the control, but the accuracy of the quantification in this case is limited	–/+
	One of the pivotal studies used in the assessment of homing success assessed the number of bees returning after release 7 m away from the hive. It may be that this underestimates the number of bees which would fail to return to the hive if they were released at a greater distance	+
	There was no reliable endpoint for forager mortality	+
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	The level of the dilution of the residue concentrations of the consumed pollen and nectar in colony-feeder experiments with free flying bee could not be estimated from the available data	+
	For some colony-feeder experiments where bees were fed with sugar solution, the actual % of sugar was unknown and therefore assumed to be 50%. This would have an impact on the assumed consumption and in turn on the active substance intake	+/–
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	For the overwintering success, the food consumption of foragers and nurse bees were considered and the lower food consumption of resting winter bees was not accounted for when estimating exposure in the experiments. This might have overestimated the exposure in the experiments	+
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1171 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–

Honeybee	Treated crop scenario for winter oilseed rape (low dose)	
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–
	The RUD values used for calculation of the exposure assessment goal for honeybees were from studies where dilution from uncontaminated nectar and pollen could not have occurred	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	For overwintering assessment, the exposure assessment goal was based on consumption from active bees, and could therefore be overestimating the actual exposure of bees during winter	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative The available evidence does not give a clear picture and provides only weak evidence that effects on honeybees which breach the SPG for honeybees may occur. Consequently, a low risk to honeybees from exposure to pollen and nectar residues in winter oilseed rape has not been demonstrated	

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

No formal weight of evidence assessment has been performed for the treated crop scenario for the **high dose application to winter oilseed rape** as the results will not differ to that presented in Table 13 for the low dose application. Consequently, a low risk to honeybees from exposure to pollen and nectar residues in winter oilseed rape for the high dose application has not been demonstrated.

Table 14: Integration of the lines of evidence for honeybees for the treated crop scenario for spring oilseed rape (low dose)

Honeybee	Treated crop scenario for spring oilseed rape (low dose)
Class 1	
Colony strength	Refer to Appendix F, Section 1.1, Figures 7 and 8 All endpoints were of low reliability and few endpoints came from experiments where there was sufficient information to estimate the exposure in the experiment. There were two endpoints indicating a greater than negligible negative deviation where the level of exposure was notably lower than the assessment goal. In addition, there was a single study performed using spring oilseed rape where the extreme negative deviation reached a small level. It is acknowledged that there is a lack of exposure–dose trend however; there are only a few of the studies where the exposure could be estimated. Overall, there is weak evidence to suggest a greater than negligible effect on colony strength for the low dose application to spring oilseed rape **Weak evidence for greater than negligible effect**

Honeybee	Treated crop scenario for spring oilseed rape (low dose)
Overwintering assessments	Refer to Appendix F, Section 1.2, Figures 17 and 18 All endpoints were of low reliability and half of the endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. On the basis of the information available, there was weak evidence to suggest a greater than negligible level of effect **Weak evidence for greater than negligible effect**
Class 2	
Mortality at the hive	Refer to Appendix F, Section 1.3, Figures 27 and 28 All endpoints were of low reliability and more than half of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There is a clear and consistent trend of negligible deviation of mortality in front of the hive across all of the studies. However, as none of the endpoints are from studies where the estimated exposure met the exposure assessment goal, this line of evidence is inconclusive **Line of evidence inconclusive**
Brood	Refer to Appendix F, Section 1.4, Figures 37 and 38 All endpoints were of low reliability and many of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There was very high variability both between and within the studies. When accounting for the level and length of exposure in the pivotal studies, there is little evidence which is useful for the consideration for the low dose application to oilseed rape. For this reason, this line of evidence is considered to be inconclusive **Line of evidence inconclusive**
Homing success	Refer to Appendix F, Section 1.5, Figure 46 All endpoints were of low reliability but the level of exposure in the experiment was available for all studies. The available data indicate contradictory information on the magnitude of effect on the homing success of honeybees. This may be due to different study designs or other confounding factors. When considering that the exposure assessment goal for the low dose application spring oilseed rape is greater than all of the experiments, it is considered that there is moderate evidence to suggest an effect greater than negligible on the homing success of honeybees **Moderate evidence for greater than negligible effect**
Worker longevity	Refer to Appendix F, Section 1.6 Only a single endpoint was available which was assessed to be of low reliability. Furthermore, it was not possible to estimate the exposure to honeybees in the experiment. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**
Integration of lines of evidence	For the lines of evidence for the Class 1 endpoints, colony strength and overwintering assessments, there was weak evidence suggesting that effects may exceed a negligible level. There was no evidence available for the Class 1 endpoint forager mortality The lines of evidence for the Class 2 endpoints brood abundance, mortality in front of the hive and worker longevity was inconclusive. Although for the Class 2 endpoint, homing success, there was moderate evidence that effects may exceed a negligible level. This could in principle lead to an increase of forager mortality, but the quantification of such increase cannot be directly deduced from the available data, due to the artificial design of homing trials Although there is moderate evidence suggesting that the low dose application to spring oilseed rape may have an impact on the homing ability of honeybees, which could impact on forager mortality, it is not possible to link the observed effects to the SPG. When considering the Class 1 endpoints, there is only weak evidence to suggest a potential effect on honeybees

Honeybee	Treated crop scenario for spring oilseed rape (low dose)	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore, the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	For some experiments, pre-exposure assessments were lacking and therefore it is not possible to understand whether the observed deviations were due to initial differences	– –/+ +
	Within some experiments, pre-exposure measurements revealed that some endpoints did not start at comparable level. This initial difference was accounted for in the derivation of the deviation from the control, but the accuracy of the quantification in this case is limited	–/+
	One of the pivotal studies used in the assessment of homing success assessed the number of bees returning after release 7 m away from the hive. It may be that this underestimates the number of bees which would fail to return to the hive if they were released at a greater distance	+
	There was no reliable endpoint for forager mortality	+
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	The level of the dilution of the residue concentrations of the consumed pollen and nectar in colony-feeder experiments with free flying bee could not be estimated from the available data	+
	For some colony-feeder experiments where bees were fed with sugar solution, the actual % of sugar was unknown and therefore assumed to be 50%. This would have an impact on the assumed consumption and in turn on the active substance intake	+/–
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	For the overwintering success, the food consumption of foragers and nurse bees were considered and the lower food consumption of resting winter bees was not accounted for when estimating exposure in the experiments. This might have overestimated the exposure in the experiments	+

Honeybee	Treated crop scenario for spring oilseed rape (low dose)	
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1171 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–
	The RUD values used for calculation of the exposure assessment goal for honeybees were from studies where dilution from uncontaminated nectar and pollen could not have occurred	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	For overwintering assessment, the exposure assessment goal was based on consumption from active bees, and could therefore be overestimating the actual exposure of bees during winter	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative Although there was moderate evidence for an impact on the homing success of honeybees, it is not possible to link the observed effect directly to the SPG. Moreover, the available evidence for Class 1 endpoints does not give a clear picture and provides only weak evidence that effects on honeybees which breach the SPG for honeybees may occur. Consequently, a low risk to honeybees from exposure to pollen and nectar residues in spring oilseed rape has not been demonstrated	

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

No formal weight of evidence assessment has been performed for the treated crop scenario for the **high dose application to spring oilseed rape** as the results will not differ to that presented in Table 14 for the low dose application. Consequently, a low risk to honeybees from exposure to pollen and nectar residues in spring oilseed rape for the high dose application has not been demonstrated.

Table 15: Integration of the lines of evidence for honeybees for the treated crop scenario for maize (low dose)

Honeybee	Treated crop scenario for maize (low dose)
Class 1	
Colony strength	Refer to Appendix F, Section 1.1, Figures 9 and 10 All endpoints were of low reliability and few endpoints came from experiments where there was sufficient information to estimate the exposure in the experiment. On the basis of the information available, there was weak evidence to suggest effects on colony strength will not exceed negligible **Weak evidence for negligible effect**
Overwintering assessments	Refer to Appendix F, Section 1.2, Figures 19 and 20 All endpoints were of low reliability and half of the endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There was a single endpoint indicating a positive deviation from study where the level of exposure meets the exposure assessment goal, however, there were two endpoints which indicate a small negative deviation where the estimated exposure is lower relative to the exposure assessment goal. One of these experiments was performed using maize. On this basis, it was considered that there was very weak evidence to suggest effects may exceed a negligible level **Very weak evidence for greater than negligible effect**
Class 2	
Mortality at the hive	Refer to Appendix F, Section 1.3, Figures 29 and 30 All endpoints were of low reliability and more than half of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There is a clear and consistent trend of negligible deviation of mortality in front of the hive across all of the studies including two experiments for which the exposure assessment gaol was met **Moderate evidence for negligible effect**
Brood	Refer to Appendix F, Section 1.4, Figures 39 and 40 All endpoints were of low reliability and many of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There was very high variability both between and within the studies. When taking account of the level and length of exposure in the studies, there was moderate evidence for lack of effect exceeding negligible on honeybee brood abundance **Moderate evidence for negligible effect**
Homing success	Not relevant for maize
Worker longevity	Refer to Appendix F, Section 1.6 Only a single endpoint was available which was assessed to be of low reliability. Furthermore, it was not possible to estimate the exposure to honeybees in the experiment. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**
Integration of lines of evidence	The line of evidence for the Class 1 endpoint, colony strength, indicated weak evidence for negligible effects. On the contrary, there was very weak evidence to suggest a greater than negligible effect on overwintering assessment For the Class 2 endpoints, mortality in front of the hive and brood abundance, there was moderate evidence to suggest negligible effect. The evidence for the Class 2 endpoint, worker longevity, was inconclusive Overall, there is only very weak evidence to suggest a potential effect on the Class 1 endpoint for overwintering assessment. All other lines of evidence are considered to offer weak to moderate evidence for negligible effects only

Honeybee	Treated crop scenario for maize (low dose)	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	For some experiments, pre-exposure assessments were lacking and therefore it is not possible to understand whether the observed deviations were due to initial differences	– –/+ +
	Within some experiments, pre-exposure measurements revealed that some endpoints did not start at comparable level. This initial difference was accounted for in the derivation of the deviation from the control, but the accuracy of the quantification in this case is limited	–/+
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering experiments was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	The level of the dilution of the residue concentrations of the consumed pollen and nectar in colony-feeder experiments with free flying bee could not be estimated from the available data	+
	For some colony-feeder experiments where bees were fed with sugar solution, the actual % of sugar was unknown and therefore assumed to be 50%. This would have an impact on the assumed consumption and in turn on the active substance intake	+/–
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	For the overwintering success, the food consumption of foragers and nurse bees were considered and the lower food consumption of resting winter bees was not accounted for when estimating exposure in the experiments. This might have overestimated the exposure in the experiments	+
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1171 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++

Honeybee	Treated crop scenario for maize (low dose)	
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The exposure assessment goals were calculated using residues in pollen considering empirical dilution (residues from foragers) No data are available to roughly quantify the possible dilution for maize	+
	For overwintering assessment, the exposure assessment goal was based on consumption from active bees, and could therefore be overestimating the actual exposure of bees during winter	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative There was only very weak evidence to suggest a potential effect on the Class 1 endpoint overwintering assessment. All other lines of evidence are considered to offer weak to moderate evidence for negligible effects. Consequently, a low risk to honeybees from exposure to residues in pollen in maize has not been demonstrated	

LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

Table 16: Integration of the lines of evidence for honeybees for the treated crop scenario for maize (high dose)

Honeybee	Treated crop scenario for maize (high dose)
Class 1	
Colony strength	Refer to Appendix F, Section 1.1, Figures 11 and 12 All endpoints were of low reliability and few endpoints came from experiments where there was sufficient information to estimate the exposure in the experiment. Furthermore, there was little information which was useful for the consideration relative to the assessments of the high dose application to maize. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**
Overwintering assessments	Refer to Appendix F, Section 1.2, Figures 21 and 22 All endpoints were of low reliability and half of the endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. On the basis of the available information, it was considered that there was weak evidence to suggest effects may exceed a negligible level **Weak evidence for greater than negligible effect**

Honeybee	Treated crop scenario for maize (high dose)	
Class 2		
Mortality at the hive	Refer to Appendix F, Section 1.3, Figures 31 and 32 All endpoints were of low reliability and more than half of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There is a clear and consistent trend of negligible deviation of mortality in front of the hive across all of the studies including one experiment for which the exposure assessment goal was met **Moderate evidence for negligible effect**	
Brood	Refer to Appendix F, Section 1.4, Figures 41 and 42 All endpoints were of low reliability and many of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There was very high variability both between and within the studies. When taking account the level and length of exposure in the studies, there was moderate evidence for negligible effects on honeybee brood abundance **Moderate evidence for negligible effect**	
Homing success	Not relevant for maize	
Worker longevity	Refer to Appendix F, Section 1.6 Only a single endpoint was available which was assessed to be of low reliability. Furthermore, it was not possible to estimate the exposure to honeybees in the experiment. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence	There was weak evidence to suggest a greater than negligible effect on overwintering assessments. However, for the Class 1 endpoint, colony strength, the evidence was inconclusive For the Class 2 endpoints, mortality in front of the hive and brood abundance, there was moderate evidence to suggest negligible effect. The evidence for the Class 2 endpoint, worker longevity, was inconclusive Overall, there is only weak evidence to suggest a potential effect on the Class 1 endpoint for overwintering assessment. All other lines of evidence were inconclusive or offered moderate evidence for negligible effects	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	For some experiments, pre-exposure assessments were lacking and therefore it is not possible to understand whether the observed deviations were due to initial differences	– –/+ +
	Within some experiments, pre-exposure measurements revealed that some endpoints did not start at comparable level. This initial difference was accounted for in the derivation of the deviation from the control, but the accuracy of the quantification in this case is limited	–/+
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++

Honeybee	Treated crop scenario for maize (high dose)	
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	The level of the dilution of the residue concentrations of the consumed pollen and nectar in colony-feeder experiments with free flying bee could not be estimated from the available data	+
	For some colony-feeder experiments where bees were fed with sugar solution, the actual % of sugar was unknown and therefore assumed to be 50%. This would have an impact on the assumed consumption and in turn on the active substance intake	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	For the overwintering success, the food consumption of foragers and nurse bees were considered and the lower food consumption of resting winter bees was not accounted for when estimating exposure in the experiments. This might have overestimated the exposure in the experiments	+
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1171 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values.	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up.	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The exposure assessment goals were calculated using residues in pollen considering empirical dilution (residues from foragers) No data are available to roughly quantify the possible dilution for maize	+
	For overwintering assessment, the exposure assessment goal was based on consumption from active bees, and could therefore be overestimating the actual exposure of bees during winter	–

Honeybee	Treated crop scenario for maize (high dose)
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative There was only weak evidence to suggest a potential effect on the Class 1 endpoint overwintering assessment. All other lines of evidence a were inconclusive or offered moderate evidence for negligible effects. Consequently, a low risk to honeybees for the high dose application to maize has not been demonstrated

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

Table 17: Integration of the lines of evidence for honeybees for the succeeding crop scenario (for all uses)

Honeybee	Succeeding crop scenario (all GAPs)
Class 1	
Colony strength	Refer to Appendix F, Section 1.1, Figures 13 and 14 All endpoints were of low reliability and few endpoints came from experiments where there was sufficient information to estimate the exposure in the experiment. On the basis of the information available, there was weak evidence to suggest a greater than negligible level of effect **Weak evidence for greater than negligible effect**
Overwintering assessments	Refer to Appendix F, Section 1.2, Figures 23 and 24 All endpoints were of low reliability and half of the endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. On the basis of the information available, there was weak evidence to suggest a greater than negligible level of effect In addition, there was a single study (C.312) where the overwinter survival rate of colonies was assessed. The endpoint was assessed to be reliable with major restrictions but did not indicate any difference in the number of colonies which survived the winter. There was no reliable residue assessment and therefore the exposure in this study cannot be compared with the exposure assessment goal **Weak evidence for greater than negligible effect**
Class 2	
Mortality at the hive	Refer to Appendix F, Section 1.3, Figures 33 and 34 All endpoints were of low reliability and more than half of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There is a clear and consistent trend of negligible deviation of mortality in front of the hive across all of the studies including one experiment for which the exposure assessment gaol was met **Moderate evidence for negligible effect**
Brood	Refer to Appendix F, Section 1.4, Figures 43 and 44 All endpoints were of low reliability and many of the reliable endpoints came from experiments where there was insufficient information to estimate the exposure in the experiment. There was very high variability both between and within the studies. When taking account of the level and length of exposure in the studies, there was weak evidence for lack of effect exceeding negligible on honeybee brood abundance **Weak evidence for negligible effect**

Honeybee	Succeeding crop scenario (all GAPs)	
Homing success	Refer to Appendix F, Section 1.5, Figure 47 All endpoints were of low reliability but the level of exposure in the experiment was available for all studies. The available data indicate contradictory information on the magnitude of effect on the homing success of honeybees. This may be due to different study designs or other confounding factors. However, the exposure assessment goal for the succeeding crop scenario is lower than in all experiments which indicated a negative effect. Therefore, it was considered that there was moderate evidence for lack of effects exceeding negligible **Moderate evidence for negligible effect**	
Worker longevity	Refer to Appendix F, Section 1.6 Only a single endpoint was available which was assessed to be of low reliability. Furthermore, it was not possible to estimate the exposure to honeybees in the experiment. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence for winter oilseed rape (low dose)	For the lines of evidence for the Class 1 endpoints, colony strength and overwintering assessment, there was weak evidence suggesting that greater than negligible effect might occur. There was no evidence available for the Class 1 endpoint forager mortality For the Class 2 endpoints, mortality in front of the hive and homing success, there was moderate evidence to suggest negligible effects whereas for brood abundance there was only weak evidence for negligible effects. The evidence for the Class 2 endpoint, worker longevity, was inconclusive Overall, the available evidence does not give a clear picture and only provides weak evidence that effects on honeybees which breach the SPG for honeybees may occur	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore, the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	For some experiments, pre-exposure assessments were lacking and therefore it is not possible to understand whether the observed deviations were due to initial differences	– –/+ +
	Within some experiments, pre-exposure measurements revealed that some endpoints did not start at comparable level. This initial difference was accounted for in the derivation of the deviation from the control, but the accuracy of the quantification in this case is limited	–/+
	One of the pivotal studies used in the assessment of homing success assessed the number of bees returning after release 7 m away from the hive. It may be that this underestimates the number of bees which would fail to return to the hive if they were released at a greater distance	+
	There was no reliable endpoint for forager mortality	+
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+

Honeybee	Succeeding crop scenario (all GAPs)	
	The level of the dilution of the residue concentrations of the consumed pollen and nectar in colony-feeder experiments with free flying bee could not be estimated from the available data	+
	For some colony-feeder experiments where bees were fed with sugar solution, the actual % of sugar was unknown and therefore assumed to be 50%. This would have an impact on the assumed consumption and in turn on the active substance intake	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	For the overwintering success, the food consumption of foragers and nurse bees were considered and the lower food consumption of resting winter bees was not accounted for when estimating exposure in the experiments. This might have overestimated the exposure in the experiments	+
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1171 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–
	The RUD values used for calculation of the exposure assessment goal for honeybees were from studies where dilution from uncontaminated nectar and pollen could not have occurred	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The $PEC_{plateau}$ for the GAPs under consideration are lower than the PEC_{soils} of the available residue trials. Therefore, the exposure assessment goals are conservative for the GAPs under consideration	–
	For overwintering assessment, the exposure assessment goal was based on consumption from active bees, and could therefore be overestimating the actual exposure of bees during winter	–

Honeybee	Succeeding crop scenario (all GAPs)
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative The available evidence does not give a clear picture and provides only weak evidence that effects on honeybees which breach the SPG for honeybees may occur. Consequently, a low risk to honeybees from exposure to pollen and nectar residues in succeeding crops has not been demonstrated

GAP: Good Agricultural Practice; WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

5.1.1.4.2. Weight of evidence higher tier risk assessment for bumblebees

Lines of evidence

The Class 1 endpoints giving lines of evidence identified for the WoE assessment for bumblebees are from the reproductive output family: queen production, drone production, worker production and brood production. There was no data for Class 2 endpoints available.

The lines of evidence for bumblebees were considered against the exposure protection goal for the treated crop scenario for winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario. Where useful, a visual representation of the identified lines of evidence was performed, as described in Section 3.4.1 and Figure 3. Owing the high volume of data, the results are presented in Appendix F (Section 2, Figures 48–67). For each type of endpoint, a figure is presented summarising the observations in the available higher tier effect studies. The general interpretation of the biological observations for each endpoint (e.g. number of reliable endpoints, general trend, etc.) is also presented in the Appendix F along with a final interpretation, which takes in to account the GAP/scenario specific exposure assessment goal and expected duration of exposure.

Integration of the lines of evidence

The second step of the WoE exercise is the integration of the lines of evidence. The following section, presents the integration of the evidence for the treated crop scenario for winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario (all GAPs).

Table 18: Integration of the lines of evidence for bumblebees for the treated crop scenario for winter oilseed rape (low dose)

Bumblebee	Treated crop scenario for winter oilseed rape (low dose)
Class 1	
Queen production	Refer to Appendix F, Section 2.1, Figure 48 All but one endpoint was of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There were two endpoints from studies indicating a negative deviation for bumblebee queen production at concentrations lower than the exposure assessment goal. In addition, there were five endpoints indicating a negative deviation which were from studies performed using winter oilseed rape. It is likely that the exposure in these studies was lower than the exposure assessment goal for winter oilseed rape. Taking account of all the available evidence, it is considered that the data indicate that there moderate evidence for an effect which is greater than negligible **Moderate evidence for greater than negligible effect**
Worker production	Refer to Appendix F, Section 2.2, Figure 53 All of the endpoints were of low reliability. Moreover, many of the endpoints came from studies which lacked a reliable estimate for exposure. Although the variability both within and between the experiments is large. There is a trend for a negative deviation. When accounting for the level of exposure, the length of exposure and the crop used in the studies, there is weak evidence to suggest an effect greater than negligible for the low dose application to winter oilseed rape **Weak evidence for greater than negligible effect**

Bumblebee	Treated crop scenario for winter oilseed rape (low dose)	
Drone production	Refer to Appendix F, Section 2.3, Figure 58 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There is a single endpoint indicating a medium negative deviation where the exposure in the study was considerably lower than the exposure assessment goal. On this basis, there is weak evidence for effects exceeding negligible **Weak evidence for greater than negligible effect**	
Brood production	Refer to Appendix F, Section 2.4, Figure 63 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was high variability both between and within the studies. Considering that the length of exposure in the pivotal studies indicating negative deviations exceeds the realistic flowering period for winter oilseed rape, the lack of an exposure–response trend and the lack of estimated exposure estimates in several of the studies, it is considered that this line of evidence for the low dose application to winter oilseed rape is inconclusive **Line of evidence inconclusive**	
Reproductive output from queenless microcolonies	Refer to Appendix F, Section 2.5 There was a single study which investigated the reproductive output of bumblebees from queenless microcolonies. The endpoint from this study indicated a negligible deviation on the reproductive output. However, as the exposure in the study was a single dose, it was not considered to be representative of the length of the flowering period for winter oilseed rape. Therefore, this line of evidence was considered to be inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence	The lines of evidence for the Class 1 effects for queen production, worker production and drone production had moderate or weak evidence for a greater than negligible effect. The evidence for brood production and reproductive output from queenless microcolonies was inconclusive. Accounting for all lines of evidence, there is a rather clear indication of a greater than negligible effect on bumblebee reproductive output meaning that the SPG for bumblebees is likely to be breached	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	In one of the pivotal colony-feeder study, there was evidence of avoidance to the feeding solution. The effects observed may be amplified by the food avoidance	–
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+

Bumblebee	Treated crop scenario for winter oilseed rape (low dose)	
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	In one of the pivotal studies giving endpoints for bumblebees only residues in bumblebees pollen were measured in the study. Therefore, the residue in nectar was assumed to be 0. This means that the estimated exposure in the study is likely to be an underestimation.	–
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1342 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The majority of RUD values used for the exposure assessment goal for bumblebees were from studies where dilution from uncontaminated nectar and pollen could not have occurred. Only a single value for bumblebee pollen entering the colony was used. Therefore, the exposure assessment goal may overestimate residues entering the colony	–
	Insufficient RUD values from winter oilseed rape were available to perform an exposure assessment. Therefore, the available RUD values for spring oilseed rape were also used	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative Overall, when considering that there is a moderate evidence to indicate a greater than negligible effect on bumblebee queen production, a high risk to bumblebees from exposure to pollen and nectar residues in winter oilseed rape is indicated. It should be noted that this conclusion is based on moderate evidence for effects exceeding a negligible level	

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

No formal weight of evidence assessment has been performed for the treated crop scenario for the **high dose application to winter oilseed rape** as the results will not differ to that presented in Table 18 for the low dose application. Consequently, a high risk to bumblebees from residues in nectar and pollen for the treated crop scenario for high dose application to winter oilseed rape is concluded.

Table 19: Integration of the lines of evidence for bumblebees for the treated crop scenario for spring oilseed rape (low dose)

Bumblebee	Treated crop scenario for spring oilseed rape (low dose)
Class 1	
Queen production	Refer to Appendix F, Section 2.1, Figure 49 All but one endpoint was of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure There were two endpoints from studies indicating a negative deviation for bumblebee queen production at concentrations lower than the exposure assessment goal. One endpoint was assessed to be reliable with minor restrictions (negligible deviation) while the other was assessed to be reliable with major restrictions (large deviation). In addition, there was one endpoint which was from a study performed using spring oilseed rape and five endpoints from studies performed using winter oilseed rape which indicated a greater than negligible deviation. It is likely that the exposure in these studies was lower than the exposure assessment goal for spring oilseed rape. Taking account of all the available evidence, it is considered that the data indicate that there is moderate evidence for an effect which is greater than negligible **Moderate evidence for greater than negligible effect**
Worker production	Refer to Appendix F, Section 2.2, Figure 54 All of the endpoints were of low reliability. Moreover, many of the endpoints came from studies which lacked a reliable estimate for exposure. There is a trend for a negative deviation. However, considering that the length of exposure in the pivotal studies indicating negative deviations notably exceeds the realistic flowering period for spring oilseed rape, this line of evidence is considered to be inconclusive **Line of evidence inconclusive**
Drone production	Refer to Appendix F, Section 2.3, Figure 59 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was a single endpoint indicating a medium negative deviation where the exposure in the study was considerably lower than the exposure assessment goal. On this basis, there is weak evidence for effects exceeding negligible **Weak evidence for greater than negligible effect**
Brood production	Refer to Appendix F, Section 2.4, Figure 64 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was high variability both between and within the studies. Considering that the length of exposure in the pivotal studies indicating negative deviations exceeds the realistic flowering period for spring oilseed rape, the lack of an exposure–response trend and the lack of estimated exposure estimates in several of the studies, it is considered that this line of evidence for the low dose application to winter oilseed rape is inconclusive **Line of evidence inconclusive**

Bumblebee	Treated crop scenario for spring oilseed rape (low dose)	
Reproductive output from queenless microcolonies	Refer to Appendix F, Section 2.5 There was a single study which investigated the reproductive output of bumblebees from queenless microcolonies. The endpoint from this study indicated a negligible deviation on the reproductive output. However, as the exposure in the study was a single dose, it was not considered to be representative of the length of the flowering period for spring oilseed rape. Therefore, this line of evidence was considered to be inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence	The lines of evidence for the Class 1 effects for queen production and drone production had moderate or weak evidence for a greater than negligible effect. The evidence for worker, brood production and reproductive output from queenless microcolonies was inconclusive. Accounting for all lines of evidence, there is a rather clear indication of a greater than negligible effect on bumblebee reproductive output meaning that the SPG for bumblebees is likely to be breached	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore, the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	In one of the pivotal colony-feeder study, there was evidence of avoidance to the feeding solution. The effects observed may be amplified by the food avoidance	–
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	In one of the pivotal studies giving endpoints for bumblebees only, residues in bumblebee pollen were measured in the study. Therefore, the residue in nectar was assumed to be 0. This means that the estimated exposure in the study is likely to be an underestimation	–
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1342 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++

Bumblebee	Treated crop scenario for spring oilseed rape (low dose)	
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The majority of RUD values used for the exposure assessment goal for bumblebees were from studies where dilution from uncontaminated nectar and pollen could not have occurred. Therefore, the exposure assessment goal may overestimate residues entering the colony	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative Overall, when considering that there is a moderate evidence to indicate a greater than negligible effect on bumblebee queen production, a high risk to bumblebees from exposure to pollen and nectar residues in spring oilseed rape is indicated. It should be noted that this conclusion is based on moderate evidence for effects exceeding a negligible level	

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

No formal weight of evidence assessment has been performed for the treated crop scenario for the **high dose application to spring oilseed rape** as the results will not differ to that presented in Table 19 for the low dose application. Consequently, a high risk to bumblebees from residues in nectar and pollen for the treated crop scenario for high dose application to spring oilseed rape is concluded.

Table 20: Integration of the lines of evidence for bumblebees for the treated crop scenario for maize (low dose)

Bumblebee	Treated crop scenario for maize (low dose)
Class 1	
Queen production	Refer to Appendix F, Section 2.1, Figure 50 All but one endpoint was of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure None of the endpoints were from studies performed using maize. Although, there is a general trend in the data in a negative direction, when accounting for the level of exposure, length of exposure and the crop used in the experiment, there is little evidence relevant to the low dose application to maize. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**

Bumblebee	Treated crop scenario for maize (low dose)	
Worker production	Refer to Appendix F, Section 2.2, Figure 55 All of the endpoints were of low reliability. Moreover, many of the endpoints came from studies which lacked a reliable estimate for exposure. There is a trend for a negative deviation. However, considering that the length of exposure in the pivotal studies indicating negative deviations notably exceeds the realistic flowering period for maize and the lack of exposure–response, this line of evidence is considered to be inconclusive **Line of evidence inconclusive**	
Drone production	Refer to Appendix F, Section 2.3, Figure 60 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was a single endpoint indicating a medium negative deviation where the exposure in the study was lower than the exposure assessment goal. On this basis, there is weak evidence for effects exceeding negligible **Weak evidence for greater than negligible effect**	
Brood production	Refer to Appendix F, Section 2.4, Figure 65 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was high variability both between and within the studies. Accounting for the level of exposure, length of exposure, the lack of the exposure–response trend and the high variability of the endpoints, it is considered that there is weak evidence to suggest that effects on bumblebee brood will not exceed a negligible level for the low dose application to maize **Weak evidence for negligible effect**	
Reproductive output from queenless microcolonies	Refer to Appendix F, Section 2.5 There was a single study which investigated the reproductive output of bumblebees from queenless microcolonies. The endpoint from this study indicated a negligible deviation on the reproductive output. However, as the exposure in the study was a single dose, it was not considered to be representative of the length of the flowering period for maize. Therefore, this line of evidence was considered to be inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence	The lines of evidence for the Class 1 effects for drone production gave weak evidence for a greater than negligible effect. On the contrary, there was weak evidence for a negligible effect on brood production. The evidence for queen production, worker production and reproductive output from queenless microcolonies was inconclusive. There is no consistency for the lines of evidence for the Class 1 endpoints Overall, the available evidence does not give a clear picture and only provides weak evidence that effects on bumblebees which breach the SPG may occur	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	In one of the pivotal colony-feeder study there was evidence of avoidance to the feeding solution. The effects observed may be amplified by the food avoidance	–
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++

Bumblebee	Treated crop scenario for maize (low dose)	
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	In one of the pivotal studies giving endpoints for bumblebees only residues in bumblebee pollen were measured in the study. Therefore, the residue in nectar was assumed to be 0. This means that the estimated exposure in the study is likely to be an underestimation	–
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1342 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The majority of RUD values used for the exposure assessment goal for bumblebees were from studies where dilution from uncontaminated nectar and pollen could not have occurred. Therefore, the exposure assessment goal may overestimate residues entering the colony	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative The available evidence does not give a clear picture and provides only weak evidence that effects on bumble bees which breach the SPG may occur. Therefore, a low risk to bumblebees for the low dose application to maize has not been demonstrated	

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

Table 21: Integration of the lines of evidence for bumblebees for the treated crop scenario for maize (high dose)

Bumblebee	Treated crop scenario for maize (high dose)
Class 1	
Queen production	Refer to Appendix F, Section 2.1, Figure 51 All but one endpoint was of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure None of the endpoints were from studies performed using maize. Although, there is a general trend in the data in a negative direction, when accounting for the level of exposure, length of exposure and the crop used in the experiment, there is little evidence relevant to the high dose application to maize. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**
Worker production	Refer to Appendix F, Section 2.2, Figure 56 All of the endpoints were of low reliability. Moreover, many of the endpoints came from studies which lacked a reliable estimate for exposure. There is a trend for a negative deviation. However, considering that the length of exposure in the pivotal studies indicating negative deviations notably exceeds the realistic flowering period for maize and the lack of exposure-response, this line of evidence is considered to be inconclusive **Line of evidence inconclusive**
Drone production	Refer to Appendix F, Section 2.3, Figure 61 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was a single endpoint indicating a medium negative deviation where the exposure in the study was lower than the exposure assessment goal. On this basis, there is weak evidence for effects exceeding negligible **Weak evidence for greater than negligible effect**
Brood production	Refer to Appendix F, Section 2.4, Figure 66 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was high variability both between and within the studies. Accounting for the level of exposure, length of exposure, the lack of the exposure–response trend and the high variability of the endpoints, it is considered that there is weak evidence to suggest that effects on bumblebee brood will not exceed a negligible level for the high dose application to maize **Weak evidence for negligible effect**
Reproductive output from queenless microcolonies	Refer to Appendix F, Section 2.5 There was a single study which investigated the reproductive output of bumblebees from queenless microcolonies. The endpoint from this study indicated a negligible deviation on the reproductive output. However, as the exposure in the study was a single dose it was not considered to be representative of the length of the flowering period for maize. Therefore, this line of evidence was considered to be inconclusive **Line of evidence inconclusive**
Integration of lines of evidence	The line of evidence for the Class 1 effects for drone production gave weak evidence for a greater than negligible effect. On the contrary, there was weak evidence for a negligible effect on brood production. The evidence for queen production, worker production and reproductive output from queenless microcolonies was inconclusive. There is no consistency for the lines of evidence for the Class 1 endpoints Overall, the available evidence does not give a clear picture and only provides weak evidence that effects on bumblebees which breach the SPG may occur

Bumblebee	Treated crop scenario for maize (high dose)	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	In one of the pivotal colony-feeder study, there was evidence of avoidance to the feeding solution. The effects observed may be amplified by the food avoidance	–
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	In one of the pivotal studies giving endpoints for bumblebees only, residues in bumblebee pollen were measured in the study. Therefore, the residue in nectar was assumed to be 0. This means that the estimated exposure in the study is likely to be an underestimation	–
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1342 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–

Bumblebee	Treated crop scenario for maize (high dose)	
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The majority of RUD values used for the exposure assessment goal for bumblebees were from studies where dilution from uncontaminated nectar and pollen could not have occurred. Therefore, the exposure assessment goal may overestimate residues entering the colony	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative The available evidence does not give a clear picture and provides only weak evidence that effects on bumble bees which breach the SPG may occur. Therefore, a low risk to bumblebees for the high dose application to maize has not been demonstrated	

WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

Table 22: Integration of the lines of evidence for bumblebees for the succeeding crop scenario (for all uses)

Bumblebee	Succeeding crop scenario, all gaps
Class 1	
Queen production	Refer to Appendix F, Section 2.1, Figure 52 All but one endpoint was of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. Although, there is a general trend in the data in a negative direction, when accounting for the level of exposure, length of exposure and the crop used in the experiment, there is little evidence relevant to the succeeding crop scenario. Therefore, this line of evidence is inconclusive **Line of evidence inconclusive**
Worker production	Refer to Appendix F, Section 2.2, Figure 57 All of the endpoints were of low reliability. Moreover, many of the endpoints came from studies which lacked a reliable estimate for exposure. There is a trend for a negative deviation. However, given that the pivotal studies indicating a negative deviation were from experiments where either the level or length of exposure was too severe, this line of evidence is considered to be inconclusive **Line of evidence inconclusive**
Drone production	Refer to Appendix F, Section 2.3, Figure 62 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was a single endpoint indicating a medium negative deviation where the exposure in the study was lower than the exposure assessment goal. On this basis, there is weak evidence for effects exceeding negligible **Weak evidence for greater than negligible effect**
Brood production	Refer to Appendix F, Section 2.4, Figure 67 All of the endpoints were of low reliability. Moreover, the majority of the endpoints came from studies which lacked a reliable estimate for exposure. There was high variability both between and within the studies. Considering that the length of exposure in the pivotal studies indicating negative deviations exceeds the realistic flowering period for succeeding crops, the lack of an exposure–response trend and the lack of estimated exposure estimates in several of the studies, it is considered that this line of evidence for succeeding crop scenario is inconclusive **Line of evidence inconclusive**

Bumblebee	Succeeding crop scenario, all gaps	
Reproductive output from queenless microcolonies	Refer to Appendix F, Section 2.5 There was a single study which investigated the reproductive output of bumblebees from queenless microcolonies. The endpoint from this study indicated a negligible deviation on the reproductive output. However, as the exposure in the study was a single dose, it was not considered to be representative of the length of the flowering period for succeeding crops. Therefore, this line of evidence was considered to be inconclusive **Line of evidence inconclusive**	
Integration of lines of evidence)	The lines of evidence for the Class 1 effects for drone production gave weak evidence for a greater than negligible effect. The evidence for queen production, worker production, brood production and reproductive output from queenless microcolonies was inconclusive. There is no consistency for the lines of evidence for the Class 1 endpoints Overall, the available evidence does not give a clear picture and only provides weak evidence that effects on bumblebees which breach the SPG may occur	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Most of the available endpoints were assessed to be reliable with major restrictions; therefore the overall reliability of the WoE is limited	–/+
	The reasons for the reliability assessment categorisation differed between the studies	–/+
	The consistency of most lines of evidence is low	–/+
	Many of the data were not presented in sufficient detail to derive accurate deviations from the control. Therefore, only crude estimates could be used in the lines of evidence	–/+
	In one of the pivotal colony-feeder study there was evidence of avoidance to the feeding solution. The effects observed may be amplified by the food avoidance	–
	Exposure in the experiments	
	A proper estimation of the exposure was missing in the large majority of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	– –/++
	The exposure level of the effect field experiments on crops with nectar was calculated considering 15% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were values reported < LOD, which were conservatively considered as 0 mg/kg	–
	In one of the pivotal studies giving endpoints for bumblebees, only residues in bumblebees pollen were measured in the study. Therefore, the residue in nectar was assumed to be 0. This means that the estimated exposure in the study is likely to be an underestimation	–
	Confounding factors in the experiments	
	In the majority of the studies, the control was only analysed for clothianidin and metabolites. There is the possibility for contamination of the control and treatment by other neonicotinoid substances in the higher tier effects studies. The exception to this was for study C.1342 where the study design minimised the potential for contamination from outside of the treated fields and the study report included information on the use of PPPs on the control fields during the previous 5 years	– –/++

Bumblebee	Succeeding crop scenario, all gaps	
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 15% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	The $PEC_{plateau}$ for the GAPs under consideration are lower than the PEC_{soils} of the available residue trials. Therefore, the exposure assessment goals are conservative for the GAPs under consideration	–
	The RUD values used for the exposure assessment goal for bumblebees were from studies where dilution from uncontaminated nectar and pollen could not have occurred. Therefore, the exposure assessment goal may overestimate residues entering the colony	–
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction and therefore do not suggest that the overall assessment is over or under conservative The available evidence does not give a clear picture and provides only weak evidence that effects on bumble bees which breach the SPG may occur. Therefore, a low risk to bumblebees for the succeeding crop scenario has not been demonstrated	

GAP: Good Agricultural Practice; WoE: weight of evidence; LOD: limit of detection; LOQ: limit of quantification; RUD: residue per unit dose; SPG: specific protection goal; PPP: Plant Protection Products.

5.1.1.4.3. Weight of evidence higher tier risk assessment for solitary bees

Lines of evidence

Several reproductive endpoints were measured for solitary bees (e.g. completed nests, tubes with brood, cocoon production, emergence after winter). The endpoint for the number of offspring emerging after winter (i.e. the reproductive output) represents the accumulation of all of these endpoints. For this reason, it was decided to base the solitary bee weight of evidence risk assessment on this endpoint only. It is noted that there were several studies which did not include an assessment of the emergence after winter (e.g. only the number of completed nests was assessed). The endpoints from these studies were also considered in the weight of evidence assessment (termed as other Class 1 endpoints in Table 23).

The lines of evidence for solitary bees were considered against the exposure protection goal for the treated crop scenario for winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario. Where useful, a visual representation of the identified lines of evidence was performed, as described in Section 3.4.1 and Figure 3. Owing the high volume of data, the results are presented in Appendix F (Section 3, Figures 68–71). For each type of endpoint, a figure is presented summarising the observations in the available higher tier effect studies. The general interpretation of the biological observations for each endpoint (e.g. number of reliable endpoints, general trend, etc.) is also presented in the Appendix F along with a final interpretation, which takes in to account the GAP/scenario specific exposure assessment goal and expected duration of exposure.

Integration of the lines of evidence

The second step of the WoE exercise is the integration of the lines of evidence. Table 23 presents the integration of the evidence for the treated crop scenario for the low dose application to winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario. A consideration of the integrated lines of evidence for solitary bees for the high dose application to maize, winter oilseed rape and spring oilseed rape are not presented as the conclusion for this line of evidence will not differ from that of the low dose applications.

Table 23: Integration of the lines of evidence for solitary bees for the treated crop scenario for the low dose applications to winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario

Solitary bee	**Treated crop scenario for winter oilseed rape (low dose), spring oilseed rape (low dose), maize (low dose) and the succeeding crop scenario**	
Reproductive output	Refer to Appendix F, Section 3.1, Figures 68, 69, 70 and 71 There were two reliable endpoints for the reproductive output of solitary bees indicated no effect. However, one of the studies lacked an exposure estimate and the estimated exposure in the second study considerably below the exposure assessment goals. Consequently, this line of evidence for the low dose application to winter oilseed rape, spring oilseed rape, maize and the succeeding crop scenario is inconclusive **Line of evidence inconclusive**	
Other Class 1 endpoints	Refer to Appendix F, Section 3.2 No reliable additional Class 1 endpoints, from experiments which did not include an assessment of reproductive output, were available. Therefore, no evidence is provided by this line of evidence **No evidence provided by this line of evidence**	
Integration of lines of evidence	The line of evidence for the Class 1 endpoint, reproductive output was inconclusive. Furthermore, the studies which did not include an assessment of the reproductive output (emergence) also did not provide any additional reliable Class 1 endpoints. Therefore, there was no additional evidence from this line of evidence	
Uncertainty analysis (– potential to make the true risk lower + potential to make the true risk higher)	**Quantification of the effects**	
	Few reliable data were available	–/+
	Exposure in the experiments	
	The exposure level of the effect field experiments on crops with nectar was calculated considering 10% sugar content of the nectar, which is the low end value of the realistic range. This may result in an overestimation of the estimated exposure of those experiments	+
	The exposure in the studies was estimated using mean residue measurements. In some studies, there were less than three sample dates	–/+
	A proper estimation of the exposure was missing in a number of the effect studies, which makes it impossible to check whether the exposure assessment goals were achieved	–/+
	Only residues in solitary bee pollen were measured in the study giving the one of the reliable endpoints (C.1309). Therefore, the residue in nectar was assumed to be 0. This means that the estimated exposure in the study is likely to be an underestimation	– –
	Confounding factors in the experiments	
	In some of the higher tier experiments where the bees were free flying, there were indications for the use of different pesticides, including insecticides. This may affect both control and treatment. In some cases, different pesticides were used in the control and treatment There is also uncertainty that this practice could have been done also in experiments where this was not clearly reported	+/–

Solitary bee	Treated crop scenario for winter oilseed rape (low dose), spring oilseed rape (low dose), maize (low dose) and the succeeding crop scenario	
	Exposure assessment goals	
	The limited number of valid residue studies available for the exposure assessment goal, restricted the potential for the representativeness to cover 90th percentile exposure situations	+
	The exposure assessment goal was based on maximum measured residue values	–
	For the determination of the exposure assessment goals, a 10% sugar content of the nectar was assumed, which is the low end value of the realistic range. This may have resulted in an overestimation of the exposure assessment goal. (Comment not relevant for maize)	–
	In some residue studies (used for the exposure assessment goal), the sampling frequency and pattern did not guarantee that the actual maximum occurrence had been picked up	+
	The exposure assessment goals were calculated assuming residues equal to the LOQ every time measured concentration were < LOQ	–
	For the succeeding crop scenario, the $PEC_{plateau}$ for the GAPs under consideration are lower than the PEC_{soils} of the available residue trials. Therefore, the exposure assessment goals are conservative for the GAPs under consideration	–
	For the exposure assessment goal for winter oilseed rape, there were insufficient RUD values from winter oilseed rape available. Therefore, the available RUD values for spring oilseed rape were also used	–
	The majority of RUD values used for the exposure assessment goal for solitary bees were from studies where dilution from uncontaminated nectar and pollen could not have occurred. Only a single value for solitary bee brood pollen was used for the exposure assessment goal for winter oilseed rape. Therefore, the exposure assessment goal is conservative and is likely to overestimate residues entering the nest	– –
	Specific issues	
	Data are only available on one solitary bee species (*Osmia bicornis*) out of the hundreds present in Europe	–/++
Conclusion	As detailed above, there are numerous uncertainties with the risk assessment. The identified uncertainties point both in a positive and negative direction; however, there is a tendency to indicate that the assessment is conservative With the information available, a low risk to solitary bees for the use as a seed treatment to winter oilseed rape, spring oilseed rape, maize and for the succeeding crop scenario has not been demonstrated	

5.1.2. Risk from contamination of adjacent vegetation via dust drift

5.1.2.1. Tier-1 risk assessment

The Tier-1 risk assessment for the representative GAPs were performed by using the EFSA's BeeTool (v.3.) (Appendix Y to EFSA, 2013c) for honeybees and bumblebees, where suitable toxicity data were available. It was assumed that a deflector was used during the seed drilling.

The outcome of these calculations is summarised in Table 24 for the contact route of exposure and in Table 25 for the oral route of exposure. A screening assessment was carried out for solitary bees and for the chronic adult assessment for bumblebees as only surrogate endpoints were available. Only a provisional risk assessment could be performed for honeybee larvae due to uncertainties with the toxicity endpoint. Since no toxicity data was available for honeybee HPG development or bumblebee and solitary bee larvae, no assessment was performed for these scenarios.

For the oral route of exposure, a low risk is indicated only if all categories (acute, chronic and larva) for both the field margin and adjacent crop scenarios resulted in low risk. When one or more combinations indicated a high risk or that a low risk cannot be demonstrated (screening with surrogate data) than this is indicated in the tables below. The detailed results are included in Appendix C.

Table 24: Summary of the outcome of Tier-1 risk assessment for the contact route of exposure (field margin and adjacent crop scenario for the seed treatment uses)

Crop	Honeybee		Bumblebee		Solitary bee	
	Lowest 'maximum application rate'	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**
Alfalfa (seed production) Carrot Winter cereals Spring cereals Chicory Clover (seed production) Maize Mustard Sunflower	High risk	High risk	High risk	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Spring rape Winter rape	Low risk only with a deflector	High risk	Low risk only with a deflector	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Poppy	Low risk only with a deflector	High risk	Low risk only with a deflector	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Sugar and fodder beet	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk only with a deflector

Table 25: Summary of the outcome of Tier-1 risk assessment for the oral route of exposure (field margin and adjacent crop scenario for the seed treatment uses) (only for acute, chronic, honeybee larvae; no toxicity data for bumblebee and solitary bee larvae and honeybee HPG)

Crop	Honeybee		Bumblebee		Solitary bee	
	Lowest 'maximum application rate'	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**
Alfalfa (seed production) Carrot Winter cereals Spring cereals Chicory Clover (seed production) Maize Mustard Poppy Spring rape Winter rape Sunflower	High risk	High risk	High risk	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Sugar and fodder beet	Low risk	Low risk only with a deflector	Low risk not demonstrated using screening	Low risk not demonstrated using screening	Low risk not demonstrated using screening	Low risk not demonstrated using screening

When accounting for both contact and oral exposure, a low risk to honeybees, for the field margin and adjacent crop scenario, was indicated for the seed treatment uses to sugar and fodder beet. For the highest application rate to sugar/fodder beet, a low risk to honeybees was only demonstrated when it is assumed that a deflector is fitted to the sowing machine to mitigate the dust drift. However, the screening level assessment performed for bumblebees and solitary bees for sugar/fodder beet was not sufficient to demonstrate a low risk. For all other seed treatment uses under consideration, a high risk to honeybees and bumblebees was indicated and a low risk to solitary bees was not demonstrated with a screening assessment.

5.1.2.2. Exposure assessment for the field margin and adjacent crop scenario

No new reliable data on dust drift deposits of clothianidin treated seeds in addition to the data set already used in previous EFSA Conclusions (2013a, 2016b) were available for this evaluation. Therefore, no refined exposure assessment for contamination in field margins and adjacent crops could be performed.

In the open call for data information was provided on the measurement of the dust content of oilseed rape and maize seeds (Heubach values); and in most cases for oilseed rape, also information on active ingredient content in the dust (Heubach a.i. values) was provided from seed samples from seed merchants. Dust was quantifiable/present in all seed batches tested. In maize seed, measured dust was just reported to be significantly below the industry standard of below 3 g dust/100 kg seed. Oilseed rape, seeds treated in 2013 from 326 seed treatment sites had a 90th percentile total dust Heubach value of 0.192 g/700,000 seeds. These values for Heubach a.i. were 6 mg/700,000 seeds for clothianidin (156 sites), 1.4 mg/700,000 seeds for imidacloprid (52 sites) and 7.8 mg/700,000 seeds for thiamethoxam (104 sites).

Heubach a.i. values in seed samples from an additional 10 different seed treatment facilities also where seed was treated in 2013 were 0.21, 0.27, 0.33, 0.46, 0.6, 0.96, 1.29, 1.3, 8.9 and 16.6 mg/700,000 seeds for clothianidin.

As all these results are from the same year so they do not provided any information on dustiness of the seed being supplied to farmers in different years and whether dust levels have reduced in recent years. It is clear that the Heubach a.i. values can be variable. It is clear that reducing the dust content of seed to be treated as well as any dust produced during the treatment process as well as any that might be generated during storage and transport of seed is a good target for improved risk management. However, with the information available in this review, it was not possible to account for this in any refined exposure and or risk characterisation.

5.1.2.3. Tier-2 risk assessment

As no refined exposure assessment for dust drift was available, no Tier-2 risk assessment could be performed.

5.1.2.4. Tier-3 risk assessment

There were several higher tier effect studies investigating the effects of dust-drift during the sowing of clothianidin treated seeds on honeybees (1 with winter cereal seed, 9 with maize, 9 with oilseed rape and 1 with sugar beet). There were no higher tier effects studies available performed with bumblebee and solitary bees. The honeybee studies investigated the Class 1 endpoint colony strength and the Class 2 endpoints mortality in front of the hive and brood abundance. None of the available studies investigated effects on forager mortality or colony strength after overwinter.

In order to utilise these studies in a risk assessment according to EFSA (2013c), it would be necessary to have a refined exposure assessment for the GAPs and formulated products under consideration. As this is not available, no Tier-3 risk assessment for dust deposition can be performed. For transparency, evidence for the effect endpoints from the available studies has been considered, in general terms, in the following sections.

Maize

The key exposure parameters and results of the effects assessments from the available studies performed with clothianidin-treated maize seeds has been summarised in Table 26.

Table 26: Summary of the impact of dust-drift from clothianidin treated maize seeds on the mortality of honeybees measured at the hive

Study	Key exposure parameters	Mortality at the hive
C.1059	Dust (< 160 μm) containing 12.4–17.7% clothianidin from treated maize seed applied directly to flowering phacelia 0.25 g a.s./ha Field conditions	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 2 for 4 days) in the treatment hives relative to the control
C.1059	Dust (< 160 μm) containing 12.4–17.7% clothianidin from treated maize seed applied directly to flowering phacelia 1 g a.s./ha Field conditions	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 6 days) in the treatment hives relative to the control
C.1061 and C.562[(a)]	Maize seed sown with deflector Heubach value 0.856 g dust per 100,000 seeds 10.6% clothianidin in the dust Field conditions Application rate: 125 g clothianidin/ha	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 5 days) in the treatment hives relative to the control
C.1062 and C.563[(a)]	Maize seed sown with deflector Heubach value 0.45 g dust per 100,000 seeds 19.1% clothianidin in the dust 'Heubach g a.s./ha was 0.086 g a.s./ha Field conditions Application rate: 50 g clothianidin/ha	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 5 days) in the treatment hives relative to the control
C.1063 and C.564[(a)]	Maize seed sown with deflector Heubach value 0.74 g dust per 100,000 seeds 42% clothianidin in the dust 'Heubach g a.s./ha was 0.041 g a.s./ha Field conditions Application rate: 16.7 g clothianidin/ha	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 1 day) in the treatment hives relative to the control (low foraging activity observed)
C.1064 and C.565[(a)]	Maize seed sown with deflector Heubach value 0.7292 g dust per 700,000 seeds. 1.21% clothianidin in the dust 'Heubach g a.s./ha was 0.0046 g a.s./ha Field conditions Formulation also contained beta-cyfluthrin Application rate: 48.7 g clothianidin/ha and 9.74 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions There was an indication of increase of mortality (factor of > 2) in the treatment hives relative to the control. The duration of increase not possible to estimate due to sampling days being too infrequent
C.2044 C.562[(a)]	Maize seed sown with deflector Heubach value 0.856 g dust per 100,000 seeds 10.6% clothianidin in the dust Semifield conditions Application rate: 125 g clothianidin/ha	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 6 days) in the treatment hives relative to the control
C.2045 C.563[(a)]	Maize seed sown with deflector Heubach value 0.45 g dust per 100,000 seeds 19.1% clothianidin in the dust 'Heubach g a.s./ha was 0.086 g a.s./ha Semifield conditions Application rate: 50 g clothianidin/ha	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 7 days) in the treatment hives relative to the control
C.2047 C.564[(a)]	Maize seed sown with deflector Heubach value 0.74 g dust per 100,000 seeds 42% clothianidin in the dust 'Heubach g a.s./ha was 0.041 g a.s./ha Semifield conditions Application rate: 16.7 g clothianidin/ha	Endpoint was assessed to be reliable with major restrictions There was a clear indication of increase of mortality (factor of > 3 for 3 days or > 2 for 4 days) in the treatment hives relative to the control

Study	Key exposure parameters	Mortality at the hive
C.2048 C.564[(a)]	Maize seed sown with deflector Heubach value 0.7292 g dust per 700,000 seeds. 1.21% clothianidin in the dust 'Heubach g a.s./ha was 0.0046 g a.s./ha Semifield conditions Formulation also contained beta-cyfluthrin Application rate: 48.7 g clothianidin/ha and 9.74 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions Indication of increase of mortality (a factor of > 1.5) in the treatment hives relative to the control. Duration of increase not possible to estimate due to sampling days being too infrequent

a.s.: active substance.
(a): Additional assessments of exposure characterisation were performed and evaluated under the corresponding references. In all cases, the reliability assessment concluded that there was insufficient detail in the available study reports to assess the reliability.

As summarised in Table 26, all of the available studies performed with maize resulted in a clear and consistent increase in the level of mortality observed at the hive.

Several of the studies also assessed the endpoint, colony strength; however, in the majority of cases, the reliability assessment deemed the endpoint to be unreliable. The exception to this was for study C.1059 for which the endpoint was assessed to be 'reliable with major restrictions'. In study C.1059, for both of the tested exposure levels (Table 26), there was a negative impact on the colony strength of the treatment hives. However, it was not possible to determine the magnitude of the impact due to large differences in the colony strength of the control and treatment hives at the start of the experiment.

As previously discussed without an exposure characterisation for the GAPs under consideration it is not possible to use the available information in a risk assessment. Furthermore, the endpoint for mortality in front of the hive is not directly related to the SPG for honeybees (Section 3.1). However, the evidence from the higher tier effect studies with maize suggests that the dust-drift during the sowing of treated maize seeds has the potential to cause effects on honeybee colonies which exceed the SPG.

Oilseed rape

The key exposure parameters and results of the effects assessments from the available studies performed with clothianidin treated oilseed rape seeds has been summarised in Table 27.

Table 27: Summary of the impact of dust-drift from clothianidin treated oilseed rape seeds on the mortality of honeybees measured at the hive

Study	Key exposure parameters	Mortality at the hive
C.1065 C.566[(a)]	Heubach value: 0.061 g dust per 700,000 seeds % clothianidin in the dust: 1.3% 'Heubach g a.s./ha: 0.00067 g a.s./ha Field conditions Formulation also contained beta-cyfluthrin Application rate: 36 g clothianidin/ha and 7.2 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions The level of mortality in the treatment hives was not greater than the control for 7 days after sowing
C.1066 C.567[(a)]	Heubach value: 0.0284 g dust per 700,000 seeds % clothianidin in the dust: 2.91% 'Heubach g a.s./ha: 0.0009 g a.s./ha Field conditions Formulation also contained beta-cyfluthrin Application rate: 40.3 g clothianidin/ha and 8.06 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions The level of mortality in the treatment hives was not greater than the control during the assessments made for 7 days after sowing
C.1067 C.568[(a)]	Heubach value: 0.38 g dust per 700,000 seeds % clothianidin in the dust: 6.3% 'Heubach g a.s./ha: 0.025 g a.s./ha Field conditions Formulation also contained beta-cyfluthrin Application rate: 36 g clothianidin/ha and 7.2 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions There was an indication of increase of mortality (factor of > 1.5 for 3 days) in the treatment hives relative to the control. The observed mean number of dead bees at the hive was always < 10 for each day

Study	Key exposure parameters	Mortality at the hive
C.1068 C.569[(a)]	Heubach value: 0.102 g dust per 700,000 seeds % clothianidin in the dust: 6.83% 'Heubach g a.s./ha: 0.00871 g a.s./ha Field conditions Formulation also contained beta-cyfluthrin Application rate: 41.2 g clothianidin/ha and 8.24 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions There was an indication of increase of mortality (factor of > 2 for 2 days) in the treatment hives relative to the control. The observed mean number of dead bees at the hive was < 20 for each day
C.2049 C.566[(a)]	Heubach value: 0.061 g dust per 700,000 seeds % clothianidin in the dust: 1.3% 'Heubach g a.s./ha: 0.00067 g a.s./ha Semifield conditions Formulation also contained beta-cyfluthrin Application rate: 36 g clothianidin/ha and 7.2 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions There was an indication of increase of mortality (factor of > 2 for 2 days) in the treatment hives relative to the control hives. Observed mean number of dead bees at the hive was < 20 for each day
C.2050 C.567[(a)]	Heubach value: 0.0284 g dust per 700,000 seeds % clothianidin in the dust: 2.91% 'Heubach g a.s./ha: 0.0009 g a.s./ha Semifield conditions Formulation also contained beta-cyfluthrin Application rate: 40.3 g clothianidin/ha and 8.06 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions There was an indication of increase of mortality (factor of > 1.5 for 2 days) in the treatment hives relative to the control. Observed mean number of dead bees at the hive was < 10 for each day
C.2051 C.568[(a)]	Heubach value: 0.38 g dust per 700,000 seeds % clothianidin in the dust: 6.3% 'Heubach g a.s./ha: 0.025 g a.s./ha Semifield conditions Formulation also contained beta-cyfluthrin Application rate: 36 g clothianidin/ha and 7.2 g beta-cyfluthrin/ha	Endpoint was assessed to be reliable with major restrictions There was an indication of increase of mortality (factor of > 2 for 7 days) in the treatment hives relative to the control hives. Observed mean number of dead bees at the hive was < 17 for each day
C.2052 C.569[(a)]	Heubach value: 0.102 g dust per 700,000 seeds % clothianidin in the dust: 6.83% 'Heubach g a.s./ha: 0.00871 g a.s./ha Semifield conditions Formulation also contained beta-cyfluthrin Application rate: 41.2 g clothianidin/ha and 8.24 g beta-cyfluthrin/ha	Reliable with major restrictions There was an indication of increase of mortality (factor of > 3 for 3 days; factor of > 2 for 4 days) in the treatment hives relative to the control hives

a.s.: active substance.
(a): Additional assessments of exposure characterisation were performed and evaluated under the corresponding references. In all cases, the reliability assessment concluded that there was insufficient detail in the available study to assess the reliability

As summarised in Table 27, a number of the available studies did lead to a higher level of mortality relative to the control, however, with the exception of study C.2052, the daily observed mortality never exceeded a mean of 20 bees per day. The available studies also assessed the endpoint, colony strength; however, the reliability assessment deemed the endpoint to be unreliable.

The evidence from the higher tier effect studies with oilseed rape suggests that the dust-drift during the sowing of treated oilseed seed does not lead to a notably high level of mortality in front of the hive relative to the control. However, as previously discussed, without an exposure characterisation for the GAPs under consideration it is not possible to use the available information in a risk assessment.

Winter cereals

There was a single study investigating the effects of dust drift during the sowing of clothianidin treated winter barley seeds to honeybees (study C.851). The endpoints assessed in this study were mortality in front of the hive, colony strength and brood abundance. Table 28 summarises the key exposure parameters and results.

Table 28: Summary of the impact of dust-drift from clothianidin treated winter barley seeds on honeybees

Study	Key exposure parameters	Results of the effect assessments
C.851	Mean Heubach a.i. value: 0.026 g/100 kg seed Field conditions Formulation also contained prothioconazole Application rate: 100 g clothianidin/ha	• Mortality at the hive: The endpoint was assessed to be reliable with major restrictions Treatment field 1: indication of increase of mortality factor of > 3 for 2 days. Observed mean number of dead bees at the hive was < 12 for each day Treatment field 2: indication of increase of mortality factor of > 2 for 5 days or factor of > 3 for 2 days • Colony strength (mean of upwind and downwind colonies) Endpoint was assessed to be reliable with major restrictions Maximum negative deviation: 6.5% Maximum positive deviation: 9.5% Overall mean: negligible deviation • Brood abundance Endpoint was assessed to be reliable with major restrictions Maximum negative deviation: 11.1% Maximum positive deviation: 11.6% Overall mean: negligible deviation

a.s.: active ingredient.

As summarised in Table 28, the available field study performed with winter barley led to a notable increased level of mortality in one of the treatment fields but not in the second treated field. The observed deviations in colony strength were not consistent and deviated both positively and negatively relative to the control. Both the endpoint for mortality in front of the hive and colony strength were assessed to be reliable with major restrictions.

As previously discussed without an exposure characterisation for the GAPs under consideration it is not possible to use the available information in a risk assessment. Furthermore, the endpoint for mortality in front of the hive is not directly related to the SPG for honeybees (Section 3.1). However, the evidence from the higher tier effect study with winter barley suggests that the dust-drift during the sowing of treated winter barley could potentially lead to a notable level of mortality in front of the hive relative to the control but there is no evidence to suggest that there will be an impact on the colony strength.

Sugar beet

There was a single study investigating the effects of dust drift during the sowing treated sugar beet pill to honeybees (study C*I.1324) which had already been assessed as part of the confirmatory data (EFSA, 2016b,c). The sugar beet pills were treated with clothianidin (0.60 mg/pill), imidacloprid (0.30 mg/pill) and beta-cyfluthrin (0.08 mg/pill). The sugar beet pills were also treated with the fungicides thiram and hymexazol. The endpoints assessed in this study were mortality in front of the hive, colony strength, colony strength after overwintering and brood abundance. Table 29 summarises the key exposure parameters and results.

Table 29: Summary of the impact of dust-drift from clothianidin and imidacloprid treated sugar beet pills on honeybees

Study	Key exposure parameters	Results of the effect assessments
C*I.1324	Mean Heubach a.i. value: not given Field conditions Sugar beet pills were treated with 0.60 mg clothianidin/pill, 0.30 mg imidacloprid/pill and 0.08 mg beta-cyfluthrin/pill Application rate: 78 g clothianidin/ha 10.4 g beta-cyfluthrin/ha 39 g imidacloprid/ha Sowing machinery: Amazone (type ED 452-K) with a deflector	• Mortality at the hive: The endpoint was assessed to be reliable with major restrictions There were no indications of higher mortality in front of the hive in the treatment hives relative to the control • Colony strength Endpoint was assessed to be reliable with major restrictions Maximum negative deviation: 7.3% Maximum positive deviation: 6.5% Overall mean: negligible deviation • Colony strength after overwintering Endpoint was assessed to be reliable with major restrictions Positive deviation: 27.5% • Brood abundance Endpoint was assessed to be reliable with major restrictions Maximum negative deviation: 17.2% Maximum positive deviation: 11.9% Overall mean: negligible deviation

a.i.: active ingredient.

As summarised in Table 29, none of the endpoints assessed in study C*I.1324 indicate that the SPG for honeybees was breached. This could be considered to confirm the low risk indicated by the tier-1 risk assessment; however, without an exposure characterisation for the GAPs under consideration, it is not possible to confirm that the exposure in the study was sufficient.

5.1.3. Risk via water consumption

5.1.3.1. Guttation water

Tier-1

The Tier-1 risk assessments for exposure to honeybees via residues in guttation fluid are presented in Appendix C. The resulting acute and larvae ETR values all exceeded the respective trigger values indicating that further consideration is needed.

It should be highlighted that the EFSA evaluation of the confirmatory data for imidacloprid and clothianidin (EFSA, 2016b,d) concluded that the exposure of honeybees from contaminated guttation fluids in the crops considered therein (winter cereals, sugar beet and potatoes) was of low relevance. Such conclusion was confirmed during the expert meeting related to this assessment (Pesticide Peer Review Meeting 166), despite the experts acknowledging that such an assessment was partially based on studies presenting major limitations. On the basis of this, no risk assessment from exposure to contaminated guttation fluids was carried out, and a low risk was concluded.

Tier-2

In addition to the data already evaluated in EFSA (2016b), two new studies investigating clothianidin residues in guttation water collected from maize crop were available for the uses as seed treatment. As the data set is considered not sufficient for selecting the 90th percentile of exposure for maize, the maximum residue level of clothianidin of 46 mg a.s./L (= 0.046 μg/μL, All+.1383) measured in these open field trials was used to perform the Tier-2 risk assessment. In the new studies with maize, it is indicated that the concentrations decrease in time, but only the range is reported and therefore no dissipation rates can be derived. Therefore, for the risk assessment, the maximum value was used for all calculations.

Using the above residue value in Tier-2 calculations for honeybees, the resulting ETR values are summarised in Table 30. As the resulting ETR values all exceed the respective trigger values, a high risk is indicated.

Table 30: Tier-2 ETR for values for honeybees for exposure via residues in guttation fluid in maize

Category	Water uptake	PEC in guttation fluid µg/µL	Predicted exposure	Honeybee	
				ETR	trigger
Acute	11.4 µL/bee per day	0.046	0.52	**138**	0.2
Chronic	11.4 µL/bee per day	0.046	0.52	**552**	0.03
Larva	111 µL/larva per 5 days	0.046	5.11	**967**	0.2

PEC: predicted environmental concentration; ETR: exposure toxicity ratio.

For uses other than maize, no data providing residues in guttation fluid were available. Therefore, no Tier-2 risk assessment could be performed.

Tier-3

In total, there were six field studies investigating the effects on honeybees following the potential exposure to residues of clothianidin in guttation fluid (C+I.602, C+I.2004, C*I.607, C*I.1144, C*I.1145 and C.2002). These studies were performed using winter cereals, sugar beet and potatoes All studies were part of the confirmatory data assessment (EFSA, 2016b,c) and are also evaluated and summarised in EFSA (2018a). As no additional data are available, no Tier-3 risk assessment can be performed. It is noted that the data assessed in EFSA (2013a) was considered to indicate a low risk to honeybees from exposure to residues in guttation fluid in maize and oilseed rape grown from treated seeds under the specific conditions that the studies were performed. However, insufficient information was available to generalise the findings of the studies to a risk assessment in a wider context. For this reason, the risk assessment was not finalised and a data gap was concluded. The information available in the current data set are not able to address the previous concern, and therefore, for maize, spring oilseed rape and winter oilseed rape, a low risk to honeybees from residues in guttation fluid has not been demonstrated.

5.1.3.2. Puddle water

It was not necessary to perform exposure modelling to predict residues of clothianidin in puddles as the concentrations in surface runoff calculated by PRZMsw (a surrogate approach for estimating puddle concentrations following EFSA (2013c) are always negligible when seeds are drilled below the soil surface. Consequently, a low risk to honeybees from residues in puddles for the seed treatment uses under consideration is concluded. Experts from Member States noted that the EFSA (2013c) approach might represent a best case as cultivation following harvesting of the treated crop redistributes soil residues, such that concentrations at the soil surface will be present to desorb into puddles. PRZM calculations as prescribed by FOCUS surface water do not account for this as the FOCUS PRZM tool and FOCUS surface water runoff scenarios do not account for soil cultivation.

5.1.3.3. Surface water

In the absence of agreed input parameters for FOCUS surface water modelling, no exposure assessment for the representative uses could be performed. Therefore, the risk to honeybees consuming residues in surface water could not be assessed.

5.2. Risk assessments for granule

5.2.1. Risk via systemic translocation in plants – residues in nectar and pollen

5.2.1.1. Tier-1 risk assessment

The Tier-1 risk assessment for the representative GAPs were performed by using the EFSA's BeeTool (v.3.) (Appendix Y to EFSA, 2013c) for honeybees and bumblebees, where suitable toxicity data were available.

The outcome of these calculations is summarised in Table 31. A screening assessment was carried out for solitary bees and for the chronic adult assessment for bumblebees as only surrogate endpoints

were available. Only a provisional risk assessment could be performed for honeybee larvae due to uncertainties with the toxicity endpoint. Since no toxicity data was available for honeybee HPG development or bumblebee and solitary bee larvae, no assessment was performed for these scenarios. Insufficient information was available to be able to perform a risk assessment for the granular use to forestry nurseries.

A high risk is indicated for all cases where one or more combinations (categories of acute, chronic and larva combined with the treated crop, weed and succeeding crop scenarios) indicated a high risk or that a low risk could not be demonstrated (screening with surrogate data). The detailed results are included in Appendix C.

Table 31: Summary of the outcome of the Tier-1 risk assessment for the treated crop, weeds and succeeding crop scenario for the granular uses of clothianidin (only for acute, chronic, honeybee larvae; no toxicity data for bumblebee and solitary bee larvae and honeybee HPG)

Crop	Honeybee		Bumblebee		Solitary bee	
	Lowest 'maximum application rate'	Highest 'maximum application rate'	Lowest 'maximum application rate'	Highest 'maximum application rate'	Lowest 'maximum application rate'	Highest 'maximum application rate'
Maize, Potatoes, Sorghum, Sweet maize	High risk	High risk	High risk	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Greenhouse maize, Greenhouse sweet maize	Low risk to bees from crops sown and maintained in permanent greenhouses					

As presented in the above table, the first-tier oral risk assessment for the treated crop, weed and succeeding crop scenario for all outdoor granular uses under consideration indicated a high risk to honeybees and bumblebees. The screening assessment for solitary bees indicated that a risk cannot be excluded. No risk assessment could be performed for honeybee HPG development or bumblebee and solitary bee larvae. A low risk to honeybees, bumblebees and solitary bees was concluded for the uses to maize and sweet maize in permanent greenhouses.

5.2.1.2. Refined exposure assessment for the treated and succeeding crop scenarios

Treated crop scenario

No new higher tier studies on residues of clothianidin in nectar and pollen, in addition to the data set already used in previous EFSA Conclusions (2013a, 2015a, 2016b), were available for this evaluation. Therefore, no refined exposure assessment for residues in nectar and/or pollen for the treated crop scenario could be performed.

Succeeding crop scenario

As the concentrations in pollen and nectar in succeeding crops is considered to be independent of the GAP and formulation type, and the soil PEC values for the granular uses are covered by available succeeding crop studies (Appendix G), the refined exposure assessment performed for the seed treatment uses under Section 5.1.1.2 are also applicable to the granular uses of clothianidin under consideration. The only exception to this is for the use to forestry nursery where it was previously considered that the refined exposure assessment was not applicable (EFSA, 2016b).

5.2.1.3. Refined exposure assessment for the scenario for weeds in the treated field

According to EFSA (2013a), it is possible to refine the risk to bees for the scenario of flowering weeds in the treated field by consideration of the weed coverage within the field. The guidance indicates that if the coverage of attractive weeds is less than 10% then the exposure bees for this route of exposure can be considered to result in a low risk.

No new data in addition to that already considered for the confirmatory data assessment of clothianidin (EFSA, 2016a,b) were available. Information assessing the abundance of weeds in maize

and potatoes field was assessed as part of the confirmatory data assessment (Negrini, 2014, evaluated in EFSA, 2016c). This information was considered sufficient to indicate a low risk to bees for the weed scenario for the granular uses in maize, sorghum and potatoes (EFSA, 2016a,b). Therefore, on the basis of the previous assessment, a low risk to bees, for the weed scenario, for these uses is concluded. No data is available to refine the exposure to bees from contaminated weeds for the granular uses in forestry nurseries.

5.2.1.4. Tier-2 risk assessment

Treated crop scenario

As no refined exposure assessment for residues in nectar and/or pollen for the treated crop scenario was available, no Tier-2 risk assessment was performed.

Succeeding crop scenario

As the concentrations in pollen and nectar in succeeding crops is considered to be independent of the GAP and formulation type, the Tier-2 risk assessment performed for the seed treatment uses are also applicable to the granular uses of clothianidin under consideration. The only exception to this is for the use to forestry nursery where it was previously considered that the refined exposure assessment was not applicable (EFSA, 2016b). The Tier-2 risk assessment performed in Section 5.1.1.3 indicated a high risk for both honeybees and bumblebees whereas for solitary bees a low risk could not be demonstrated with the screening level assessment.

5.2.1.5. Tier-3 risk assessment

Treated crop scenario

As no refined exposure assessment for residues in nectar and/or pollen for the treated crop scenario were available, no Tier-3 risk assessment was performed

Succeeding crop scenario

As the concentrations in pollen and nectar in succeeding crops is considered to be independent of the GAP and formulation type, the weight of evidence risk assessment performed for the succeeding crop scenario for the seed treatment uses (Section 5.1.1.4) is also relevant to the granular uses of clothianidin under consideration (with the exception of the use to forest nursery). The available Tier-3 risk assessment for honeybees, bumblebees and solitary bees was not sufficient to demonstrate a low risk for the succeeding crop scenario.

5.2.2. Risk from contamination of adjacent vegetation via dust drift

5.2.2.1. Tier-1 risk assessment

The Tier-1 risk assessment for the representative GAPs were performed by using the EFSA's BeeTool (v.3.) (Appendix Y to EFSA, 2013c) for honeybees and bumblebees, where suitable toxicity data were available. Insufficient information was available to be able to perform a risk assessment for the granular use to forestry nurseries.

The outcome of these calculations is summarised in Table 32 for the contact route of exposure and Table 33 for the oral route of exposure. A screening assessment was carried out for solitary bees and for the chronic adult assessment for bumblebees as only surrogate endpoints were available. Only a provisional risk assessment could be performed for honeybee larvae due to uncertainties with the toxicity endpoint. Since no toxicity data was available for honeybee HPG development or bumblebee and solitary bee larvae, no assessment was performed for these scenarios.

For the oral route of exposure, a low risk is indicated only if all categories (acute, chronic and larva) for both the field margin and adjacent crop scenarios resulted in low risk. When one or more combinations indicated a high risk or that a low risk cannot be demonstrated (screening with surrogate data) than, this is indicated in the tables below. The detailed results are included in Appendix C.

Table 32: Summary of the outcome of Tier-1 risk assessment for the contact route of exposure (field margin and adjacent crop scenario for the uses as granules)

Crop	Honeybee		Bumblebee		Solitary bee	
	Lowest 'maximum application rate'	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**
Maize, Potatoes, Sorghum, Sweet maize	High risk	High risk	High risk	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Greenhouse maize, Greenhouse sweet maize	Low risk to bees from crops sown and maintained in permanent greenhouses					

Table 33: Summary of the outcome of Tier-1 assessment for the oral route of exposure (field margin and adjacent crop scenario for the uses as granules) (only for acute, chronic, honeybee larvae; no toxicity data for bumblebee and solitary bee larvae and honeybee HPG)

Crop	Honeybee		Bumblebee		Solitary bee	
	Lowest 'maximum application rate'	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**	**Lowest 'maximum application rate'**	**Highest 'maximum application rate'**
Maize, Potatoes, Sorghum, Sweet maize	High risk	High risk	High risk	High risk	Low risk not demonstrated using screening	Low risk not demonstrated using screening
Greenhouse maize, Greenhouse sweet maize	Low risk to bees from crops sown and maintained in permanent greenhouses					

The first-tier contact and oral risk assessment for the field margin and adjacent crop scenario for all outdoor granular uses under consideration indicated a high risk to honeybees and bumblebees. The screening assessment for solitary bees indicated that a risk cannot be excluded. No risk assessment could be performed for honeybee HPG development or bumblebee and solitary bee larvae. A low risk to honeybees, bumblebees and solitary bees was concluded for the uses to maize and sweet maize in permanent greenhouses.

5.2.2.2. Refined exposure assessment for the field margin and adjacent crop scenario

Previously, it has been agreed that there is a low exposure to the field margin and adjacent crop from dust drift deposition for specific machinery types are used during the application of granular formulations (EFSA, 2016b). The GAPs for the granular uses of clothianidin currently under consideration (Appendix A) have not specified that the application of the granules is restricted to specific application machinery. Therefore, exposure to the field margin and adjacent crop cannot be excluded. No new valid data on dust drift deposits of clothianidin granules were available for this evaluation. Therefore, no refined exposure assessment for contamination in field margins and adjacent crops could be performed.

5.2.2.3. Tier-2 risk assessment

As no refined exposure assessment for dust drift was available, no Tier-2 risk assessment could be performed.

5.2.2.4. Tier-3 risk assessment

There were no newly available higher tier data investigating the effects to bees of dust drift during the application of granules. Therefore, no Tier-3 risk assessment was performed.

5.2.3. Risk via water consumption

5.2.3.1. Guttation water

Tier-1

The Tier-1 risk assessments for exposure to honeybees via residues in guttation fluid are presented in Appendix C. The resulting acute and larvae ETR values all exceeded the respective trigger values indicating that further consideration is needed.

It should be highlighted that the EFSA evaluation of the confirmatory data for imidacloprid and clothianidin (EFSA, 2016b,d) concluded that the exposure of honeybees from contaminated guttation fluids in the crops considered therein (winter cereals, sugar beet, and potatoes) was of low relevance. Such conclusion was confirmed during the expert meeting related to this assessment (Pesticide Peer Review Meeting 166), despite the experts acknowledging that such an assessment was partially based on studies presenting major limitations. On the basis of this, no risk assessment from exposure to contaminated guttation fluids was carried out, and a low risk was concluded.

Tier-2 and Tier-3

In total, there were six field studies investigating the effects on honeybees following the potential exposure to residues of clothianidin in guttation fluid (C+I.602, C+I.2004, C*I.607, C*I.1144, C*I.1145 and C.2002). These studies were performed using winter cereals, sugar beet and potatoes All studies were part of the confirmatory data assessment (EFSA 2016a,b,c) and are also evaluated and summarised in EFSA (2018a). As no additional data are available, no Tier-2 or Tier-3 risk assessment can be performed. It is noted that the data assessed in EFSA (2013a) concerning the risk to honeybees from residues in guttation fluid grown from maize treated with clothianidin granules, was considered insufficient to demonstrate a low risk to honeybees. For this reason, the risk assessment was not finalised and a data gap was concluded. The information available in the current data set are not able to address the previous concern, and therefore, for the granular use to maize, a low risk to honeybees from residues in guttation fluid has not been demonstrated.

5.2.3.2. Puddle water

It was not necessary to perform exposure modelling to predict residues of clothianidin in puddles as the concentrations in surface runoff calculated by PRZMsw (a surrogate approach for estimating puddle concentrations following EFSA, 2013c) are always negligible where granules are incorporated below the soil surface. Consequently, a low risk to honeybees from residues in puddles for the granular uses under consideration is concluded. Experts from Member States noted that the EFSA, 2013c approach might represent a best case as cultivation following harvesting of the treated crop redistributes soil residues, such that concentrations at the soil surface will be present to desorb into puddles. PRZM calculations as prescribed by FOCUS surface water do not account for this as the FOCUS PRZM tool and FOCUS surface water runoff scenarios do not account for soil cultivation.

5.2.3.3. Surface water

In the absence of agreed input parameters for FOCUS surface water modelling, no exposure assessment for the representative uses could be performed. Therefore, the risk to honeybees consuming residues in surface water could not be assessed. The use of granules in permanent greenhouses will not lead to contamination of surface water; therefore, there is a low risk to bees via this route of exposure.

6. Overall conclusion

The conclusion of the risk assessment to bees for the uses of clothianidin as seed treatment and granule is summarised below, considering the different scenarios.

For the crop-specific conclusion achieved at each assessment tier, please refer to Table 34.

The assessments included in this conclusion considered the risk to bees from clothianidin as active substance only. It should be noted that formulation products containing clothianidin may also contain other insecticides including imidacloprid, as shown in the GAP table in Appendix A.

Risk via systemic translocation in plants – residues in nectar and pollen

Treated crop scenario

Tier-1:

- A high risk to honeybees and bumblebees was indicated for all uses other than the granular use to forestry nurseries, the greenhouse use to maize and sweet maize and those crops which are harvested before flowering.
- Several crops (carrot, chicory, fodder beet and sugar beet) are normally harvested before flowering except when they are grown for production of seeds. In these cases, the risk to bees for the treated crop scenario is low.
- Only a screening assessment, using the honeybee toxicity values divided by 10, could be performed for solitary bees as no toxicity data were available. The screening level assessment did not exclude a high risk for all uses other than the granular use to forestry nurseries, the greenhouse use to maize and sweet maize and those crops which are harvested before flowering.
- No Tier-1 risk assessment could be performed for the granular uses to forestry nurseries owing to insufficient details in the GAP.

For the greenhouse uses to maize and sweet maize, a low risk for all bee species was concluded as it was confirmed in the GAP that the crop will remain in permanent greenhouses until harvest. Tier-2:

- Sufficient data were available to refine the exposure estimates and perform a Tier-2 risk assessment for the seed treatment uses to maize, winter oilseed rape and spring oilseed rape.
- A high risk to honeybees and bumblebees was indicated for all uses where a Tier-2 risk assessment could be performed.
- Only a screening assessment, using the honeybee toxicity values divided by 10, could be performed for solitary bees as no toxicity data were available. The screening level assessment did not exclude a high risk for all uses where a Tier-2 risk assessment could be performed.

Tier-3:

- Sufficient data were only available to calculate exposure assessment goals for the seed treatment uses to maize, winter oilseed rape and spring oilseed rape. As the exposure assessment goal is fundamental for the Tier-3 risk assessment, only these uses could be considered at Tier-3.
- The Tier-3 risk assessment was not sufficient to demonstrate a low risk to honeybees from the seed treatment uses to winter oilseed rape, spring oilseed rape and maize.
- For bumblebees, a high risk was concluded for the seed treatment uses to winter and spring oilseed rape.
- The Tier-3 risk assessment was not sufficient to demonstrate a low risk to bumblebees for the seed treatment uses to maize.
- The Tier-3 risk assessment was not sufficient to demonstrate a low risk to solitary bees for the seed treatment uses to maize, winter oilseed rape and spring oilseed rape.

Succeeding crop scenario

Tier-1:

- A high risk to honeybees and bumblebees was indicated for all uses other than the granular use to forestry nurseries and the greenhouse use to maize and sweet maize.
- Only a screening assessment, using the honeybee toxicity values divided by 10, could be performed for solitary bees as no toxicity data were available. The screening level assessment did not exclude a high risk for all uses other than the granular use to forestry nurseries and the greenhouse use to maize and sweet maize.
- No Tier-1 risk assessment could be performed for the granular uses to forestry nurseries owing to insufficient details in the GAP.
- For the greenhouse uses to maize and sweet maize, a low risk for all bee species was concluded as it was confirmed in the GAP that the crop will remain in permanent greenhouses until harvest.

Tier-2:

- Sufficient data were available to refine the exposure estimates and perform a Tier-2 risk assessment for all uses other than the granular use to forestry nurseries.
- A high risk to honeybees and bumblebees was indicated for all uses where a Tier-2 risk assessment could be performed.
- Only a screening assessment, using the honeybee toxicity values divided by 10, could be performed for solitary bees as no toxicity data were available. The screening level assessment did not exclude a high risk for all uses where a Tier-2 risk assessment could be performed.

Tier-3:

- The exposure assessment goal determined for the succeeding crop scenario was relevant for all uses other than the granular use to forestry nurseries. Therefore, a Tier-3 risk assessment was performed for all uses other than the granular use to forestry nurseries.
- The Tier-3 risk assessment was not sufficient to demonstrate a low risk to honeybees, bumblebees and solitary bees for the succeeding crop scenario.

Weed crop scenario

Tier-1:

- The weed scenario is not relevant for seed treatment uses according to EFSA (2013c) and therefore a low risk is concluded for all seed treatment uses.
- A Tier-1 risk assessment was performed and indicated a high risk to honeybees and bumblebees for all uses other than the granular use to forestry nurseries and the greenhouse use to maize and sweet maize.
- Only a screening assessment, using the honeybee toxicity values divided by 10, could be performed for solitary bees as no toxicity data were available. The screening level assessment did not exclude a high risk for all granular uses other than the granular use to forestry nurseries and the greenhouse use to maize and sweet maize.
- No Tier-1 risk assessment could be performed for the granular uses to forestry nurseries owing to insufficient details in the GAP.
- For the greenhouse uses to maize and sweet maize, a low risk for all bee species was concluded as it was confirmed in the GAP that the crop will remain in permanent greenhouses until harvest.

Tier-2:

- In line with the conclusion of the assessment of confirmatory data (EFSA 2016b), a low risk to bees from the weed scenario was concluded for the granular uses to maize and potatoes.

Risk from contamination of adjacent vegetation via dust drift

Field margin and adjacent crop scenarios

Tier-1:

- A high risk to honeybees and bumblebees was indicated for all uses other than the use as a seed treatment to sugar and fodder beet, the granular use to forestry nurseries and the greenhouse use to maize and sweet maize. The risk assessment for seed treatments uses assumed that a deflector was fitted to the sowing machinery.
- Only a screening assessment, using the honeybee toxicity values divided by 10, could be performed for solitary bees as no toxicity data were available. The screening level assessment did not exclude a high risk for all uses other than the granular use to forestry nurseries and the greenhouse use to maize and sweet maize.
- No Tier-1 risk assessment could be performed for the granular uses to forestry nurseries owing to insufficient details in the GAP.
- For the greenhouse uses to maize and sweet maize, a low risk for all bee species was concluded as it was confirmed in the GAP that the seeds will be sown in permanent greenhouses only.
- For the use as a seed treatment to sugar and fodder beet, a low acute and chronic risk to adult honeybees and to honeybee larvae was indicated. For the high dose application, a low risk was only indicated when it was assumed a deflector was fitted to the sowing machinery. It

is noted that the endpoint for larvae was only considered to be provisional, a reliable endpoint for HPG is not available and there was no assessment of the potential for accumulative effects available. Nevertheless, the provisional risk assessment is considered sufficient to conclude a low risk for this particular crop and scenario but it would be prudent to update the risk assessment when further data are available.

- For the use as a seed treatment to sugar beet, a low acute risk to adult bumblebees was indicated. For the high dose application, a low risk was only indicated when it was assumed a deflector was fitted to the sowing machinery. However, for the chronic assessment only a screening assessment, using the honeybee toxicity value divided by 10, was performed. This assessment was not sufficient to exclude a high risk to bumblebees. Furthermore, data were lacking to be able to perform even a screening risk assessment for bumblebee larvae.

Tier-2:

- There were insufficient data to be able to refine the exposure estimates for all uses under consideration. Therefore, no Tier-2 risk assessment could be performed.

Tier-3:

- Although several higher tier effects studies were available, no Tier-3 risk assessment could be performed owing to the lack of an exposure assessment goal.

Risk via consumption of contaminated water

Guttation fluids

- A low risk to honeybees was concluded for the seed treatment uses to sugar beet and winter cereals and for the granular use to potatoes, in agreement with the evaluation of the confirmatory data for (EFSA, 2016b) and confirmed during the expert meeting related to this assessment (Pesticides Peer Review Experts' Meeting 166).
- For all other crops, a low risk to honeybees could not be demonstrated using the screening assessment based on the solubility of clothianidin.
- A refined exposure assessment and Tier-2 risk assessment was performed for maize. The Tier-2 risk assessment indicated high risk to honeybees.
- For the seed treatment uses to maize, spring oilseed rape and winter oilseed rape, and for the granular use to maize, a low risk to honeybees from residues in guttation fluid was not demonstrated at Tier 3 with the available information.

No additional higher tier effect data were available to perform a Tier-2 or Tier-3 risk assessment.

Puddle water

- A low risk is concluded to honeybees from residues in puddles for all uses under consideration.

Surface water

- In the absence of agreed input parameters for FOCUS surface water modelling, for all uses other than those in permanent greenhouses, no exposure assessment for the representative uses could be performed. Therefore, the risk to honeybees consuming residues in surface water could not be finalised.
- For the greenhouse uses to maize and sweet maize, a low risk to honeybees was concluded as exposure to surface water from granular uses in permanent greenhouses is considered to be negligible.

Table 34: A summary of the conclusions for the tiered risk assessment

Use	Tier	Honeybee								Bumble bee					Solitary bee				
		Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Guttation fluid	Surface water	Puddle water	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop
Alfalfa (seed production) seed treatment Harvested after flowering 0.0017 mg a.s./seed 80 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Alfalfa (seed production) seed treatment Harvested after flowering 0.0017 mg a.s./seed 100 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Carrot seed treatment Harvested after flowering 0.07 mg a.s./seed 120 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Carrot seed treatment Harvested before flowering 0.07 mg a.s./seed 120 g a.s./ha	Tier-1	L	N/R	R1	R1	R1	R2	X	L	L	N/R	R1	R1	R1	L	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Winter cereals seed treatment 0.015 mg a.s./seed 48 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	L	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Winter cereals seed treatment 0.028 mg a.s./seed 100 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	L	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Spring cereals seed treatment 0.028 mg a.s./seed 75 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2

Use	Tier	Honeybee								Bumble bee					Solitary bee				
		Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Guttation fluid	Surface water	Puddle water	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop
Spring cereals seed treatment 0.028 mg a.s./seed 90 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Chicory seed treatment Harvested after flowering 0.3 mg a.s./seed 33 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Chicory seed treatment Harvested before flowering 0.3 mg a.s./seed 33 g a.s./ha	Tier-1	L	N/R	R1	R1	R1	R2	X	L	L	N/R	R1	R1	R1	L	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Chicory seed treatment Harvested after flowering 0.3 mg a.s./seed 75 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Chicory seed treatment Harvested before flowering 0.3 mg a.s./seed 75 g a.s./ha	Tier-1	L	N/R	R1	R1	R1	R2	X	L	L	N/R	R1	R1	R1	L	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Clover (seed production) seed treatment Harvested after flowering 0.013 mg a.s./seed 60 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Clover (seed production) seed treatment Harvested after flowering 0.013 mg a.s./seed 105 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2

Use	Tier	Honeybee								Bumble bee					Solitary bee				
		Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Guttation fluid	Surface water	Puddle water	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop
Maize seed treatment 0.5 mg a.s./seed 35 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2	R1				R1	R1			R1				R1	R2				R2
	Tier-3	R2				R2	R2			R2				R2	R2				R2
Maize seed treatment 1.25 mg a.s./seed 125 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2	R1				R1	R1			R1				R1	R2				R2
	Tier-3	R2				R2	R2			R2				R2	R2				R2
Mustard seed treatment 0.035 mg a.s./seed 25 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Mustard seed treatment 0.07 mg a.s./seed 50 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Poppy seed treatment 0.004 mg a.s./seed 7 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Poppy seed treatment 0.013 mg a.s./seed 22 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Spring rape seed treatment 0.025 mg a.s./seed 20 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2	R1				R1				R1				R1	R2				R2
	Tier-3	R2				R2	R2			R1				R2	R2				R2
Spring rape seed treatment 0.05 mg a.s./seed 60 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2	R1				R1				R1				R1	R2				R2
	Tier-3	R2				R2	R2			R1				R2	R2				R2
Winter rape seed treatment 0.025 mg a.s./seed 20 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2	R1				R1				R1				R1	R2				R2
	Tier-3	R2				R2	R2			R1				R2	R2				R2

Use	Tier	Honeybee								Bumble bee					Solitary bee				
		Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Guttation fluid	Surface water	Puddle water	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop
Winter rape seed treatment 0.05 mg a.s./seed 60 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2	R1				R1				R1				R1	R2				R2
	Tier-3	R2				R2	R2			R1				R2	R2				R2
Sugar and fodder beet seed treatment Harvested after flowering 0.1 mg a.s./seed 13 g a.s./ha	Tier-1	R1	N/R	L	L	R1	L	X	L	R1	N/R	R2	R2	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Sugar and fodder beet seed treatment Harvested before flowering 0.1 mg a.s./seed 13 g a.s./ha	Tier-1	L	N/R	L	L	R1	L	X	L	L	N/R	R2	R2	R1	L	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Sugar and fodder beet seed treatment Harvested after flowering 0.6 mg a.s./seed 78 g a.s./ha	Tier-1	R1	N/R	L	L	R1	L	X	L	R1	N/R	R2	R2	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Sugar and fodder beet seed treatment Harvested before flowering 0.6 mg a.s./seed 78 g a.s./ha	Tier-1	L	N/R	L	L	R1	L	X	L	L	N/R	R2	R2	R1	L	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Sunflower seed treatment 0.5 mg a.s./seed 27 g a.s./ha	Tier-1	R1	N/R	R1	R1	R1	R2	X	L	R1	N/R	R1	R1	R1	R2	N/R	R2	R2	R2
	Tier-2					R1								R1					R2
	Tier-3					R2								R2					R2
Forestry nursery granules 1–2 g/plant 4 g/m^2	Tier-1	X	X	X	X	X	X	X	L	X	X	X	X	X	X	X	X	X	X
	Tier-2																		
	Tier-3																		

Use	Tier	Honeybee								Bumble bee					Solitary bee				
		Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Guttation fluid	Surface water	Puddle water	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop
Maize granules 50 g a.s./ha	Tier-1	R1	R1	R1	R1	R1	R2	X	L	R1	R1	R1	R1	R1	R2	R2	R2	R2	R2
	Tier-2		L			R1								R1					R2
	Tier-3					R2	R2							R2					R2
Maize granules 110 g a.s./ha	Tier-1	R1	R1	R1	R1	R1	R2	X	L	R1	R1	R1	R1	R1	R2	R2	R2	R2	R2
	Tier-2		L			R1								R1					R2
	Tier-3					R2	R2							R2					R2
Greenhouse Maize granules 50 g a.s./ha	Tier-1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Tier-2																		
	Tier-3																		
Potato granules 70 g a.s./ha	Tier-1	R1	R1	R1	R1	R1	L	X	L	R1	R1	R1	R1	R1	R2	R2	R2	R2	R2
	Tier-2		L			R1								R1					R2
	Tier-3					R2								R2					R2
Sorghum granules 50 g a.s./ha	Tier-1	R1	R1	R1	R1	R1	R2	X	L	R1	R1	R1	R1	R1	R2	R2	R2	R2	R2
	Tier-2		L			R1								R1					R2
	Tier-3					R2								R2					R2
Sweet maize granules 50 g a.s./ha	Tier-1	R1	R1	R1	R1	R1	R2	X	L	R1	R1	R1	R1	R1	R2	R2	R2	R2	R2
	Tier-2		L			R1								R1					R2
	Tier-3					R2								R2					R2
Sweet maize granules 110 g a.s./ha	Tier-1	R1	R1	R1	R1	R1	R2	X	L	R1	R1	R1	R1	R1	R2	R2	R2	R2	R2
	Tier-2		L			R1								R1					R2
	Tier-3					R2								R2					R2

Use	Tier	Honeybee								Bumble bee					Solitary bee				
		Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Guttation fluid	Surface water	Puddle water	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop	Treated crop scenario	Weed scenario	Field margin	Adjacent crop	Succeeding crop
Greenhouse sweet maize granules 50 g a.s./ha	Tier-1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Tier-2																		
	Tier-3																		

a.s.: active substance.
L: A low risk is concluded for the risk assessment (for the seed treatment uses, the field margin and adjacent crop, the risk assessment assumed the use of a deflector).
R1: A high risk is concluded on the basis of the assessment.
R2: A low risk cannot be demonstrated as a result of the assessment (screening-type risk assessment or incomplete conclusion at Tier-3).
X: Assessment not finalised (lack of exposure or endpoint for effects).
Empty grey box: no assessment.
N/R: Scenario not relevant.

Overall appraisal of the uncertainty related to the risk assessment

In order to reach the aforementioned conclusions on the risk assessment of imidacloprid, clothianidin, and thiamethoxam, EFSA has considered a large number of documents, reporting very diverse experiments, where many heterogeneous endpoints were measured under different conditions and using different methodologies.

One of the most relevant outputs of this complex exercise is to account for the uncertainty related to the overall assessment. At the lower tier (e.g. Tier-1 and screening), this is accounted for by the use of conservative estimates which is particularly important when standard Tier-1 parameters have been extrapolated from more worse-case situations (e.g. in cases where data were lacking for a particular crop).On the contrary, as acknowledged in EFSA (2013c), there are several routes of exposures which are not covered by the risk assessment scheme. (e.g. insect honeydew, exposure via soil)

At higher tiers (Tier-2 and Tier-3), the uncertainty starts to act in two opposing ways, and it is worth breaking it up in different factors, whose relative importance can be investigated more in detail.

Several factors were identified as source of uncertainty when establishing the revised SVs and exposure assessment goals. Some of them indicated that the estimated exposure assessment goals might be overestimated with respect to the actual exposure to bees (e.g. calculation of the exposure assessment goals using the maximum value from each trial, assuming residues equal to the LOQ every time they were > LOQ, etc.) consequently have the potential to decrease the actual risk in comparison with the present assessment. On the contrary, other factors may act in the opposite way (e.g. the sampling frequency was insufficient ensure that the peak residue was captured, limited number of residue trials resulting in a lower capacity to ensure that the 90th percentile determination was captured, etc.).

Similar factors were identified as source of uncertainty for the estimates of exposure within the effect experiments. An even greater level of uncertainty is identified for experiments for which there were insufficient information to be able to quantify the exposure to bees within the study. For sources of uncertainty which were applicable to both the calculation of the exposure assessment goals and the estimated exposure within the experiments, it was ensured that the same assumption was equally applied to both. In this way, the uncertainty is balanced, e.g. the same percentage of sugar content in nectar was assumed for both the exposure assessment goal and the estimated exposure in the experiments.

Other sources of uncertainty are related to the quantification of the effects. In this case, the direction of the uncertainty is rarely identifiable, as the uncertainty itself is linked to low reliability of the experimental design/methodology, to the lack of reference (pre-exposure) measurements, and to the lack of precision in reporting the results.

Finally, one of the most important sources of uncertainty is related to the presence of 'confounding factors' in most of the higher tier experiments, particularly those performed under field conditions.

As an example, other chemicals (i.e. herbicides, fungicides, acaricides or other classes of insecticides) were often applied to both the treatments and the control plots in line with standard field practises. Nevertheless, the relative influence that exposure to these substances might have on the bees in the control and in the treatment is unknown.

Furthermore, putting together the information from all field experiments considered for the present risk assessment review (encompassing imidacloprid, clothianidin, and thiamethoxam), EFSA noted that in more than 40% of the cases (15 experiments out of 35), some matrices collected from the controls (e.g. from hives, plants, or soils) were contaminated with at least one neonicotinoid substance. Contamination of controls was sometimes even indicated in experiments where bee colonies were exposed via contaminated sugar solutions.

It is worth noting that, in the large majority of the cases, the residue analysis only focused on the substance used in the treatment and on its metabolites. There were only six studies where residues for a wider range of neonicotinoid substances were investigated. Five of these studies reported residues of substances not included in the study design at quantifiable concentrations. Cross-contamination from substances other than the test item resulted, in some cases, in residue levels comparable to those due to the applied treatment.

Similar issues had been already pointed out by EFSA in relation to other studies not included in the present review (EFSA, 2013a,b).

This finding can be explained considering that neonicotinoids substances have been largely used in Europe for several years and on a wide range of crops. Furthermore, neonicotinoids insecticides are

persistent in the environment, particularly in soil. EFSA (2008) reported field DT_{50} value ranging from 104 to 228 days for imidacloprid. For the other two substances, some DT_{50} values are reported in the respective EU review reports (European Commission, 2006a,b). The mean/median DT_{50} values reported therein are 156 days for clothianidin and 174 days for thiamethoxam. It might be worth noting that the main soil metabolite of thiamethoxam is clothianidin, so that the DT_{50} of the active substance alone is not fully representative of the whole exposure time-variable profile.

It is important to note that this finding has implications on different aspects of the present Tier-3 risk assessment for the treated crop and succeeding crops scenarios. First, it impaired the reliability of some experiments where contamination of controls was recorded. Furthermore, it creates great uncertainty around the reliability of the results for those studies where either residue measurements were not available or, as in the vast majority of the studies, where substances other than the test item were not properly investigated. In general, this finding highlights a general disadvantage about the use of field studies for addressing the risk assessment. It exposed a source of uncertainty related to the biological observations from field studies, particularly for their interpretation and their reliability when used in the risk assessment.

It is very likely that one cause of the control contamination/cross-contamination recorded in the available studies was due to applications performed during previous years on the control plots. Other sources may be from other treated crops or contaminated plants in the landscape. It is acknowledged that the same mechanism had the potential to artificially increase the exposure in the 'treated' groups of the experiments, thus potentially amplifying effects expected from the treatment alone. Nevertheless, widespread use of these substances makes this situation likely to occur in the environment, and the data should not necessarily be disregarded as uninformative for the present risk assessment.

7. Overview of the concerns identified for each representative use considered

Table 35: Summary of concerns for each scenario according to the risk assessment scheme in EFSA (2013c)

Use	Honeybee	Bumble bee	Solitary bee
Alfalfa (seed production) seed treatment Harvested after flowering 0.0017 mg a.s./seed 80 g a.s./ha	X	X	X
Alfalfa (seed production) seed treatment Harvested after flowering 0.0017 mg a.s./seed 100 g a.s./ha	X	X	X
Carrot seed treatment Harvested after flowering 0.07 mg a.s./seed 120 g a.s./ha	X	X	X
Carrot seed treatment Harvested before flowering 0.07 mg a.s./seed 120 g a.s./ha	X	X	X
Winter cereals seed treatment 0.015 mg a.s./seed 48 g a.s./ha	X	X	X
Winter cereals seed treatment 0.028 mg a.s./seed 100 g a.s./ha	X	X	X
Spring cereals seed treatment 0.028 mg a.s./seed 75 g a.s./ha	X	X	X

Use	Honeybee	Bumble bee	Solitary bee
Spring cereals seed treatment 0.028 mg a.s./seed 90 g a.s./ha	X	X	X
Chicory seed treatment Harvested after flowering 0.3 mg a.s./seed 33 g a.s./ha	X	X	X
Chicory seed treatment Harvested before flowering 0.3 mg a.s./seed 33 g a.s./ha	X	X	X
Chicory seed treatment Harvested after flowering 0.3 mg a.s./seed 75 g a.s./ha	X	X	X
Chicory seed treatment Harvested before flowering 0.3 mg a.s./seed 75 g a.s./ha	X	X	X
Clover (seed production) seed treatment Harvested after flowering 0.013 mg a.s./seed 60 g a.s./ha	X	X	X
Clover (seed production) seed treatment Harvested after flowering 0.013 mg a.s./seed 105 g a.s./ha	X	X	X
Maize seed treatment 0.5 mg a.s./seed 35 g a.s./ha	X	X	X
Maize seed treatment 1.25 mg a.s./seed 125 g a.s./ha	X	X	X
Mustard seed treatment 0.035 mg a.s./seed 25 g a.s./ha	X	X	X
Mustard seed treatment 0.07 mg a.s./seed 50 g a.s./ha	X	X	X
Poppy seed treatment 0.004 mg a.s./seed 7 g a.s./ha	X	X	X
Poppy seed treatment 0.013 mg a.s./seed 22 g a.s./ha	X	X	X
Spring rape seed treatment 0.025 mg a.s./seed 20 g a.s./ha	X	X	X
Spring rape seed treatment 0.05 mg a.s./seed 60 g a.s./ha	X	X	X
Winter rape seed treatment 0.025 mg a.s./seed 20 g a.s./ha	X	X	X

Use	Honeybee	Bumble bee	Solitary bee
Winter rape seed treatment 0.05 mg a.s./seed 60 g a.s./ha	X	X	X
Sugar and fodder beet seed treatment Harvested after flowering 0.1 mg a.s./seed 13 g a.s./ha	X	X	X
Sugar and fodder beet seed treatment Harvested before flowering 0.1 mg a.s./seed 13 g a.s./ha	X	X	X
Sugar and fodder beet seed treatment Harvested after flowering 0.6 mg a.s./seed 78 g a.s./ha	X	X	X
Sugar and fodder beet seed treatment Harvested before flowering 0.6 mg a.s./seed 78 g a.s./ha	X	X	X
Sunflower seed treatment 0.5 mg a.s./seed 27 g a.s./ha	X	X	X
Forestry nursery granules 1–2 g/plant 4 g/m^2	Assessment not finalised	Assessment not finalised	Assessment not finalised
Maize granules 50 g a.s./ha	X	X	X
Maize granules 110 g a.s./ha	X	X	X
Greenhouse Maize granules 50 g a.s./ha			
Potato granules 70 g a.s./ha	X	X	X
Sorghum granules 50 g a.s./ha	X	X	X
Sweet maize granules 50 g a.s./ha	X	X	X
Sweet maize granules 110 g a.s./ha	X	X	X
Greenhouse sweet maize granules 50 g a.s./ha			

a.s.: active substance.

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Abbreviations

a.i.	active ingredient
a.s.	active substance
AChE	acetylcholinesterase
BBCH	growth stages of mono- and dicotyledonous plants
DT_{50}	period required for 50% dissipation (define method of estimation)
EEC	European Economic Community
ETR	exposure toxicity ratio
ETR_{acute}	exposure toxicity ratio for acute exposure
$ETR_{chronic}$	exposure toxicity ratio for chronic exposure
ETR_{larvae}	exposure toxicity ratio for larvae
ETR_{HPG}	exposure toxicity ratio for effects on honeybee hypopharyngeal glands

FOCUS	Forum for the Co-ordination of Pesticide Fate Models and their Use
GAP	Good Agricultural Practice
HPG	hypopharyngeal glands
ISO	International Organization for Standardization
IUPAC	International Union of Pure and Applied Chemistry
LD_{50}	lethal dose, median; dosis letalis media
LDD_{50}	lethal dietary dose; median
LOD	limit of detection
LOQ	limit of quantification
NOEC	no observed effect concentration
NOEL	no observed effect level
OECD	Organisation for Economic Co-operation and Development
PEC	predicted environmental concentration
PEC_{air}	predicted environmental concentration in air
PEC_{gw}	predicted environmental concentration in groundwater
PEC_{sed}	predicted environmental concentration in sediment
PEC_{soil}	predicted environmental concentration in soil
PEC_{sw}	predicted environmental concentration in surface water
PER	Proboscis Extension Reflex
PPP	Plant Protection Products
PRZM-sw	Pesticide Root Zone Model
RUD	residue per unit dose
SPG	specific protection goal
SV	shortcut value
TWA	time-weighted average
WoE	weight of evidence

Appendix A – List of supported uses

Appendix A can be found in the online version of this output ('Supporting information' section): https://doi.org/10.2903/j.efsa.2018.5177

Appendices from B to I

Appendices from B to I are provided as a separate document which can be found in the online version of this output ('Supporting information' section): https://doi.org/10.2903/j.efsa.2018.5177

Appendix B – Overview of endpoint types and related relevance class assigned within the scope of the present risk assessment

Appendix C – Tier-1 risk assessment based on EFSA (2013c)

Appendix D – Measured residue values and RUD values used for calculation of exposure assessment goals

Appendix D can be found in the online version of this output ('Supporting information' section): https://doi.org/10.2903/j.efsa.2018.5177

Appendix E – Residue intake in the effect studies

Appendix F – Tier-3 lines of evidence

Appendix G – Calculations of Predicted Environmental Concentration (PEC) in soil

Appendix H – List of study references

Appendix I – Used compound codes