2024

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Schweizerisches Zentrum für angewandte Ökotoxikologie
Centre Suisse d'écotoxicologie appliquée

SGV – Proposal by the Ecotox Centre for *Pendimethalin*

First proposal: 25.06.2024 (last bibliographic research)
30.09.2024 (implementation of the expertise)

Imprint

Publisher
Swiss Centre for Applied Ecotoxicology, 8600 Duebendorf/1015 Lausanne

Commissioned by
FOEN, Federal Office for the Environment, Soil and Biotechnology Division, 3003 Bern

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The external reviewer is not responsible for the final published SGV or the contents of this dossier that is the sole responsibility of the authors.

Acknowledgement
This project was funded by the Swiss Federal Office for the Environment. The authors would like to thank Sophie Campiche (EnviBioSoil) and the people listed under scientific support for the exchange we had and the advice they provided.

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Citation Proposal
Lauber E*, Tierbach A*, Renaud M, Junghans M. 2024. SGV – Proposal by the Ecotox Centre for Pendimethalin. Swiss Centre for Applied Ecotoxicology, Dübendorf, Switzerland; 97 pp.

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Policy disclaimer

According to the Action Plan for PPP (AP-PPP) (measure 6.3.3.7), pesticides in soil should be monitored in order to verify the evaluation carried out within the framework of the registration regarding the persistence of pesticides in the environment and their effect on soil organisms and soil functions. Therefore, a suitable method (indicator) for effects of PPP on soil fertility has to be developed and applied in field studies. Risk-based reference values for PPP residues should be available by 2025, and bioindicators for the effects of PPP residues on soil fertility should be developed by 2027.

In response to the AP-PPP and tasked by FOEN and FOAG, experts from the Ecotox Centre and EnviBioSoil have been working since 2018 on an integrative concept to assess the effects of PPP residues in soil. The following dossier represents the full evaluation, derivation and proposal of a Soil Guideline Value (a risk-based reference value), according to the recommended methodology developed within the AP-PPP project (Marti-Roura *et al.* 2023), and does not have a regulatory nature that goes beyond their intended use within the ongoing AP-PPP project. Further information on the ConSoil project and its framework can be found at: https://www.ecotoxcentre.ch/projects/soil-ecotoxicology/monitoring-concept-for-plant-protection-products-in-soils?_ga=2.170121120.1893072167.1726132886-1891293576.1686657912.

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Executive summary

As part of the Federal Action Plan on Plant Protection Products (Bundesrat, 2017), the Ecotox Centre develops proposals for Soil Guideline Values (SGV). These values are intended to provide an initial screening tool for assessing the potential risk for the long-term fertility of agricultural soils and for the soil ecosystem in general. Based on existing effect data for pendimethalin and applying the methodology described in the EU Technical Guidance Document on risk assessment (EC TGD 2003), with adaptations described in Marti-Roura *et al.* (2023), **a generic SGV** for pendimethalin of **17 µg a.s./kg soil d.w.** is proposed **for a standard soil with 3.4 % organic matter.**

Zusammenfassung

Im Rahmen des Aktionsplans Pflanzenschutzmittel (Bundesrat, 2017) erarbeitet das Ökotoxzentrum Vorschläge für Bodenrichtwerte (SGV). Diese Werte sollen ein erstes Screening-Instrument zur Bewertung der potenziellen Risiken für die langfristige Fruchtbarkeit landwirtschaftlicher Böden und für das Ökosystem Boden im Allgemeinen darstellen. Auf der Grundlage vorhandener Wirkungsdaten für Pendimethalin und unter Anwendung der im Technischen Leitfaden der EU zur Risikobewertung beschriebenen Methodik (EC TGD 2003) und den in Marti-Roura *et al.* (2023) beschriebenen Anpassungen wird **ein generischer SGV** für Pendimethalin von **17 µg a.s. pro kg Bodentrockengewicht für einen Standardboden mit 3,4 % organischer Substanz** vorgeschlagen.

Résumé

Dans le cadre du plan d'action Produits phytosanitaires (Conseil fédéral, 2017), le Centre Ecotox élabore des propositions de valeurs guides pour les sols (SGV). Ces valeurs sont destinées à fournir un outil de dépistage initial pour évaluer le risque potentiel pour la fertilité à long terme des sols agricoles et pour l'écosystème du sol en général. Sur la base des données existantes relatives aux effets du pendiméthaline et en appliquant la méthodologie décrite dans le document d'orientation technique de l'UE sur l'évaluation des risques (EC TGD 2003), avec les adaptations décrites dans Marti-Roura *et al.* (2023), **une SGV générique** pour le pendiméthaline de **17 µg a.s./kg de sol p.s. est proposée pour un sol standard contenant 3,4 % de matière organique**.

Sommario

Nell'ambito del Piano d'azione dei prodotti fitosanitari (Consiglio federale svizzero, 2017), il Centro Ecotox sviluppa proposte di valori guida per il suolo (SGV). Questi valori sono destinati a fornire uno strumento di screening iniziale per valutare il rischio potenziale per la fertilità a lungo termine dei suoli agricoli e per l'ecosistema del suolo in generale. Sulla base dei dati esistenti sugli effetti del pendimetalin e applicando la metodologia descritta nel documento tecnico di orientamento dell'UE sulla valutazione del rischio (EC TGD 2003), con gli adattamenti descritti in Marti-Roura *et al.* (2023), viene proposto **un SGV generico per** il pendimetalin di **17 µg a.s./kg di suolo (peso secco) per un suolo standard con il 3,4% di materia organica.**

Table of content

1 General information

Information on the pesticide active substance pendimethalin in relation to the soil environment is presented in this chapter. Registration information and risk assessments referred to are as follows:

- *(EC 2015), Draft Assessment Report and Proposed decision of the Netherlands prepared in the context of the possible renewal of the approval of pendimethalin under Regulation (EC) 1107/2009, Rapporteur Member State (RMS): The Netherlands, Co-RMS: Spain.*
- *(EFSA 2016), Conclusion on the peer review of the pesticide risk assessment of the active substance pendimethalin. EFSA Journal 2016;14(3):4420.*
- *(EFSA 2021), Outcome of the consultation with Member States, the applicant and EFSA on the pesticide risk assessment for pendimethalin in light of confirmatory data, EFSA Supporting publication 2021:EN-6944.*
- *(EC 2021), Updated Draft Assessment Report and Proposed decision of the Netherlands prepared in the context of the possible renewal of the approval of pendimethalin under Regulation (EC) 1107/2009, Rapporteur Member State (RMS): The Netherlands, Co-RMS: Spain.*
- *(BASF 2021), Dossier for the renewal of the active substance Pendimethalin (BAS 455 48 H), BASF Agro B.V. Arnhem (NL) Freienbach Branch.*
- *(US EPA 2017b), Transmittal of the Preliminary Environmental Fate and Ecological Risk Assessment for Registration Review, United States Environmental Protection Agency, Office of chemical safety and pollution prevention, Memorandum, PC Code: 108501, DP Barcode: 438210.*[1]

A draft assessment report dossier is available for pendimethalin for the active substance and two representative products, BAS 455 48 H and AG-P4-400 SC, from 2015 (EC 2015), on which the EFSA conclusion was based (EFSA 2016). At that time there were issues that could not be finalised and could not be concluded upon (e.g. PBT properties) as well as high risk was identified for some (in the case of e.g. terrestrial organisms other than vertebrates) or for all representative uses (with regard to e.g. aquatic organisms). Therefore the applicant was required to submit further information, which was evaluated and then consulted publicly (EFSA 2021). As a result of the confirmatory data evaluation, the draft assessment report was updated for the active substance and the product BAS 455 48 H and updated ecotoxicology sections were provided for these (EC 2021).

In addition, within the framework of the 5th European program for the renewal of approvals of pesticide active substances (AIR 5), a dossier was submitted in the EU in 2021 for the next renewal assessment. The public version of the submitted dossier is available online (BASF 2021) and if necessary (e.g. newly submitted study, insufficient information in the study summary for a previously evaluated study) the study evaluations are reconsidered and/or amended based on the available original study reports.

1.1 Identity and physico-chemical properties

Pendimethalin (CAS 40487-42-1; unofficially also known as penoxalin/penoxaline) is a dinitroaniline herbicide. The minimum purity of the technical grade active substance as manufactured is 90 % (900 g/kg) containing nitrosamine up to 45 mg/kg as relevant impurity in the technical material (EC 2015). No technical specification was set for the potentially relevant impurity of 1,2-dichloroethane (CL-44817), that occurred in the original 5-batch analysis at levels up to 5.66 g/kg (EC 2015, Vol. 3CA B.1).

[1] US EPA document is included for checking the completion of the data that were submitted to the EU. Recently it has been revealed that some manufacturers did not hand in all the studies to EFSA that they handed in to EPA (Mie and Rudén, 2023).

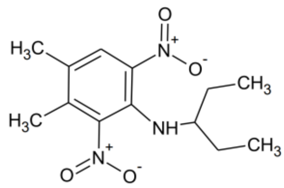
The active compound is an orange-yellow solid with low water solubility and medium volatility (Table 1). It is often supplied as CS (capsule suspension) or SC (suspension concentrate) formulations, which can be used as spray application after mixing with water (EC 2015).

The representative pendimethalin formulations are Stomp aqua (company code: BAS 455 48 H) containing 455 g/L active substance and Pendimethalin 400 SC (company code: AG-P4-400 SC) with 400 g/L active substance (EC 2015). For the 2002 EU assessment dossier (as cited in EC 2003), studies were also conducted with the representative product at that time, BAS 455 24 H (Stomp 400 SC, 400 g/L pendimethalin). At time of the previous renewal AIR 3 renewal program studies were also conducted with other representative products, FSG 01100 H (Pendimethalin 400 SC / Activus SC, 400 g/L pendimethalin; owned by Adama) and BAS 455 37 H (Stomp 400 SC, 400 g/L pendimethalin; all the products with a developer code starting with “BAS” are owned by BASF; the market name can change with time, country etc.). Study results with the previous representative products were also included in the current dossier where possible and relevant.

Due to the low water solubility of the active, recently an enhanced ZC formulation (a combination of CS and SC) of pendimethalin got patented, a microcapsule suspension with pendimethalin inside along with another active substance (there are more possible options) as a suspension concentrate outside of the microcapsules (EPO 2022).

Table 1 summarises the identity and physico-chemical properties of pendimethalin.

Table 1: Identification and physico-chemical properties of pendimethalin. Abbreviations: est. – estimated; exp. – experimental data; cal. – calculated value

Characteristics	Values	References
Common name	Pendimethalin	(EC 2021), Vol. 1
Producer’s development code number	BAS 455 H	(EC 2021), Vol. 1
IUPAC name	N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine	(EC 2021), Vol. 1
Chemical group	Dinitroaniline herbidice	(EC 2021), Vol. 1
Structural formula		(EC 2021), Vol. 1
Molecular formula	$C_{13}H_{19}N_3O_4$	(EC 2021), Vol. 1
CAS	40487-42-1	(EC 2021), Vol. 1
EC Number	254-938-2	(ECHA 2024a)
SMILES code (canonical SMILES)	CCC(CC)NC1=C(C=C(C(=C1[N+](=O)[O-])C)C)[N+](=O)[O-]	Lewis (2016)
International Chemical Identifier key (InChIKey)	CHIFOSRWCNZCFN-UHFFFAOYSA-N	Lewis (2016)
Molecular weight [g/mol]	281.3	(EC 2021), Vol. 1
Melting point [°C]	53-56 (purity 99.5-99.6 %; exp.)	Kroehl (2011) and Walter (2002) cited in (EC 2015), Vol. 3CA B.2.1
Boiling point [°C]	approx.. 246-251, overlapped by beginning of decomposition (purity 99.5 %; exp.)	Walter (2002) cited in (EC 2015), Vol. 3CA B.2.1

Solubility		
Water solubility [mg/L]	0.309 ± 0.007 at pH 6.04, 20°C (purity 99.5 %; exp.)	Walter (2000) cited in (EC 2015), Vol. 3CA B.2.5
Solubility in organic solvents [g/L]	Ethyl acetate: > 1000 Toluene: > 1000 Dichloromethane: > 1000 Acetone: > 1000 Methanol: > 250 n-Heptane: > 333 (25°C, purity 93.3 %; exp.)	Class (2013) cited in (EC 2015), Vol. 3CA B.2.6
Dissociation constant (pK_a)	2.8 The compound will exist primarily in the non-ionized form in the pH range of 5 - 9, which is the pH range normally encountered in the environment.	(EC 2003) cited in (EC 2015), Vol. 3CA B.2.8
Stability		
Aqueous hydrolysis	Stable (pH 4, 5, 7, 9 and at 20, 22, 37, 50°C)	(EC 2015), LoEP and Vol. 1
Aqueous photolysis [d]	DT50: 3.5 (arithmetic mean)	(EC 2015), LoEP
Photochemical degradation [h]	DT50: 4.2 (Atkinson model, est.)	(EC 2015), LoEP
Volatilisation		
Vapour pressure [Pa]	1.39×10^{-3} at 20°C, 3.34×10^{-3} at 25°C (purity 99.3 %; exp.)	Schneider (2001) cited in (EC 2015), Vol. 3CA B.2.2
Henry's law constant [$Pa \cdot m^3 \cdot mol^{-1}$]	1.27 (cal.)	Kroehl (2013) cited in (EC 2015), Vol. 3CA B.2.2
Partition/Adsorption		
Octanol-water partition coefficient (log P_{ow})	5.4, at pH 6.5, 20°C (purity 99.5 %; est., HPLC method)	Walter (2001) cited in (EC 2015), Vol. 3CA B.2.7
Organic carbon normalised Freundlich partitioning coefficient (K_{foc})	See section 1.5.3, Table 3	

1.2 Mode of action

Pendimethalin belongs to the dinitroaniline herbicides. In targeted weed species, the compound inhibits root and shoot growth of sensitive plants through disrupting plant cell division and elongation. It binds to tubulins disrupting their polymerisation into microtubules. This in turn prevents the alignment and separation of chromosomes during mitosis. Pendimethalin treatment can fully prevent the emergence of sensitive weeds or result in stunted, twisted and discoloured cotyledons (EC 2015).

Based on the re-evaluation of the previously submitted developmental toxicity study in rabbits, increased incidence of less than twelve pairs of ribs and missing/incomplete vertebrae were observed in the absence of maternal toxicity (ECHA 2019). This indicates that pendimethalin could have adverse effects on foetal skeletal ossification in mammals.

With regard to human toxicology, it was also shown that the target organs are the liver (in all tested species) and the thyroid glands (in rats). Although in *in vitro* tests pendimethalin showed positive chromosome aberration, altogether it was concluded that pendimethalin is unlikely to be genotoxic *in* *vivo* (EFSA 2016). The US Environmental Protection Agency (US EPA) did not find evidence of a developmental toxicity, reproductive toxicity, neurotoxicity or immunotoxicity. However, based on thyroid follicular cell adenomas in rats (both male and female), they considered pendimethalin as a possible human carcinogen (US EPA 2017a).

European Commission's Joint Research Centre (JRC) published a report summarising the screening of the available toxicological evidence on chemical compounds registered in the EU (EC 2016). In this report, pendimethalin was preliminarily identified as an endocrine disruptor (ED). It is noted in the report though that the listed substances were not evaluated according to the respective EU legislations and thus based on the results of the report they cannot be considered EDs within the meaning of the EU legislations.

Pendimethalin showed some estrogen receptor agonist activity in the Endocrine Disruptor Screening Program (EDSP) of the US EPA (2023b). However, the European Food Safety Authority (EFSA) held the view that there was no clear evidence to support an endocrine-mediated activity of pendimethalin acknowledging that sensitive studies on endocrine disruption were lacking and thus no firm conclusion could be drawn regarding the ED potential (EFSA 2016).

Apart from the fact that the data on endocrine effects of pendimethalin on vertebrates are inconclusive, it needs to be highlighted that the endocrine system of soil invertebrates displays substantial differences as compared to vertebrate species. With this in mind, extrapolation of the endocrine mode of action from vertebrates to soil invertebrates is not possible. At present, no validated tools are available for the determination of invertebrate endocrine mode of action (OECD 2018, Crane *et al.* 2022). Additionally, a specific literature search on pendimethalin yielded no data on relevant ED endpoints for soil organisms (status 07.2022).

1.3 Use and emission

Pendimethalin is a non-selective herbicide that is applied for pre- and post-emergent control of annual weeds including grasses (monocotyledons) and certain broadleaf weeds (dicotyledons) in cereals, fruits and vegetables. The target pests include, but are not limited to, barnyardgrass, goosegrass, pigweed, goosefoot and purslane (Lewis 2016, BLV 2022). It can be applied as a formulated product containing one single active or in combination with other active substances. In Switzerland, the formulations are usually available as suspension concentrate (SC), capsule suspension (CS), emulsion concentrate (EC) or granules (GR) (BLV 2022). Pendimethalin is authorised for plant protection both in the EU and in Switzerland as well as in other countries, e.g. Australia and the USA (Lewis 2016).

The formulated product can be applied in the pre-plant, pre-emergence and/or post-emergence stages of the crop. Some example applications in Switzerland are the following: at 2.2-3.5 L/ha Hysan Aqua (38.9 % a.s., Omya AG) on artichokes before planting or at the same amount of Stomp Aqua (38.9 % a.s., BASF Schweiz AG) on carrots before emergence; 3-4 L/ha Sitradol SC (38 % a.s., Stähler Suisse SA) on barley, spelt, rye and triticale before or after emergence and 100-130 kg/ha Milltox Royal (1.71 % a.s., Eric Schweizer AG) on ornamental and sports turf (BLV 2022). Non-professional uses are not authorised in Switzerland (BLV 2022).

1.4 Classification and environmental limit values

<u>Pendimethalin</u>

In alignment with the CLP Regulation ((EC) No. 1272/2008), pendimethalin was proposed to be classified as ***Aquatic category aqute 1*** (H400), ***Aquatic category chronic 1*** (H410), ***Skin sensitiser***

category 1 (H317) and ***Reproductive toxicity category 2*** (H361d) during the regulatory renewal review of the active substance (EFSA 2016).

Based on the re-evaluation of the study results on rabbits – indicating that pendimethalin has the potential to induce developmental toxicity in mammalian species – and the following Pesticide Peer Review Meeting, the classification of ***Reproductive toxicitiy category 2*** (H361d; Suspected of damaging the unborn child) was added to the formal proposal of ECHA for the globally harmonised classification (ECHA 2019). It is noted though that despite the proposal (ECHA 2019), the current official classification does not contain the previously included category of H317 (ECHA 2024a).

At the end of the European regulatory assessment it was concluded that pendimethalin is unlikely to be genotoxic *in vivo* (EFSA 2016). Nonetheless, in the human health risk assessment report of the US EPA pendimethalin is considered as a ***possible human carcinogen*** (Group C; US EPA 2017a).

Based on the information available at the time of the CLH report, pendimethalin was not classified as persistent, bioaccumulative or toxic (PBT) (ECHA 2019). However, in the implementing regulation renewing the approval of the active substance in the EU, it was considered *appropriate to renew the approval of pendimethalin as a candidate for substitution* as well as *appropriate to require further confirmatory information* (EC 2017). Currently pendimethalin is included in the list of candidates for substitution (EC 2011, consolidated version in force). The EFSA conclusion on the final result of the confirmatory information with regard to pendimethalin being potentially a PBT compound has not been published yet (EFSA 2021). Due to its persistence and potential toxicity, the compound is identified as a candidate for substitution in Switzerland (see consolidated version of 01.01.2024 of PSMV 2010) and in the USA (Toxics Release Inventory; US EPA 2023a).

Up to date, no soil protection value could be found for pendimethalin.

<u>1,2-dichloroethane</u>

Besides the active compound, the relevant impurities might also be of hazard concern. One of them is 1,2-dichloroethane (CAS No. 107-06-2) that is classified as ***Flammable liquids category 2*** (H225), ***Acute toxicity category 4*** (H302), ***Skin corrosion/irritation category 2*** (H315), ***Serious eye damage/irritation category 2*** (H319), ***Specific target organ toxicity – single exposure category 3*** (H335) and ***Carcinogenicity category 1B*** (H350) (ECHA 2024b).

<u>Nitrosamines</u>

In general, N-nitrosamines are a group of organic compounds, most of which are classified as possible or probable human carcinogens (IARC 2024). It is not specified in the publicly available parts of the renewal assessment report, which nitrosamines would occur in technical grade pendimethalin (EC 2015). However, in the CLH report for pendimethalin (ECHA 2019) specifically nitroso-pendimethalin is listed. For nitroso-pendimethalin (CAS No. 68897-50-7; N-nitroso-(1-ethylpropyl)-2,6-dinitro-3,4-xylidene) no harmonised CLH classification is available; by companies H315 and H319 were notified to ECHA (ECHA 2024c).

Please note that the information included here may have changed since finalisation of the dossier.

1.5 Environmental fate in soil

<u>Volatilisation from soil surface</u>

Considering the physico-chemical properties of pendimethalin (Table 1), the compound can be considered as medium volatile (EC 2008). Based on the volatilisation of < 4-6 % after 24 hours from plant and soil surfaces as well as the short photochemical degradation half-life (DT50 = 4.2 hours) it was concluded that no long-range transport in the air is expected (EC 2015). Based on a field study it was also concluded that short-range transport via deposition after volatilisation to non-target areas plays only a minor role (EC 2015). On the other hand, pendimethalin was found in local agricultural, semi-remote and remote areas where it was not applied, and monitoring results demonstrated at least a medium range transport (1–1000 km) through air (EFSA 2016, Vighi *et al.* 2017). The adsorption of pendimethalin to atmospheric particles can increase its aerial persistence allowing its transport over midrange distances (< 1000 km) (EFSA 2016, Vighi *et al.* 2017). Despite the fact that pendimethalin applied onto the soil surface can dissipate faster than the soil-incorporated compound (Strandberg & Scott-Fordsmand 2004), soil incorporation after spraying application is not specifically recommended (EFSA 2016).

<u>Photodegradation</u>

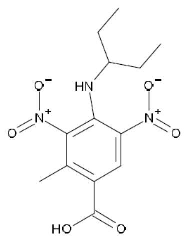
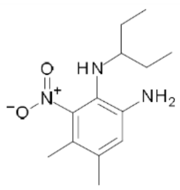
On one hand it was found that pendimethalin is stable to soil photolysis (US EPA 2017b). On the other hand, photodegradation might contribute to pendimethalin dissipation on the soil surface as some mineralisation occurred and pendimethalin showed faster degradation under irradiated conditions than in the dark (EC 2021). However, no transformation products originating from pendimethalin photodegradation were identified (EC 2015, EFSA 2016).

1.5.1 Route of degradation

Pendimethalin degradation in soil is mainly characterised by incorporation into the organic soil structure with tight binding to fulvic acids, humic acids and humines. Mineralisation occurs only at a low level (EC 2015).

Table 2 summarises the primary transformation products of pendimethalin in soil.

Table 2: Pendimethalin transformation products in soil.

Code/Trivial name	Chemical name	Structural formula	Reference
M455H001 (P44, CL99900, Reg. No. 4108474) aerob	2-methyl-3,5-dinitro-4-(pentan-3-ylamino) benzoic acid		(EC 2015), Vol. 3CA B.8
M455H033 (P48, former M12, Reg. No. 4295966) anaerob	4,5-dimethyl-3-nitro-N2-(pentan-3-yl) benzene-1,2-diamine		(EC 2015), Vol. 3CA B.8

<u>Aerobic degradation in soil</u>

In laboratory and field experiments one aerobic soil metabolite, M455H001 (P44, M01) was found with a maximum formation rate of 6.9 % AR (applied radioactivity) after 63 days (EC 2015).

Anaerobic degradation in soil

The anaerobic metabolite M455H033 (P48, former M12) is formed under anaerobic conditions in soil and in water/sediment systems (EC 2015). The maximum formation rate in soil reached 25.9 % AR after 29 days (EC 2015).

Mineralisation and non-extractable residues

Mineralisation was highly varying with 0.4 % AR after 120 days under anaerobic conditions, 1.7-18.1 % AR after 120 days under aerobic conditions and 13.4 % AR after 30 days in soil photolysis. Non-extractable residues were 71.1, 5.6-43.2 and 19.3 % AR, respectively, in aerobic, anaerobic and photolysis soil studies (EC 2015).

1.5.2 Rate of degradation

Laboratory degradation studies

Pendimethalin showed a medium to high persistence in aerobic degradation studies (soil pH ranging from 5.7 to 8.6) with non-normalised degradation half-lives of 41.0-166.8 days (5 soils relevant to European conditions) and 301.6-301.7 days (two American soils not representative of European soils), with no pH dependence (EC 2021). The normalised DT50 values (20°C, pF 2) for the EU-relevant soils are 53.6-146/201 days (SFO, single first-order kinetics / slow phase DFOP, double first-order in parallel kinetics). In studies submitted to and evaluated by the US EPA, pendimethalin degraded in soil under aerobic soil conditions with a half-life range of 95.3-1272 days (US EPA 2017b; MRID 4018510 and 49207701-03).

The degradation of the aerobic soil metabolite M455H001 was much more variable showing low to high persistence with non-normalised DT50 values of 11.2-101.2 days, not showing pH dependence (EC 2021). The degradation of M455H033 differed under aerobic (non-normalised DT50 = 0.36-1.46 d) and anaerobic conditions (non-normalised DT50 = 9.0 d).

Field dissipation studies

In the EU renewal dossier, field studies from Greece, Italy, Germany, France, the UK and Spain with altogether 19 soils were included, two of which (from Italy) were not found acceptable. These studies were conducted with CS, SC, EC and WG formulations and it was shown that there was no statistically significant difference in the dissipation between the CS and the non-CS formulations. The non-normalised field dissipation half-lives ranged from 39.8 to 187 days with a geometric mean of 83.2 days (n = 17; EC 2021). The non-normalised field half-lives are used as trigger for determining if a substance fulfils the persistency category as defined in the EU REACH regulation ((EC) No. 1907/2006). Based on the non-normalised geometric mean, the persistence criterion of field DissT50 > 120 days with regard to PBT is not met, although on some occasions the field half-lives exceeded the trigger. Altogether it was proposed that pendimethalin would not fulfil the PBT, POP (persistent organic pollutant) or vPvB (very persistent and very bioaccumulative) criteria (EC 2021).

Vighi *et al.* (2017) reviewed and summarised the same dataset that can be found in the EU renewal dossier discussed above (with some very minor, < 1 day differences in the listed DissT50 values).

Further regulatory terrestrial field dissipation studies with pendimethalin are reported by EPA (MRIDs 45364705, 45364706, 45163802, and 45136801), which were performed in Indiana (USA), Lousiana (USA) and Mississippi (USA) (US EPA 2017b). The field dissipation half-lives ranged between 4 and 147 days with no leaching to deeper soil layers, in line with the mobility studies below (US EPA 2017b).

It is noted that no details of these studies (author, date, guideline used, study summary etc.) are available in the US EPA document.

With metabolite M455H001 one dissipation study in one soil was conducted in Germany that resulted in a non-normalised DissT50 of 117.7 days (EC 2021).

Additional studies

Additionally, many field studies focusing on the dissipation of pendimethalin in soil have been published in the literature. The review of Strandberg & Scott-Fordsmand (2004) provides a good summary of those studies and explanations for the strong variances in the results. The reported dissipation half-lives are in the range of a few days and more than 200 days (Strandberg & Scott-Fordsmand 2004). The large variation can be attributed to differences in the experimental conditions. As pendimethalin dissipation depends on many factors such as soil type, temperature, humidity, application regime and soil microbial activity (Strandberg & Scott-Fordsmand 2004), it is safe to say that there are difficulties with predicting the behaviour of pendimethalin in soil under field conditions.

1.5.3 Adsorption/desorption properties and bioavailability

Adsorption

The adsorption/desorption potential of pendimethalin was investigated in nine soils with organic carbon contents ranging from 0.6 to 4.1 % (Table 3). The results indicate that pendimethalin has a strong preference to bind to organic matter and therefore has a low leaching potential (EC 2021). Based on the available data (i.e. Kfoc = 8942 – 27 578 mL/g), the compound can be considered as immobile in soil (EC 2021).

Comparable data are available for pendimethalin in studies that were conducted in the USA and Japan (soil OC % of 0.44 – 2.91). These studies also characterised pendimethalin as immobile with Koc values of 7011 – 43 863 (MRID 00153765 and MRID 43041901 cited in US EPA 2017b).

In addition to the parent, the adsorption/desorption behaviour of the main soil transformation products of pendimethalin are also available in the European regulatory dossier (EC 2021). M455H001 shows medium to high mobility (Kfoc = 76.6 – 328.9 mL/g), whereas M455H033 is considered to exhibit low mobility or to be immobile (Kfoc = 1669 – 5747 mL/g) (EC 2015, EFSA 2016).

Table 3: Soil adsorption of the active substance pendimethalin. Abbreviations: OC – organic carbon; K_f – Freundlich soil-water distribution coefficients; K_{foc} – organic carbon-normalised Freundlich distribution coefficients; 1/n – Freundlich exponent.

Soil	OC [%]	Soil pH ($CaCl_2$)	Kf [mL/g]	Kfoc [mL/g]	1/n	Reference
Loamy sand (Borstel)	1.29	5.4	159.7	12 380	0.919	Müller (2001a) cited in (EC 2021), Vol. 1 Level 2; EFSA (2016)
Silty clay loam (Rendzina Soest)	4.10	7.3	366.6	8942	0.980	
Loamy sand (LUFA 2.2)	2.17	5.7	273.4	12 599	0.943	
Silt loam (Parabraunerde Soest)	1.26	6.9	123.7	9814	0.941	
Sand	0.60	5.6	113.7	18 954	0.993	

Soil	OC [%]	Soil pH ($CaCl_2$)	Kf [mL/g]	Kfoc [mL/g]	1/n	Reference
(LUFA 2.1)						Ebert & Kuhnke (2013a) cited in (EC 2021), Vol. 1 Level 2; EFSA (2016)
Sandy loam (LUFA 2.3)	0.99	6.7	110.5	11 160	0.958	
Sandy loam (Bruch West)	1.63	7.3	202.8	12 442	0.961	
Silt loam (Nierswalder Wildacker)	1.85	5.7	510.2	27 578	0.960	
Sandy clay loam (La Gironda)	1.22	7.4	125.1	10 258	0.931	
pH dependence		No				(EC 2021), LoEP

Leaching

The adsorption properties of pendimethalin (see above) imply that its leaching into deeper soil layers is highly unlikely, which was confirmed by the ground water modelling results as well (EFSA 2016).

Bioavailability

The bioavailability of a chemical compound and in turn the actual toxicity of a substance to in-soil organisms is dependent on various factors including the soil physical and chemical properties (e.g. organic matter content, texture/clay content, pH and/or cation exchange capacity) as well as the physiology and behaviour of the organism considered (e.g. surface-volume ratio, anatomy, feeding strategy and/or preferences in habitat) (Peijnenburg 2020, Marti-Roura *et al.* 2023). Proper consideration of bioavailability can help with reducing the overestimation of the actual risk. In order to account only for the bioavailable portion of the tested substance, the test results need to be normalised to the above mentioned soil properties. However, in the absence of appropriate equations that can mirror the whole complex system, in regulatory context normalisation takes place only to the organic matter content that is considered the main factor influencing bioavailability for organic compounds (Marti-Roura *et al.* 2023).

In the case of pendimethalin, soil pH and texture do not seem to affect the adsorption of the compound to soil particles (EFSA 2016). For non-ionized organic compounds like pendimethalin (Table 1), it is assumed that bioavailability is mainly driven by the organic matter content of the soil (EC TGD 2003); therefore test results are normalised to organic matter content (see Section 3).

1.6 Bioaccumulation and biomagnification

Substances, such as lipophilic organic compounds, can potentially accumulate along the food chain resulting in a risk for higher vertebrates, such as worm-eating birds and mammals. Especially compounds with a log Pow greater than three can pose a risk of secondary poisoning to animals at higher trophic levels. Pendimethalin has a log Pow of 5.4 (Table 1), and thus there is a potential for bioaccumulation and biomagnification that should be considered in a separate assessment (as it is out of the scope of the current SGV derivation).

2 Chemical analysis and environmental concentrations

Comprehensive techniques are necessary for the extraction of plant protection product residues from soil and for their analysis. Through a recent development, a new multi-residue method has been developed and will be used for soil monitoring in Switzerland (Acosta-Dacal *et al.* 2021, Rösch *et al.* 2023). Pesticides are extracted using an optimised QuEChERS (quick, easy, cheap, effective, rugged and safe) approach followed by chemical analysis *via* liquid chromatography coupled to tandem mass spectrometry with electrospray ionisation (LC-ESI-MS/MS, triple quadrupole). In the case of pendimethalin, the limit of quantification for the method (MLOQ) was determined as 0.5 ng a.s./g (corresponding to 0.0005 mg a.s./kg soil; Rösch *et al.* 2023, Table S6).[2]

The soil guideline value that is derived in this dossier for pendimethalin will be used in conjunction with the actual soil concentrations monitored in Swiss soils by using the above-described measurement method. The initial measurements on some selected, partly agricultural, Swiss soils resulted in pendimethalin concentrations between < 0.0005 mg a.s./kg soil (< MLOQ) and 0.0041 mg a.s./kg soil (Rösch *et al.* 2023, Table S12).

For pendimethalin, the initial predicted environmental concentration in soil (PECsoil) is 2.133 mg a.s./kg soil; while the predicted plateau value resulting from accumulation after years of long-term use, is 0.186 mg a.s./kg soil, following the most critical EU GAP (Good Agricultural Practices, i.e. the proposed and evaluated representative uses of pendimethalin in the EU, max. 1 x 1593 g a.s./ha/season; EC (2021)). So the worst-case estimated overall PECsoil,accumulation value (PECsoil,initial + PECsoil,plateau) in the EU is 2.319 mg a.s./kg soil.

3 Effect data on pendimethalin

Effect data for soil organisms were collected from studies retrieved from the European registration information (EC 2015, EFSA 2016, EC 2021). Additionally, a bibliographic search was performed for pendimethalin and its CAS number (CAS 40487-42-1) in the ECOTOX Knowledgebase (US EPA 2024) and in the database of the German Federal Environment Agency (UBA 2024). Furthermore, a search was performed on Scopus by using a combination of key words (soil, EC50, LC50, NOEC, LOEC, LCx, ECx, toxicity and various soil organisms such as earthworm, Collembola or mite) and the compound's name or CAS number. Studies performed with formulated products were included in the dataset, unless the amount of active substance within the formulation was unknown or the formulation contained other active substances in addition to pendimethalin.

In general, only reliable and relevant data should be used for SGV derivation. Different approaches to assessment and classification of (eco)toxicological data have been published. An established method introduced by Klimisch *et al.* (1997) uses four levels of quality: (1) reliable, (2) reliable with restrictions, (3) not reliable, (4) not assignable. This categorisation is followed by the regulatory assessments. The CRED approach (criteria for reporting and evaluating ecotoxicity data; Moermond *et al.* 2016) is based on a similar classification scheme but takes into account the relevance of test results in a more detailed way. This assessment method was originally developed for the aquatic environment and therefore in order to assess and classify (eco)toxicological studies for the soil compartment, the CRED approach needed to be adapted by incorporating soil-specific aspects (Casado-Martinez *et al.* 2024). This modified approach is applied for the assessment of the studies in this dossier and used for evaluating the reliability

[2] Unless it is specified otherwise, active substance and metabolite concentrations in soil are meant per kg soil dry weight.

and relevance of the studies (see scores for "R" and "C", respectively, in Table 4 and Table A1-Table A4).

A short summary of the main points of considerations are given below. For further details on the consideration with regard to the study evaluation and the SGV derivation, please refer to Appendix 1 as well as to the above mentioned soil CRED article (Casado-Martinez *et al.* 2024) and the methodological proposal for deriving soil guideline values (Marti-Roura *et al.* 2023).

Since the bioavailability of non-ionized organic compounds, like pendimethalin, to soil organisms is assumed to be mainly driven by the organic matter (OM) content of soil (EC TGD 2003), effect data should be normalised to a standard organic matter content in order to make the results comparable among different soil types. The EC TGD (2003, p.116) recommends for non-ionic organic compounds, a normalisation to a standard organic matter content of 3.4 % (corresponding to 2 % organic carbon (OC)). This is in line with the findings in Swiss agricultural soils (Meuli *et al.* (2014); personal communication from NABO). The normalisation is performed according to the following equation:

$$Effect\ concentration\ [standard] = \ Effect\ concentration\ [exp] \times \frac{Fom\ soil\ (standard)}{Fom\ soil(exp)}$$

Where:
Effect concentration [standard] – effect concentration in standard soil [mg/kg]
Effect concentration [exp] – effect concentration in experiment [mg/kg]
Fom soil (standard) – fraction of organic matter in standard soil (0.034) [kg/kg]
Fom soil (exp) – fraction of organic matter in experimental soil [kg/kg]

Studies, where the information about the organic matter (or carbon) content is missing are classified as "*not assignable*" (R4) in accordance with the CRED criteria. Besides the organic matter content, other soil properties such as pH and texture (clay content) also need to be considered. The pH ($CaCl_2$ method) for Swiss agricultural soils ranges between 4.5 and 7.5 (median 6.0) whereas clay content ranges between 5 % and 50 % (median 20 %; Marti-Roura *et al.* 2023). As there is no evidence that adsorption and in turn bioavailability of pendimethalin is affected by soil pH or clay content (EC 2015, EFSA 2016), studies outside the recommended range (or without knowing the pH or the clay content) were not excluded from the dataset.

In the course of the evaluation, reproduction endpoints are considered the most relevant endpoints as they are good indicators of the long-term sustainability of the population. Other chronic endpoints affecting survival and growth (biomass) of individuals are also accepted, since they are traditionally measured endpoints that are frequently extrapolated to represent the impact at population level (Marti-Roura *et al*. 2023). If multiple comparable toxicity values for the same species and the same measured effect are available, a geometric mean of the effect concentrations is calculated.

Regulatory studies and their endpoints are either accepted without additional assessment (at face value, although without applying the additional divison of the endpoint by two in case of log Pow ≥ 2) or partially/fully re-considered if needed to set the endpoints in line with our criteria as summarised in Appendix 1. This is the case, for example, when organisms were not exposed through soil (e.g. plant vegetative vigour tests *via* foliar application); normalisation to a standard organic matter content was not possible due to lack of data or not the most statistically robust effect concentration was proposed/agreed upon as a final endpoint.

If more than one endpoint is available from the same study for the same effect, the statistically more robust one is preferred. This means that the statistically more robust endpoint is chosen even if it is higher than another one or it includes more than 10 % effect (choosing non-significant endpoints with

< 10 % effects is a precautionary approach that is often used at European level). If the latter is the case, it will be highlighted and discussed further in the uncertainty analysis (see later below). If both NOEC and EC10 are available from the same study and statistically both are equally robust, due to the inherent uncertainties of the NOEC, the EC10 is preferred over the NOEC (for further explanation, please refer to Appendix 1).

Complete lists of laboratory and field studies reporting soil effect values for pendimethalin and its transformation products are shown in Appendix 2 (for pendimethalin, Table A1 with laboratory and Table A2 with field studies) and in Appendix 3 (for the major soil metabolites, Table A3 and Table A4). If necessary, some clarifications and/or justifications of the assessment are provided in form of Notes to those tables (see Notes A1 and Notes A2) in Appendix 2 and 3, respectively) and also the same respective notes for Table 4. In Table 4 of the main text, all the reliable and relevant results are summarised with the exception of plants. An extensive amount of relevant and reliable plant data including EC50 and NOEC values are available from regulatory studies. With regard to the nature of the other long-term data (NOEC/EC10 values) and for comparability, for plants only NOEC endpoints are summarised in Table 4 and used for SGV derivation. The EC50 values are listed in Table A1 (Appendix 2) and are always the same or higher than the respective NOECs. In Table 4 the lowest values per species per measured effects with the same duration are shown in bold. If there are only greater-than values, the highest one is shown in bold as they mean that up to the highest tested concentration no adverse effects were observed. The geomean, if it is possible to calculate from the results (i.e. there are equal-to values for the same species/effect/duration/type of effect concentration), is used for choosing the lowest value rather than the individual effect concentrations. This sifting procedure helps to choose the lowest effect concentrations per species/group for the SGV derivation (see Table 5).

3.1 Comparison between data for active substance and formulated products

A statistical analysis of potential differences in the toxicity of the active substance and the formulated products was not possible due to the scarcity of data. Therefore, toxicity data obtained with the active substance and the formulations were merged (see data for the parent in Table 4 and Table A1). When multiple comparable toxicity values for the same species and the same endpoint were available, the geometric mean of the effect values was calculated, irrespective of whether the data was obtained with the active ingredient or a formulation.

Table 4: Pendimethalin – All reliable (R1-R2) and relevant (C1-C2) effect data – with the exception of plants, for which the NOEC values are preferred and presented here (the EC50 values can be found in Appendix 1). The lowest reliable and relevant data per species per measured effect for the same duration are shown in bold. The geomean, if it is possible to calculate from the results (equal-to values for the same species/effect/duration/type of effect concentration), is used for choosing the lowest value rather than the individual effect concentrations. For non-target plants, the values are grouped per species and per measured effect. Calculated data are rounded to three significant figures. Abbreviations: n.r. – not reported; n.a. – not applicable; cc. – concentration; WHC – water holding capacity; OC – organic carbon; OM – organic matter; CFU – colony forming units. The full set of studies can be found in Appendix 1 (Table A1 and Table A2). Data were evaluated for reliability and relevance according to the modified CRED criteria (see R/C scores) or taken at face value from regulatory dossiers (Assessment score 1-3). The explanation of notes are included after this table (Notes 1).

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida (Earthworm)	Pendimethalin (a.s.)	adult mortality	14 d	LC50	> 933	5	> 634	Artificial soil: 5 % peat, pH 5.6-6.2, 57-58 % MWHC	A, F	1	Friedrich (2010b) cited in (EC 2021), Vol. 3CA B.9.4.1.1, p.230
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 449 g a.s./L measured)	adult mortality	14 d	LC50	639	5	435	Artificial soil: 5 % sphagnum peat, 20 % kaolin clay, 75 % industrial sand, 0.12 % $CaCO_3$, pH 6.1-6.8, MWHC 56-59 %	B	C1/R1	Vértesi (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.1, p.152; Anonymous (2008) cited in (BASF 2021), BASF DocID 2008/1035606
***Eisenia fetida* (Earthworm)**	**BAS 455 48 H (455 g a.s./L nominal, 449 g a.s./L measured)**	**adult mortality**	**14 d**	**NOEC**	**190**	**5**	**129**	**Artificial soil: 5 % sphagnum peat, 20 % kaolin clay, 75 % industrial sand, 0.12 % $CaCO_3$, pH 6.1-6.8, MWHC 56-59 %**	**B**	**C1/R1**	**Vértesi (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.1, p.152; Anonymous (2008) cited in (BASF 2021), BASF DocID 2008/1035606**
Eisenia fetida (Earthworm)	Stomp 400 SC (400 g a.s./L)	adult mortality	28 d	NOEC	≥ 80.0	10	≥ 27.2	Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH 5.9-6.3, approx. 60 % MWHC	D	R2/C2	Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154, Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681
***Eisenia fetida* (Earthworm)**	**FSG 01100 H (Pendimethalin 400 SC, 400 g a.s./L)**	**adult mortality**	**28 d**	**NOEC**	**≥ 92.4**	**5**	**≥ 62.8**	**Artificial soil: 5 % peat, pH 6.0-6.2, 58-59 % MWHC**	**E, F**	**1**	**Friedrich (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.7.1.2, p.120**

[3] M – monocotyledonous, D – dicotyledonous plant species

[4] DE – diversity endpoint, EE – enzymatic endpoint, FE – functional endpoint

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 454.1 g a.s./L measured)	adult mortality	28 d	NOEC	≥ 138 (≥ 358 mg product/kg soil)	10	≥ 46.9	Artificial soil: 10 % peat, pH 5.7-6.3, 60 % MWHC	L	R1/C1	Anonymous (2016) cited in (BASF 2021), BASF DocID 2016/1323860
Eisenia fetida (Earthworm)	Pendimethalin (a.s.)	adult biomass change	14 d	NOEC	117	5	79.6	Artificial soil: 5 % peat, pH 5.6-6.2, 57-58 % MWHC	A, F	1	Friedrich (2010b) cited in (EC 2021), Vol. 3CA B.9.4.1.1, p.230
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 449 g a.s./L measured)	adult biomass change	14 d	NOEC	381	5	259	Artificial soil: 5 % sphagnum peat, 20 % kaolin clay, 75 % industrial sand, 0.12 % $CaCO_3$, pH 6.1-6.8, MWHC 56-59 %	B	C1/R2	Vértesi (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.1, p.152; Anonymous (2008) cited in (BASF 2021), BASF DocID 2008/1035606
		geomean					**144**				
Eisenia fetida (Earthworm)	Stomp 400 SC (400 g a.s./L)	adult biomass change	28 d	NOEC	≥ 80.0	10	≥ 27.2	Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH 5.9, approx. 60 % MWHC	D	R2/C2	Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154, Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681
***Eisenia fetida* (Earthworm)**	**FSG 01100 H (Pendimethalin 400 SC, 400 g a.s./L)**	**adult biomass change**	**28 d**	**NOEC**	**≥ 92.4**	**5**	**≥ 62.8**	**Artificial soil: 5 % peat, pH 6.0-6.2, 58-59 % MWHC**	**E, F**	**1**	**Friedrich (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.7.1.2, p.120**
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 454.1 g a.s./L measured)	adult biomass change	28 d	NOEC	≥ 138 (≥ 358 mg product/kg soil)	10	≥ 46.9	Artificial soil: 10 % peat, pH 5.7-6.3, 60 % MWHC	L	R1/C1	Anonymous (2016) cited in (BASF 2021), BASF DocID 2016/1323860
Eisenia fetida (Earthworm)	Stomp 400 SC (400 g a.s./L)	reproduction	56 d	NOEC	16.0	10	5.44	Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH	D	R2/C2	Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154; Anonymous (2001) cited

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
								5.9-6.3, approx. 60 % MWHC			in (BASF 2021), BASF DocID 2001/1007681
Eisenia fetida (Earthworm)	FSG 01100 H (Pendimethalin 400 SC, 400 g a.s./L)	reproduction	56 d	NOEC	69.3	5	47.1	Artificial soil: 5 % peat, pH 6.0-6.2, 58-59 % MWHC	E, F	1	Friedrich (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.7.1.2, p.120
		geomean					**16.0**				
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 454.1 g a.s./L measured)	reproduction	56 d	NOEC	≥ 138 (≥ 358 mg product/kg soil)	10	≥ 46.9	Artificial soil: 10 % peat, pH 5.7-6.3, 60 % MWHC	L	R1/C1	Anonymous (2016) cited in (BASF 2021), BASF DocID 2016/1323860
***Eisenia fetida* (Earthworm)**	**Pendimethalin (98 % purity)**	**juvenile growth (weight gain)**	**21 d**	**NOEC**	**< 10**	**2.7**	**< 12.6**	**Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0**	**G**	**R2/C2**	**Belden *et al.* (2005)**
Folsomia candida (Collembola)	BAS 455 48 H (455 g a.s./L)	adult mortality	28 d	NOEC	193 (500 mg product/kg soil)	5	131	Artificial soil: 5 % peat, pH 5.7-6.1, 58 % MWCH	H	R1/C1	Friedrich (2011c) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.169; Anonymous (2011b) cited in (BASF 2021), BASF DocID 2011/1067589
Folsomia candida (Collembola)	Pendimethalin 400 SC (400 g a.s./L)	adult mortality	28 d	NOEC	97.8	5	66.5	Artificial soil: 5 % peat, pH 5.6-6.1, 50 % MWHC	F	1	Vinall (2011) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.122
		geomean					**93.3**				
Folsomia candida (Collembola)	BAS 455 48 H (455 g a.s./L)	reproduction	28 d	NOEC	193 (500 mg product/kg soil)	5	131	Artificial soil: 5 % peat, pH 5.7-6.1, 58 % MWCH	H	R1/C1	Friedrich (2011c) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.169; Anonymous (2011b) cited in (BASF 2021), BASF DocID 2011/1067589

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Folsomia candida (Collembola)	Pendimethalin 400 SC (400 g a.s./L)	reproduction	28 d	NOEC	78.22	5	53.2	Artificial soil: 5 % peat, pH 5.6-6.1, 50 % MWHC	F	1	Vinall (2011) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.122
		geomean					**83.5**				
Folsomia candida (Collembola)	Pendimethalin (98 % purity)	reproduction	28 d	NOEC	≥ 30 (< 90)	2.7	≥ 37.8 (< 113)	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R2/C1	Belden *et al.* (2005)
***Hypoaspis aculeifer* (Mite)**	**BAS 455 48 H (455 g a.s./L)**	**adult mortality**	**14 d**	**NOEC**	**≥ 384.6**	**5**	**≥ 262**	**Artificial soil: 5 % peat, pH 5.6-5.9, 51-56 % MWHC**	**F, K**	**1**	**Ganssmann (2013b) cited in) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.171; Anonymous (2013) cited in (BASF 2021), BASF DocID 2013/1132494**
Hypoaspis aculeifer (Mite)	Pendimethalin 400 SC (400 g a.s./L)	adult mortality	14 d	NOEC	≥ 381.5	5	≥ 259	Artificial soil: 5 % peat, pH 5.7-6.1, 47-49 % MWHC	F	1	Schulz (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.124
***Hypoaspis aculeifer* (Mite)**	**BAS 455 48 H (455 g a.s./L)**	**reproduction**	**14 d**	**NOEC**	**≥ 384.6**	**5**	**≥ 262**	**Artificial soil: 5 % peat, pH 5.6-5.9, 51-56 % MWHC**	**K**	**1**	**Ganssmann (2013b) cited in) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.171; Anonymous (2013) cited in (BASF 2021), BASF DocID 2013/1132494**
Hypoaspis aculeifer (Mite)	Pendimethalin 400 SC (400 g a.s./L)	reproduction	14 d	NOEC	≥ 381.5	5	≥ 259	Artificial soil: 5 % peat, pH 5.7-6.1, 47-49 % MWHC	F	1	Schulz (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.124
Microorganisms	**BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)**	**nitrogen transformation[FE]**	**28 d**	**≤ 25 % effect (≤ 10 % effect)**	**≥ 13.2**	**2.33 (1.37 % OC)**	**≥ 19.3**	**Natural soil from untreated agricultural area: loamy sand, pH 6.6, 42-44 % MWCH**	**F, W**	**1 (R1/C1)**	**Schulz (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.9, p.181; Anonymous (2008a) cited in (BASF 2021), BASF DocID 2008/1034462**

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Microorganisms	Pendimethalin 400 SC (nominal 400 g a.s./L; measured 410.2 g a.s./L)	nitrogen transformation[FE]	28 d	≤ 25 % effect (≤ 10 % effect)	≥ 10.9	2.35 (1.38 % OC)	≥ 15.8	Natural soil from untreated agricultural area: sandy loam, pH 6.5, 41-44 % MWCH	F, W	1	Schulz (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.9, p.128
Microorganisms	**BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)**	**carbon transformation[FE]**	**28 d**	**≤ 25 % effect (≤ 10 % effect)**	**≥ 13.2**	**2.33 (1.37 % OC)**	**≥ 19.3**	**Natural soil from untreated agricultural area: loamy sand, pH 6.2-6.4, 45 % MWCH**	**L**	**R1/C1**	**Anonymous (2008b) cited in (BASF 2021), BASF DocID 2008/1034461**
Allium cepa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	28 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Allium cepa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	28 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Allium cepa*[M]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling emergence**	**23 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Allium cepa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	28 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
											2021), BASF DocID 2012/1182237
Allium cepa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	28 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Allium cepa*[M]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling growth (shoot height)**	**23 d**	**NOEC**	**0.148**	**1.3 (0.763 % OC)**	**0.388**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Allium cepa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	28 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
***Allium cepa*[M]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)**	**biomass (fresh shoot weight)**	**28 d**	**NOEC**	**0.659**	**1.39 (0.82 % OC)**	**1.61**	**Natural soil from agricultural area: silty sand, pH 6.04**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055**
Allium cepa[M]	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (shoot fresh weight)	23 d	NOEC	≥ 1.32	1.3 (0.763 % OC)	≥ 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
***Allium cepa*[M]**	**BAS 455 48 H (nominal 455 g a.s./L;**	**mortality**	**28 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous**

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
	measured 449.2 g a.s./L)										**(2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Allium cepa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	28 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Avena sativa*[M]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Avena sativa*[M]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling growth (shoot height)**	**21 d**	**NOEC**	**0.441**	**1.3 (0.763 % OC)**	**1.16**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Avena sativa*[M]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**biomass (shoot fresh weight)**	**21 d**	**NOEC**	**0.441**	**1.3 (0.763 % OC)**	**1.16**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
***Avena sativa*[M]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF**

Species (Taxonomic group)[3]	**Test substance**	**Measured effect[4]**	**Duration**	**Type of effect concentration**	**Effect concentration [mg a.s./kg soil]**	**Total OM [%]**	**Normalised effect value [mg a.s./kg soil] 3.4 % OM**	**Test soil**	**Notes**	**Assessment score**	**Source**
											2021), BASF DocID 2012/1182237
Avena sativa[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.55 (0.91 % OC)	≥ 2.90	Natural soil (LUFA Speyer): silty loamy sand pH, 7.29	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Beta vulgaris*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	0.329	1.55 (0.91 % OC)	0.723	Natural soil (LUFA Speyer): silty loamy sand pH, 7.29	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Beta vulgaris[D]	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	0.0495	1.3 (0.763 % OC)	0.130	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
		geomean					**0.307**				
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	21 d	NOEC	0.667	1.55 (0.91 % OC)	1.47	Natural soil (LUFA Speyer): silty loamy sand pH, 7.29	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	NOEC	0.165	1.39 (0.82 % OC)	0.402	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Beta vulgaris[D]	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (shoot fresh weight)	21 d	NOEC	0.148	1.3 (0.763 % OC)	0.388	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
		geomean					**0.395**				
Beta vulgaris[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	mortality	21 d	NOEC	≥ 1.32	1.55 (0.91 % OC)	≥ 2.90	Natural soil (LUFA Speyer): silty loamy sand pH, 7.29	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
											(2013b) cited in (BASF 2021), BASF DocID 2012/1182237
***Beta vulgaris*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**≥ 1.32**	**1.39 (0.82 % OC)**	**≥ 3.22**	**Natural soil from agricultural area: silty sand, pH 6.04**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055**
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Brassica napus*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Brassica napus*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling growth (shoot height)**	**21 d**	**NOEC**	**0.148**	**1.3 (0.763 % OC)**	**0.388**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	NOEC	0.659	1.39 (0.82 % OC)	1.61	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Brassica napus[D]	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (shoot fresh weight)	21 d	NOEC	0.148	1.3 (0.763 % OC)	0.388	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
		geomean					**0.790**				
***Brassica napus*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF**

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
											2021), BASF DocID 2012/1182237
Brassica napus[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Capsicum annuum[D]	Pendimethalin 400 SC (404.4 g a.s./L)	seedling emergence	35 d	NOEC	≥ 1.35	2.04 (1.2 % OC)	≥ 2.25	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
***Capsicum annuum*[D]**	**Pendimethalin 400 SC (404.4 g a.s./L)**	**seedling growth (shoot height)**	**35 d**	**NOEC**	**0.084**	**2.04 (1.2 % OC)**	**0.140**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136**
Capsicum annuum[D]	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	35 d	NOEC	0.169	2.04 (1.2 % OC)	0.282	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
***Daucus carota*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling emergence**	**23 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Daucus carota[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	28 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Daucus carota[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	28 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
***Daucus carota*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling growth (shoot height)**	**23 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Daucus carota[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	28 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
***Daucus carota*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**biomass (shoot fresh weight)**	**23 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
***Daucus carota*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**28 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
											2021), BASF DocID 2012/1182237
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Glycine max*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Glycine max*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**seedling growth (shoot height)**	**21 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
											(2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Glycine max*[D]**	**Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)**	**biomass (shoot fresh weight)**	**21 d**	**NOEC**	**≥ 1.32**	**1.3 (0.763 % OC)**	**≥ 3.46**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134**
***Glycine max*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Glycine max[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Lactuca sativa*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**

Species (Taxonomic group)[3]	**Test substance**	**Measured effect**[4]	**Duration**	**Type of effect concentration**	**Effect concentration [mg a.s./kg soil]**	**Total OM [%]**	**Normalised effect value [mg a.s./kg soil] 3.4 % OM**	**Test soil**	**Notes**	**Assessment score**	**Source**
Lactuca sativa[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	0.329	1.31 (0.77 % OC)	0.855	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Lactuca sativa[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	0.659	1.39 (0.82 % OC)	1.61	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
		geomean					**1.17**				
***Lactuca sativa*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**biomass (dry shoot weight)**	**21 d**	**NOEC**	**0.329**	**1.31 (0.77 % OC)**	**0.855**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Lactuca sativa[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	NOEC	0.659	1.39 (0.82 % OC)	1.61	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
											2021), BASF DocID 2008/1025055
***Lactuca sativa*[D]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Lactuca sativa[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d	NOEC	≥ 1.32	1.39 (0.82 % OC)	≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
***Lolium perenne*[M]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**0.329**	**1.31 (0.77 % OC)**	**0.855**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Lolium perenne[M]	Pendimethalin 400 SC (404.4 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.35	2.04 (1.2 % OC)	≥ 2.25	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
Lolium perenne[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	0.165	1.31 (0.77 % OC)	0.429	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Lolium perenne[M]	Pendimethalin 400 SC (404.4 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	0.0863	2.04 (1.2 % OC)	0.144	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
		geomean					**0.249**				
Lolium perenne[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	21 d	NOEC	0.165	1.31 (0.77 % OC)	0.429	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
***Lolium perenne*[M]**	**Pendimethalin 400 SC (404.4 g a.s./L)**	**biomass (shoot fresh weight)**	**21 d**	**NOEC**	**0.216**	**2.04 (1.2 % OC)**	**0.360**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136**
***Lolium perenne*[M]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**0.165**	**1.31 (0.77 % OC)**	**0.429**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
***Lycopersicon esculentum*[D]**	**Pendimethalin 400 SC (404.4 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.35**	**2.04 (1.2 % OC)**	**≥ 2.25**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136**
***Lycopersicon esculentum*[D]**	**Pendimethalin 400 SC (404.4 g a.s./L)**	**seedling growth (shoot height)**	**21 d**	**NOEC**	**0.0345**	**2.04 (1.2 % OC)**	**0.0575**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136**

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Lycopersicon esculentum[D]	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	21 d	NOEC	0.0863	2.04 (1.2 % OC)	0.144	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
Pisum sativum[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Pisum sativum[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Pisum sativum[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Pisum sativum[D]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	mortality	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
***Zea mays*[M]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**seedling emergence**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Zea mays[M]	Pendimethalin 400 SC (404.4 g a.s./L)	seedling emergence	21 d	NOEC	≥ 1.35	2.04 (1.2 % OC)	≥ 2.25	Natural soil: LUFA 2.2, loamy sand, pH 5.5	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
Zea mays[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOEC	≥ 1.32	1.31 (0.77 % OC)	≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
***Zea mays*[M]**	**Pendimethalin 400 SC (404.4 g a.s./L)**	**seedling growth (shoot height)**	**21 d**	**NOEC**	**0.674**	**2.04 (1.2 % OC)**	**1.12**	**2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand**	**F, S**	**1 (R1/C1)**	**Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136**
***Zea mays*[M]**	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**biomass (dry shoot weight)**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**
Zea mays[M]	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	21 d	NOEC	≥ 1.35	2.04 (1.2 % OC)	≥ 2.25	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136

Species (Taxonomic group)[3]	Test substance	Measured effect[4]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Zea mays[M]	**BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)**	**mortality**	**21 d**	**NOEC**	**≥ 1.32**	**1.31 (0.77 % OC)**	**≥ 3.43**	**Natural soil (LUFA Speyer): medium silty sand, pH 7.17**	**F, S**	**1 (R1/C1)**	**Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237**

Notes 1: Notes on soil studies for pendimethalin (relevant and reliable data).

A	The results are corrected to the purity of the test item (93.3 %).
B	Full study report is available in the newly submitted dossier (BASF 2021). The study summary has not been commented on in the dRAR (EC 2021), therefore the evaluation was conducted by the Ecotox Centre. The density of the formulation was not reported. The concentrations in mg a.s./kg soil are based on a formulation density of 1.179 kg/L that was taken from the nitrogen transformation study (Schulz 2008a) that used the same batch of the same formulation.
D	The application was sprayed over the surface of the 5 cm deep wet soil layer in the containers, without mixing, after the earthworms had been added and let burrow into the soil. This is not considered as a worst-case scenario that would involve homogenous incorporation. The study was refused for use in the prospective risk assessment. No adult mortality occurred (28 d). No effects on adult growth (28 d). Statistically robust reproduction NOEC (13 % effects) at 12 L/ha = 4.8 kg a.s./ha = 16 mg a.s./kg soil (based on 402 g a.s./L, 200 cm^2 surface of the vessels with 600 g soil dw in each). Mean reproduction effects at the highest cc. > 50 %, but probably not high enough for calculating a statistically robust EC50. Only EC10 and EC20 are reported. The confidence intervals are very wide and they very much overlap (EC20low < EC10median) thus the EC10 is not considered reliable.
E	The application was sprayed over the surface of the 5 cm deep soil layer in the containers, without mixing, after the earthworms had been added and let burrow into the soil. This is not considered as a worst-case scenario that would involve homogenous incorporation. In the 2015 version of the dRAR (EC 2015) it was still considered acceptable for use in the RA. There is no updated version from 2021 for this product dossier. The effect concentrations are based on the actually measured a.s. content of the product used in the study (396.6 g a.s./L).
F	The assessment from the EU documents (EC 2015, EFSA 2016, EC 2021) was adopted and accepted without additional assessment (i.e. at face value). The results were re-calculated according to the actual measured active substance content of the applied formulation (if it was available) thus slight differences to the EU-listed endpoints may occur (if they used the nominal a.s. content).
G	Four tests are included in the study, one each with earthworms, springtails, woodlice and non-target plants (Belden *et al.* 2005). The applied methods and the results are not reported in sufficient detail to consider reliability of the data on woodlice and plants.

	The detailed results at different concentrations, also the details of the statistical analysis (e.g. fitted curves) were not reported, therefore the EC50 results cannot be confirmed. Along with the wide spacing of the test concentrations, the reliability of the EC50 results cannot be considered. Altogether they are scored as not assignable (R4) for all tests. Pendimethalin concentrations were verified in the tests according to the Materials and Methods section but the results were not reported. It is noted though that analytical verification is not a requirement in the respective OECD guidelines for soil macroorganisms. Furthermore, the available pdf of the article is faulty, one result page appears twice, while another one is missing (including the figure of the earthworm and probably the analytical results). Unfortunately neither the authors nor the journal has an archive copy with the original content. ***Earthworms:*** The tested concentrations were 10, 40 and 160 mg a.s./kg soil and solvent control. There was 1500 % growth of juveniles in the control, while statistically significant reduction of weight gain (17%) was observed even at 10 mg a.s./kg soil. No mortality occurred in the control and at 10 mg a.s./kg soil, while 5 and 10 % mortality could be observed at 40 and 160 mg a.s./kg soil concentrations, respectively. Due to the low number of test concentrations along with the high spacing factor, the EC50 result cannot be considered reliable. On the other hand, the 21-day juvenile growth does not cover long-term effects and its relevance at population level is not clear. Therefore it is considered as a short-term endpoint in between the acute (mortality, 14 d) and chronic (28-d adult mortality, 56-d reproduction) test protocols. Considering the unusual type of measured effect along with the fact that there was significant effects even at the lowest test concentrations, the NOEC is not considered directly appropriate for SGV derivation. ***Springtails:*** The tested concentrations were 10, 30 and 90 mg a.s./kg soil and solvent control. Although the detailed numbers were not reported, it looks from the presented figure that the test likely met the validity criteria of the respective OECD 232 guideline – with modifications considering that the test used solo females per jar (i.e. in the control no mortality occurred; approx. 60-75 offspring/female were produced; based on the deviation in the control, the CV must have been < 30 %). While the reproduction was highly reduced at 90 mg a.s./kg soil, no mortality occurred in the treatments and the control. Due to the wide spacing of the test concentrations, the NOEC cannot be used directly for SGV derivation and the EC50 is not considered reliable.
H	As the reproduction effects just reached 50 % at the highest test concentration along with mortality of 20 %, no EC50 and in turn no statistically robust EC10 could be calculated. Also the fit of the curves for the EC10 and EC20 values calculated by the applicant could not be checked as the fitted curves were not provided. As a result, the statistically robust NOEC is considered as the most reliable endpoint (with no re-calculation of the ECx values). It is noted that the reproduction NOEC was used in the EU risk assessement according to the EFSA conclusion (EFSA 2016, but probably based on results earlier from 2015), but that was changed to the EC10 at the end of 2015 (according to the green colour-coding) as appeared in the updated dRAR in 2021.
K	There was no dose-response for any of the measured effects, there are no significant effects at the highest test cc. (with 16 % effects at the second highest cc. as the overall highest effect occurred). Therefore it is not clear how EC10 and EC20 values could be calculated and accepted (ECx values were calculated and submitted separately, they are not included in the study report nor in the newly submitted dossier). The confidence intervals of the EC10 and EC20 values are largely overlap. Overall the EC10 is not considered reliable. It was noted in the dRAR that "The curves were not provided and the fits could therefore not be checked by the RMS." Additionally it must be noted that the EC10 value was accepted and considered further in the EU risk assessment.
L	Study not included in the dRAR (EC 2015, 2021), but in the newly submitted dossier (BASF 2021), therefore the evaluation was conducted by the Ecotox Centre.
S	The test item was applied onto the soil surface shortly after placing the seeds into the soil. (The scoring in brackets means that study report was additionally checked for details of the method and the results by the Ecotox Centre.) If the application was given in rates (e.g. as g a.s./ha), the respective effect concentration (as mg a.s./kg soil) was calculated using the reported depth or assuming an average 10 cm depth of the containers. For futher explanation on the parameters used, please refer to Appendix 1. Phytotoxicity effects were measured half-quantitatively by subjective visual assessment. The reliability of the subjective visual assessment cannot be determined therefore the reliability of these results cannot be assigned (R4). The symptoms included chlorosis, stunting, deformation and necrosis at various levels.

W	In the OECD 216 nitrogen transformation study the 0-28 d nitrogen transformation rates are compared to the control (see explanation provided in Appendix 1). The deviations in percentage are expected to be < 25 %. In the Schulz (2008a) study there were 7 and 10 % deviation from the control for the 0-28 d interval at 6.91 and 34.55 mg product/kg soil concentrations (corresponding to 13.3 and 2.66 mg a.s./kg soil). In the Schulz (2013) study, there were 4.5 and 7.5 % deviation from the control for the 0-28 d interval at 5.73 and 28.67 mg product/kg soil concentrations (corresponding to 2.20 and 11.0 mg a.s./kg soil).

3.2 Graphic representation of effect data

The lowest most relevant and reliable data (R1-2/C1-2) per species/group per test setup – normalised to a standard organic matter content of 3.4 % – are plotted in Figure 1. If more values for the same endpoint from the same test are available (e.g. EC10 and NOEC), the statistically more robust one is shown in the figure. If both EC10 and NOEC are equally robust, EC10 is preferred (for further explanation, please refer to Appendix 1 Considerations for the evaluation of the studies). If values for more measured effects for the same species from the same test are available (e.g. reproduction, biomass, mortality etc.), the lowest one is included in the figure.

This figure aims to provide an overview of the distribution of the effect concentrations, i.e. to indicate the most sensitive species/group. The equal-to effect concentrations for chronic earthworm and microorganism data are in a similar range (5.44-47.1 mg a.s./kg), whereas the data for collembolans are somewhat higher (between 37.8-131 mg a.s./kg) with mites being the least sensitive (≥ 262 mg a.s./kg). The data on plants show the highest sensitivity (0.13-1.61 mg a.s./kg; Figure 1) with no difference between monocotyledonous and dicotyledonous species.

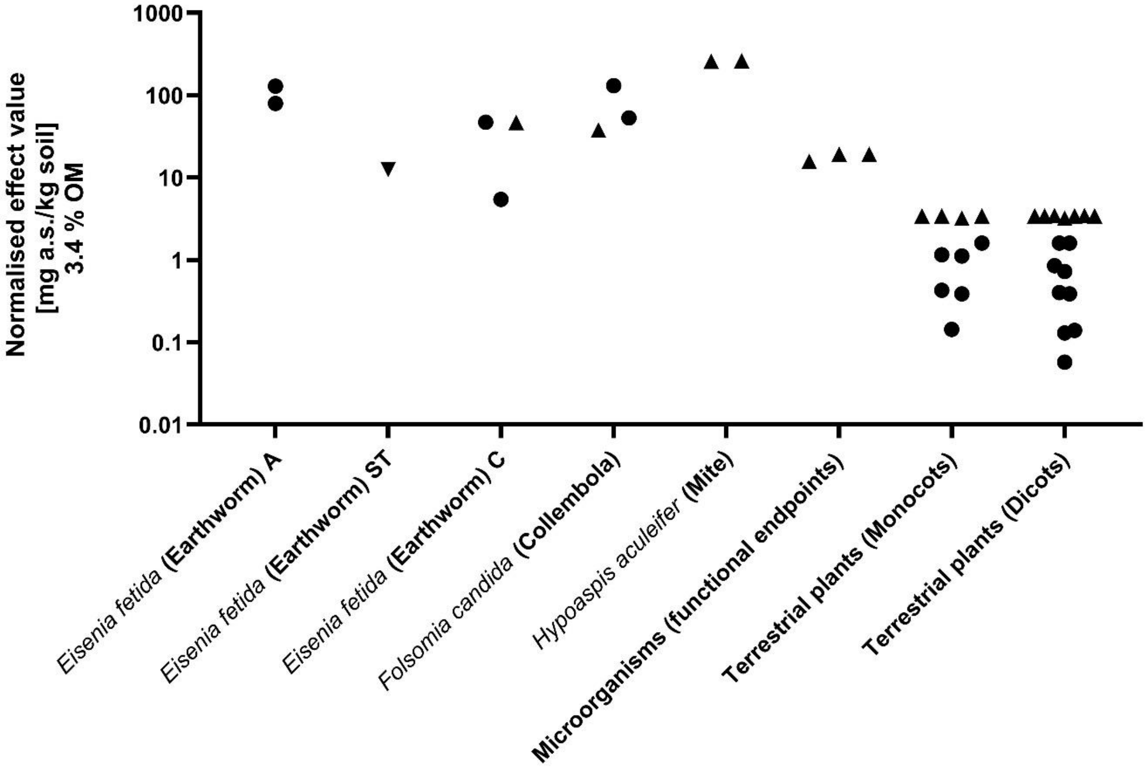


Figure 1: Effect data for pendimethalin after normalisation to a standard organic matter content of 3.4 % - the statistically most robust lowest effect values of the relevant and reliable data per species/group per test setup. For earthworms the acute (A), short-term (ST) and chronic (C) data are shown separately. For the other groups chronic data (NOEC/EC10) or equivalent to that (≤ 10 % effect) are presented. Triangles represent unbound data with the triangle facing up symbolising ≥ or > values and the triangle facing down symbolising ≤ or < values.

4 Derivation of SGV

For the SGV derivation for pendimethalin, the relevant and reliable effect concentrations of the active substance were normalised to a standard organic matter content of 3.4 %. Data on formulations were re-calculated to active substance content. Then the lowest toxicity endpoints per species (or per group, see microorganisms) were summarised (Table 5); no unbound value is included if an equal-to value is available.

Table 5: The lowest relevant and reliable chronic data for pendimethalin per species/group, rounded to three significant figures, summarised from Table 4. Effect concentrations are expressed as concentrations normalised to 3.4 % of soil organic matter content. For multiple comparable toxicity values for the same species and the same endpoint, a geometric mean was calculated.

Trophic level	Species, family (Group)	Type of effect concentration	Normalised effect concentration [mg a.s./kg soil]	Reference
Primary producers (terrestrial plants)	*Allium cepa, Amaryllidaceae* (Monocot)	NOEC	0.388	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
	Avena sativa, Poaceae (Monocot)	NOEC	1.16	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
	Lolium perenne, Poaceae (Monocot)	NOEC	0.249	***Geomean:*** Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237 Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
	Zea mays, Poaceae (Monocot)	NOEC	1.12	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
	Beta vulgaris, Amaranthaceae (Dicot)	NOEC	0.307	***Geomean:*** Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237 Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
	Brassica napus, Brassicaceae (Dicot)	NOEC	0.388	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
	Capsicum annuum, Solanaceae (Dicot)	NOEC	0.140	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
	Daucus carota, Apiaceae (Dicot)	NOEC	≥ 3.46	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134
	Glycine max, Fabaceae (Dicot)	NOEC	≥ 3.46	Fiebig (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.134

Trophic level	**Species, family (Group)**	**Type of effect concentration**	**Normalised effect concentration [mg a.s./kg soil]**	**Reference**
	Lactuca sativa, Asteraceae (Dicot)	NOEC	0.855	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
	Lycopersicon esculentum, Solanaceae (Dicot)	NOEC	0.0575	Fiebig (2013) cited in (EC 2015b), Vol. 3CP (AG) B.9.11.2, p.136
	Pisum sativum, Fabaceae (Dicot)	NOEC	≥ 3.43	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Decomposers (nutrient transformers)	Microorganisms (Functional endpoints)	≤ 10 % effect	≥ 19.3	Schulz (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.9, p.181; Anonymous (2008a) cited in (BASF 2021), BASF DocID 2008/1034462 and Anonymous (2008b) cited in (BASF 2021), BASF DocID 2008/1034461
Decomposers (litter transformers/ primary consumers)	*Eisenia fetida, Lumbricidae* (Earthworm)	NOEC	16	***Geomean:*** Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154; Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681 Friedrich (2008) cited in (EC 2015b), Vol. 3CP (AG) B.9.7.1.2, p.120
	Folsomia candida, Isotomidae (Collembola)	NOEC	83.5	***Geomean:*** Friedrich (2011c) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.169; Anonymous (2011b) cited in (BASF 2021), BASF DocID 2011/1067589 Vinall (2011) cited in (EC 2015b), Vol. 3CP (AG) B.9.7.2, p.122
Secondary consumers	*Hypoaspis aculeifer, Laelapidae* (Mite)	NOAEC	≥ 262	Ganssmann (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.171; Anonymous

Trophic level	Species, family (Group)	Type of effect concentration	Normalised effect concentration [mg a.s./kg soil]	Reference
				(2013) cited in (BASF 2021), BASF DocID 2013/1132494

4.1 Derivation of SGV using the assessment factor (AF) method

The SGV_{AF} is determined using assessment factors applied to the lowest valid toxicity endpoint (e.g. NOEC, EC10) from long-term toxicity tests. The magnitude of the AF is selected according to the adapted methods of the European guidance document on environmental risk assessment (EC TGD 2003, Marti-Roura *et al.* 2023).

The lowest toxicity endpoint available for pendimethalin (Table 5) is the NOEC of 0.0575 mg a.s./kg soil for terrestrial plants.

Pendimethalin is a herbicide, which inhibits root and shoot growth of sensitive plants through disrupting plant cell division and elongation. Thus it is expected that terrestrial plants – **primary producers** – are the most sensitive group of organisms. Data are available for 12 plant species. For nine species equal-to effect values (0.0575-1.16 mg a.s./kg soil) and for three species equal-to/higher-than effect values (≥ 3.43-3.46) have been found relevant and reliable.

The regulatory data on soil microorganisms – **decomposers (nutrient transformers)** – cover < 25 % effects rather than no observed effect concentrations. In the absence of the full study report for Schulz (2013), no statistical analysis could be conducted; the re-calculated 0-28 d nitrate formation rates showed 4.5 and 7.5 % deviations from the control. The re-evaluation of the Schulz (2008) study indicated statistically significant effects on nitrogen transformation after 28 days at the higher tested concentration, but only 7 and 10 % deviations from the control in terms of nitrate formation rate both for the lower and higher concentrations tested, respectively. Therefore in their effect sizes, these effect concentrations are considered similar and treated similarly to other EC10/NOEC values.

The lowest most relevant data for **decomposers (litter transformers/primary consumers)** is a geometric mean calculated for two long-term effect values for earthworms (16 mg a.s./kg based on Krieg (2001) and Friedrich (2008) cited in (EC 2021, 2015)). In addition, chronic data is also available for Collembola (83.5 mg a.s./kg based on a geomean; Friedrich (2011c) and Vinall (2011) cited in (EC 2021, 2015)).

Secondary consumers, namely *Hypoaspis aculeifer* (predatory mite), did not show an exceptional sensitivity (≥ 262 mg a.s./kg; Ganssmann (2013b) cited in (EC 2021)).

When long-term test results (NOEC or EC10 values) are available for at least three species representing three trophic levels with different living and feeding conditions, the EC TGD (2003) recommends the application of an assessment factor of 10 to the lowest valid effect datum (Table 20 in EC TGD (2003)). In the case of pendimethalin, data are available at all four trophic levels with the lowest endpoints as equal-to values for terrestrial plants (primary producers). To account for the uncertainties in the available data, an AF of 10 is applied to the lowest equal to effect value on plants:

$$SGV_{AF} = \frac{lowest\ EC10\ or\ NOEC}{AF}$$

$$SGV_{AF} = \frac{0.0575 \left(\frac{mg\ a.s.}{kg\ soil}\right)}{10} = 0.0058 \left(\frac{mg\ a.s.}{kg\ soil}\right)$$

The application of an AF of 10 to the lowest equal to chronic datum results in a SGV_{AF} = **0.0058 mg a.s./kg soil** for a standard soil with 3.4 % OM content (shown to two significant figures).

4.2 Derivation of SGV using the species sensitivity distribution (SSD) method

There are altogether 11 SSD-compatible equal-to long-term endpoints (including four geometric mean values) available belonging to eight taxonomic groups at family level (or four higher taxonomic groups, such as Monocots, Dicots, Clitellata and Hexapoda) representing two trophic levels (Table 5).

The inclusion of all equal-to values (plants/primary producers, and decomposers/litter transformers/primary consumers) resulted in a non-normal statistical distribution at significance level of 0.05 in all normality tests (Anderson-Darling, Kolmogorov-Smirnov and Cramer von Mises; calculated with ETX 2.3.1 software by RIVM). As pendimethalin is a herbicide, it is not surprising that plant species are one to two orders of magnitude more sensitive than other non-plant species (including microorganisms that are not supposed to be included in an SSD). Therefore the evaluation was repeated including only the plant effect concentrations.

The evaluation of the nine normalised equal-to NOEC values for plants resulted in a normal distribution and a hazardous concentration for 5 % of the species (HC5) of 0.0664 mg a.s./kg soil (with lower and upper limit of 0.0180 and 0.135 mg a.s./kg soil, respectively;Table 6). The included equal-to effect values cover four monocot and five dicot species belonging to six families (Table 5 and Figure 2).

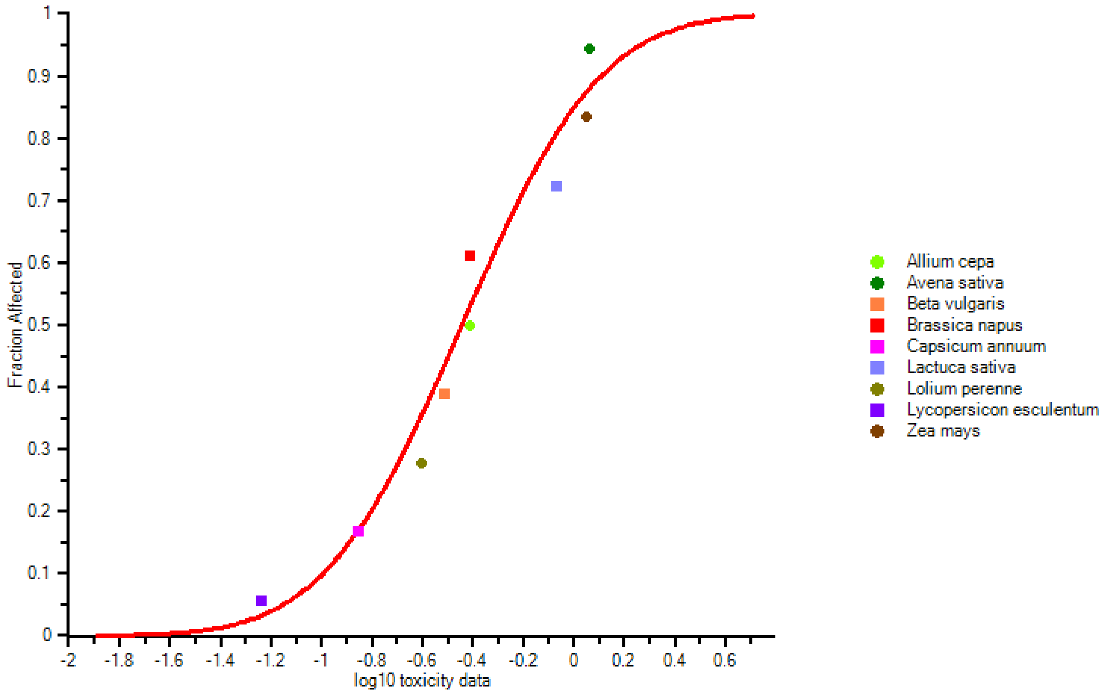


Figure 2: Species sensitivity distribution (SSD) for terrestrial plants (based on nine exact data points including monocots and dicots) calculated by ETX 2.3.1. Hazardous concentration for 5 % of the species (HC5) is 0.0664 mg pendimethalin/kg soil. Notes: dots depict monocotyledonous, squares dicotyledonous species.

It is noted that the recommended number of effect concentrations to include in the SSD would be ten (Marti-Roura *et al.* 2023), while here only nine could be used. However, originally there were 11 exact effect values for plant and decomposer species that had to be narrowed down to the 9 plant data to achieve normal distribution. Also, there are three further greater-than plant values that could not be included in the SSD; these values are higher than the ones that got included.

While there are certain statistical considerations behind the general requirement of 10-15 values, it is admitted that the number of data that included into an SSD for regulatory use is somewhat arbitrary and the data requirement of the EC TGD (2003) for deriving SSD for soil organisms is unrealistic (Marti-Roura *et al.* 2023). As the number of equal-to plant effect data is just one less than the recommended ten, and the distribution of the included data is quite even without any obvious differences in sensitivity between monocot and dicot species, the resulted SSD is considered sufficiently robust. Also, the resulted confidence interval can be considered robust (with two to three times difference around the mean value; also see the spread of the confidence interval in Table 6). As plants are the most sensitive group of species to pendimethalin, the resulted HC5 altogether is considered suitable for an SGV_{SSD} derivation.

Table 6: SSD statistical results for pendimethalin plant effect data (ETX 2.3.1). Abbreviations: HC5 - hazardous concentration for 5 % of the species, LL – lower limit, UL – upper limit (LL and UL designate the 90 % confidence interval), sprHC5 – the width of the HC5 distribution (calculated as the ratio of UL and LL).

Anderson-Darling test for normality				
Sign. level	Critical	Normal?		
0.1	0.631	Accepted		
0.05	0.752	Accepted	***AD Statistic:***	0.298
0.025	0.873	Accepted	n:	9
0.01	1.035	Accepted		

Kolmogorov-Smirnov test for normality				
Sign. level	Critical	Normal?		
0.1	0.819	Accepted		
0.05	0.895	Accepted	***KS Statistic:***	0.464
0.025	0.995	Accepted	n:	9
0.01	1.035	Accepted		

Cramer von Mises test for normality				
Sign. level	Critical	Normal?		
0.1	0.104	Accepted		
0.05	0.126	Accepted	***CM Statistic:***	0.0308
0.025	0.148	Accepted	n:	9
0.01	0.179	Accepted		

Parameters of the normal distribution		
Name	**Value**	**Description**
mean	-0.443	mean of the log toxicity values
s.d.	0.430	sample standard deviation
n	9	sample size

HC5 results			
Name	**Value**	**log10 (Value)**	**Description**
LL HC5	0.01795	-1.746	lower estimate of the HC5
HC5	0.06644	-1.178	median estimate of the HC5
UL HC5	0.1354	-0.8685	upper estimate of the HC5
sprHC5	7.540	0.8773	spread of the HC5 estimate

Taking into account all of the above detailed circumstances, that is

- initially 11 effect values for two trophic levels were included, but the non-plant data had to be excluded due to non-normality of the dataset;
- plants are the most sensitive group of organisms;
- nine equal-to (two of them are geomeans) and three greater than effect concentrations are available for plant species that altogether belong to six dicot and two monocot families, representing an adequate variety of species;
- the resulting HC5 is statistically robust,

an assessment factor (AF) of four is considered sufficient as the resulting SGV covers the LL HC5. Thus, the SGV_{SSD} has been calculated as follows:

$$SGV_{SSD} = \frac{HC5}{AF}$$

$$SGV_{SSD} = \frac{0.0664\left(\frac{mg\ a.s.}{kg\ soil}\right)}{4} = 0.017\left(\frac{mg\ a.s.}{kg\ soil}\right)$$

The application of an AF of 4 to the calculated HC5 results in a SGV_{SSD} of **0.017 mg a.s./kg soil** for a standard soil with 3.4 % OM content (shown to two significant figures).

In the SGV_{SSD} a series of data and their distribution is reflected on as opposed to the single lowest effect value for the SGV_{AF}, therefore the derived SGV_{SSD} is considered more robust and more suitable for a definitive SGV proposal.

4.3 Derivation of SGV using the equilibrium partitioning (EqP) approach

If no reliable data on terrestrial organisms is available, the equilibrium partitioning utilising aquatic toxicity data can be used to estimate the SGV_{EqP} (EC TGD 2003). In the case of pendimethalin, sufficient amount of data is available for soil organisms to cover a wide range of different types of physiology and behaviour at various trophic levels. Therefore, the derivation of SGV_{EqP} using the equilibrium partitioning approach is not required.

4.4 Determination of SGV using mesocosm/field data

Two field studies on earthworms and a study on microorganisms (litter-bag test) could be obtained for pendimethalin (see Table A2 in Appendix 2). In both earthworm field studies (Hamberger (2011) and Strömel and Teresiak (2011) cited in (EC 2021)) there were significant and non-significant but high (> 40 %) effects after one month, and in one of them also statistically significant effects even after one year (Hamberger (2011) cited in (EC 2021)). There were also significant effects in the litter-bag test (Brockmann (2011a) cited in (EC 2021)), however without a clear dose-response. Due to the observed effects as well as the analytical verification limited only to the initial application, these study results could not be used for deriving an SGV (see detailed consideration of the long-term field studies in general in Appendix 1 and specifically for these studies in the respective notes in Notes A1).

5 Toxicity of major transformation products

Effect data are available for the two major soil metabolites of pendimethalin: M455H001 (P44, CL99900, Reg. No. 4108474) and M455H033 (P48, former M12, Reg. No. 4295966). The full effect data tables are presented in Appendix 2 (Table A3 and Table A4), whereas Table 7 below summarises the lowest effect concentrations for these metabolites with regard to relevant and reliable data available per organism/group of organisms.

The earthworm and the microorganism results are quite similar for both metabolites. No further data on other soil organisms are available for EU authorisation. The existing data can indicate a similar toxicity of the metabolites to earthworms and microorganisms as the active substance itself, which are not the most sensitive groups to the active substance. As a result, it remains unclear if these metabolites would require further evaluation in a mixture risk assessment or if the risk from the metabolites is covered by the SGV and the risk assessment derived and conducted for the parent.

Table 7: Lowest reliable and relevant soil effect data for pendimethalin transformation products M455H001 (P44, CL99900, Reg. No. 4108474) and M455H033 (P48, former M12, Reg. No. 4295966). Endpoints are shown as effect concentrations normalised to 3.4 % soil organic matter.

Species	Type of effect concentration	M455H001 (P44, CL99900, Reg. No. 4108474) concentration [mg/kg soil]	M455H033 (P48, former M12, Reg. No. 4295966) concentration [mg/kg soil]	References
Eisenia fetida (Earthworm)	EC10	16.3	5.07	Friedrich (2011a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.233

Species	Type of effect concentration	M455H001 (P44, CL99900, Reg. No. 4108474) concentration [mg/kg soil]	M455H033 (P48, former M12, Reg. No. 4295966) concentration [mg/kg soil]	References
				Friedrich (2013a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.235
Microorganisms	≤ 25 % effect	7.38	8.33	Schulz (2011a) cited in (EC 2021), Vol. 3CA B.9.5, p.240 and Schulz (2011b) cited in (EC 2021), Vol. 3CA B.9.7.1, p.244
				Schöbinger (2012a) cited in (EC 2021), Vol. 3CA B.9.5, p.237 and Schöbinger (2012b) cited in (EC 2021), Vol. 3CA B.9.7.1, p.242

6 Proposed SGV to protect soil organisms

Depending on the degree of uncertainty or the representativeness of the derivation method and/or the assessment factor used for the derivation of the SGV, the final SGV can be classified as preliminary or definitive. With the available data for pendimethalin, the assessment factor and the species sensitivity distribution method could also be applied for deriving an SGV. For the assessment factor method an AF of 10, for the SSD method an AF of 4 is considered suitable and adequate. As the SSD method is statistically more robust, the SGV_{SSD} is proposed for further use.

Altogether a definitive **SGV of 0.017 mg a.s./kg soil for pendimethalin** is suggested.

7 Protection of soil organisms and uncertainty analysis

The SGV_{SSD} of 0.017 mg a.s./kg soil for pendimethalin has been derived based on a dataset containing values for various plant species showing the highest sensitivity. Data on decomposers (litter transformers/primary consumers), i.e. on earthworms (*Eisenia fetida*) and collembolans (*Folsomia candida*) had to be removed from the statistics run for the species sensitivity distribution as they showed much lower sensitivity to pendimethalin and their inclusion resulted in a non-normal distribution of the dataset.

Pendimethalin is a herbicide, thus according to its mode of action, it is expected that (non-target) plants would be the most sensitive taxonomic group. While data on non-crop species might indicate higher sensitivity than crop species usually used in regulatory studies (Boutin *et al.* 2004, Dear *et al.* 2006), the scope of this dossier focusses on in-field effects and as such the test results on non-target crop species are considered sufficiently protective.

There are 14 effect concentrations for 12 plant species (4 monocots and 8 dicots) with tomato and paprika being the most sensitive ones (NOEC of 0.0575 and 0.140 mg a.s./kg soil, respectively), resulting in 9 equal-to values (including two geomeans) and 3 greater-than values. The calculated HC5 of 0.0664 mg a.s./kg and the derived SGV_{SSD} of 0.017 mg a.s./kg are thus considered protective for the most sensitive tested species and covers the uncertainty of other crop plant species being similarly or even more sensitive.

Although the official endpoints for regulatory microorganism studies following the OECD 216 and 217 guidelines are the ≤ 25 % effects, the study results for pendimethalin indicated ≤ 10 % effects on nitrate and carbon transformation after 28 days, and as such, based on their effect sizes, they are considered and treated similarly to NOEC/EC10 values. This means that the data requirement for chronic results on decomposers (nutrient transformers) can be considered fulfilled.

The transformation products M455H001 and M455H033 exhibit similar toxicity to earthworms and microorganisms as the active substance. As these are not the most sensitive groups of organisms, the protectiveness of the SGV for the active substance pendimethalin over the metabolites needs further consideration – however that is beyond the scope of this dossier.

According to the current analytical methods described in Section 2, the concentration range around the proposed SGV is possible to be detected and quantified during the Swiss national soil monitoring (SGV of 0.017 mg a.s./kg soil vs MLOQ of 0.0005 mg a.s./kg soil). Therefore, no analytical issues are foreseen for the use of the derived SGV.

8 References

Acosta-Dacal, A., Rial-Berriel, C., Díaz-Díaz, R., Bernal-Suárez, M.d.M. and Luzardo, O.P. (2021) Optimization and validation of a QuEChERS-based method for the simultaneous environmental monitoring of 218 pesticide residues in clay loam soil. Science of The Total Environment 753, 142015. https://doi.org/10.1016/j.scitotenv.2020.142015

Anderson, R.H., Prues, A.G. and Kravitz, M.J. (2010) Determination of the biologically relevant sampling depth for terrestrial ecological risk assessments. Geoderma 154(3), 336-339. https://doi.org/10.1016/j.geoderma.2009.11.004

Azimonti, G., Galimberti, F., Marchetto, F., Menaballi, L., Ullucci, S., Pellicioli, F., Alessandra, C., Lidia, C., Alessio, I., Angelo, M., Boer, W.d. and Voet, H.v.d. (2015a) Comparison of NOEC values to EC10/EC20 values, including confidence intervals, in aquatic and terrestrial ecotoxicological risk assessment. EFSA Supporting Publications 12(12), EN-906. https://doi.org/10.2903/sp.efsa.2015.EN-906

Azimonti, G., Galimberti, F., Marchetto, F., Menaballi, L., Ullucci, S., Pellicioli, F., Alessandra, C., Lidia, C., Alessio, I., Angelo, M., Boer, W.d. and Voet, H.v.d. (2015b) Comparison of NOEC values to EC10/EC20 values, including confidence intervals, in aquatic and terrestrial ecotoxicological risk assessment. EFSA Supporting Publications 12(12), EN-906. https://doi.org/10.2903/sp.efsa.2015.EN-906

Barman, S. and Das, A.C. (2015) Residual effect of pre-emergence herbicides on microbial activities in relation to mineralization of C, N and P in the Gangetic alluvial soil of West Bengal, India. Environmental Monitoring and Assessment 187(7), 465. https://doi.org/10.1007/s10661-015-4698-9

BASF (2021) Dossier for the renewal of the active substance Pendimethalin (BAS 455 48 H), BASF Agro B.V. Arnhem (NL) Freienbach Branch. https://pub-efsa.echa.europa.eu/iuclid6-web/dossier/6e23c33a-f00f-40f3-8dcb-da009b74e3fd/(main-content:content/iuclid6:%2F6e23c33a-f00f-40f3-8dcb-da009b74e3fd%2Fheader/)?node=6e23c33a-f00f-40f3-8dcb-da009b74e3fd

Belden, J.B., Phillips, T.A., Clark, B.W. and Coats, J.R. (2005) Toxicity of pendimethalin to nontarget soil organisms. Bull Environ Contam Toxicol 74(4), 769-776. https://doi.org/10.1007/s00128-005-0648-5

BLV (2022) Bundesamt für Lebensmittelsicherheit und Veterinärwesen – Pflanzenschutzmittelverzeichnis, Wirkstoff: pendimethalin, https://www.psm.admin.ch/de/wirkstoffe/287

Boutin, C., Elmegaard, N. and Kjær, C. (2004) Toxicity Testing of Fifteen Non-Crop Plant Species with Six Herbicides in a Greenhouse Experiment: Implications for Risk Assessment. Ecotoxicology 13(4), 349-369. https://doi.org/10.1023/B:ECTX.0000033092.82507.f3

Casado-Martinez, M., Dell'Ambrogio, G., Campiche, S., Kroll, A., Lauber, E., Marti-Roura, M., Mendez-Fernandez, L., Renaud, M., Tierbach, A., Wildi, M., Wong, J.W.Y., Werner, I., Junghans, M. and Ferrari, B.J.D. (2024) Incorporation of sediment- and soil-specific aspects in the Criteria for Reporting and Evaluating Ecotoxicity Data (CRED). Integr Environ Assess Manag https://doi.org/10.1002/ieam.4948

Crane, M., Dungey, S., Lillicrap, A., Thompson, H., Weltje, L., Wheeler, J.R. and Lagadic, L. (2022) Commentary: Assessing the endocrine disrupting effects of chemicals on invertebrates in the European Union. Environmental Sciences Europe 34, 36. https://doi.org/10.1186/s12302-022-00613-3

Das, A.C., Nayek, H. and Nongthombam, S.D. (2012) Effect of pendimethalin and quizalofop on N2-fixing bacteria in relation to availability of nitrogen in a Typic Haplustept soil of West Bengal, India. Environ Monit Assess 184(4), 1985-1989. https://doi.org/10.1007/s10661-011-2093-8

Das, A.C. and Dey, S. (2013) Effect of systemic herbicides on microbial biomass in relation to availability of some plant nutrients in an alluvial soil of West Bengal. Bull Environ Contam Toxicol 90(6), 666-672. https://doi.org/10.1007/s00128-013-0994-7

Dear, B.S., Sandral, G.A. and Wilson, B.C.D. (2006) Tolerance of perennial pasture grass seedlings to pre- and post-emergent grass herbicides. Australian Journal of Experimental Agriculture 46(5), 637-644. https://doi.org/10.1071/EA04173

EC (2002) Draft Guidance Document on Terrestrial Ecotoxicology Under Council Directive 91/414/EEC. SANCO/10329/2002 rev 2 final, 17 October 2002. https://food.ec.europa.eu/system/files/2016-10/pesticides_ppp_app-proc_guide_ecotox_terrestrial.pdf.

EC (2003) Review report for the active substance pendimethalin. Finalised in the Standing Committee on the Food Chain and Animal Health at its meeting on 13 November 2002 in view of the inclusion of pendimethalin in Annex I of Directive 91/414/EEC. Brussels, Belgium. European Commission, Health & Consumer Protection Directorate-General. Directorate E – Food Safety: plant health, animal health and welfare, international questions. E1 - Plant health. 7477/VI/98-final, 13 January 2003. https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/backend/api/active_substance/download/215

EC (2008) Pesticides in air: Considerations for exposure asssessment. Report prepared by the FOCUS Working Group on pesticides in air (FOCUS Air Group). . European Commission, Health & Consumer Protection Directorate-General, Directorate E - Food Safety: plant health, animal health and welfare, international questions, E1 - Plant health. SANCO/10553/2006 Rev 2 June 2008. https://esdac.jrc.ec.europa.eu/public_path/projects_data/focus/air/docs/FOCUS_AIR_GROUP_REPORT-FINAL.pdf

EC (2011) Consolidated text (09.09.2024): 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. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02011R0540-20240901.

EC (2015) Draft Assessment Report and Proposed decision of the Netherlands prepared in the context of the possible renewal of the approval of pendimethalin under Regulation (EC) 1107/2009. Rapporteur Member State (RMS): The Netherlands; Co-RMS: Spain. https://open.efsa.europa.eu/questions/EFSA-Q-2014-00744?search=pendimethalin

EC (2016) European Commission, Screening of available evidence on chemical substances for the identification of endocrine disruptors according to different options in the context of an Impact Assessment, final report, Directorate-General for Health and Food Safety Directorate E — Food and feed safety, innovation Unit E4 — Pesticides and biocides, B-1049 Brussels, ISBN 978-92-79-59005-4, doi: 10.2875/328498, EW-02-16-567-EN-N. https://health.ec.europa.eu/system/files/2016-11/2016_impact_assessment_study_en_0.pdf

EC (2017) Commission implementing regulation (EU) 2017/1114 of 22 June 2017 renewing the approval of the active substance pendimethalin, as a candidate for substitution, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market, and amending the Annex to Commission Implementing Regulation (EU) No 540/2011 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R1114

EC (2019) Draft Renewal Assessment Report (DRAR) prepared according to the Commission Regulation (EU) No. 1107/2009 by the rapporteur Member State Spain for the existing active substance difenoconazole. https://www.efsa.europa.eu/sites/default/files/consultation/consultation/Difenoconazole.zip.

EC (2021) Draft Assessment Report and Proposed decision of the Netherlands prepared in the context of the possible renewal of the approval of pendimethalin under Regulation (EC) 1107/2009. Rapporteur Member State (RMS): The Netherlands; Co-RMS: Spain [updated after the evaluation of confirmatory data]. https://open.efsa.europa.eu/questions/EFSA-Q-2021-00631?search=pendimethalin

EC TGD (2003) Technical Guidance Document on Risk Assessment (Part II). European Commission. Joint Research Centre. EUR 20418 EN/2. https://op.europa.eu/s/y4d4.

ECHA (2017) European Chemical Agency - Guidance on Biocidal Products Regulation: Volume IV Environment - Assessment and Evaluation (Parts B+C). ECHA-17-G-23-EN; Cat. Number: ED-01-17-897-EN-N; ISBN: 978-92-9020-151-9. https://doi.org/10.2823/033935

ECHA (2019) CLH Report for Pendimethalin, Proposal for Harmonised Classification and Labelling Based on Regulation (EC) No 1272/2008 (CLP Regulation), Annex VI, Part 2 International Chemical Identification: Pendimethalin (ISO) N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine, RIVM, Bureau REACH PO Box 1, 3720 BA Bilthoven. The Netherlands. https://echa.europa.eu/documents/10162/ac5586c0-7c57-cfee-2c75-0c56603b5526

ECHA (2024a) Substance Infocard, pendimethalin (ISO); N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidene, European Chemicals Agency https://echa.europa.eu/substance-information/-/substanceinfo/100.049.927

ECHA (2024b) Substance infocard, 1,2-dichloroethane (ISO), European Chemicals Agency https://echa.europa.eu/substance-information/-/substanceinfo/100.003.145

ECHA (2024c) Substance Infocard, N-nitroso-(1-ethylpropyl)-2,6-dinitro-3,4-xylidene, European Chemicals Agency https://echa.europa.eu/substance-information/-/substanceinfo/100.261.751

EFSA (2016) Conclusion on the peer review of the pesticide risk assessment of the active substance pendimethalin. EFSA Journal 2016;14(3):4420, 212 pp. https://doi.org/10.2903/j.efsa.2016.4420

EFSA (2019) Technical report on the Outcome of the Pesticides Peer Review Meeting on general recurring issues in ecotoxicology. EFSA supporting publication 16(7), EN-1673. https://doi.org/10.2903/sp.efsa.2019.EN-1673

EFSA (2021) Outcome of the consultation with Member States, the applicant and EFSA on the pesticide risk assessment for pendimethalin in light of confirmatory data. EFSA Technical Report, 2021:EN-6944. https://doi.org/10.2903/sp.efsa.2021.EN-6944

EPO (2022) (European Patent Office) EP3405031B1 - An improved herbicidal formulation (ZC formulations comprising pendimethalin). International application number: PCT/IB2016/050294. EP Bulletin 23 https://data.epo.org/publication-server/rest/v1.0/publication-dates/20220608/patents/EP3405031NWB1/document.pdf

Filimon, M.N., Voia, S.O., Vladoiu, D.L., Isvoran, A. and Ostafe, A. (2015) Temperature dependent effect of difenoconazole on enzymatic activity from soil. J. Serb. Chem. Soc. 80(9), 1127-1137. http://dx.doi.org/10.2298/JSC141218030F

FOCUS (1997) Soil persistence models and EU registration. The final report of the work of the Soil Modelling Work group of FOCUS (FOrum for the Co-ordination of pesticide fate models and their Use). 77 pp. https://food.ec.europa.eu/system/files/2016-10/pesticides_ppp_app-proc_guide_fate_soil-persistance-1997.pdf.

Haque, A., Das Gupta, R. and Chakravorty, P.P. (2011) Effect of two herbicides on Xenylla welchi (Hexapoda: Collembola) under laboratory conditions. Bull Environ Contam Toxicol 86, 583-586. https://doi.org/10.1007/s00128-011-0277-0

IARC (2024) IARC Monographs on the identification of carcinogenic hazards to humans, International Agency for Research on Cancer, World Health Organization. https://monographs.iarc.who.int/list-of-classifications

ISO (2014) Soil quality - Effects of pollutants on earthworms - Part 3: Guidance on the determination of effects in field situations. ISO 11268-3:2014 https://www.iso.org/standard/57583.html

Klimisch, H.J., Andreae, M. and Tillmann, U. (1997) A Systematic Approach for Evaluating the Quality of Experimental Toxicological and Ecotoxicological Data. Regulatory Toxicology and Pharmacology 25, 1-5. https://doi.org/10.1006/rtph.1996.1076

Kočárek, M., Artikov, H., Voříšek, K. and Borůvka, L. (2016) Pendimethalin degradation in soil and its interaction with soil microorganisms. Soil & Water Res. 11(4), 213-219. https://doi.org/10.17221/226/2015-SWR

Lewis, K.A., Tzilivakis, J., Warner, D. and Green, A. (2016) An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment 22(4), 1050-1064. https://doi.org/10.1080/10807039.2015.1133242

Martens, D.A. and Bremner, J.M. (1993) Influence of herbicides on transformations of urea nitrogen in soil. Journal of Environmental Science and Health, Part B 28(4), 377-395. https://doi.org/10.1080/03601239309372831

Marti-Roura, M., Dell'Ambrogio, G., Campiche, S., Wong, J., Junghans, M., Renaud, M. and Ferrari, B.J.D. (2023) Methodology proposal for the derivation of Soil Guideline Values for Plant Protection Product residues. Part 2 - Recommendations for the derivation of Soil Guideline Values. Swiss Centre for Applied Ecotoxicology, Dübendorf and Lausanne, Switzerland. https://www.oekotoxzentrum.ch/media/czdbwdbi/2023_consoil_sgv_report_part_2.pdf.

Meuli, R.G., Schwab, P., Wächter, D. and Ammann, S. (2014) Nationale Bodenbeobachtung (NABO) 1985-2004. Zustand und Veränderung der anorganischen Schadstoffe und Bodenbegleitparameter. Bundesamt für Umwelt, Bern. Umwelt-Wissen Nr. 1409: 94 S. http://www.bafu.admin.ch/uz-1507-d.

Mie, A. and Rudén, C. (2023) Non-disclosure of developmental neurotoxicity studies obstructs the safety assessment of pesticides in the European Union. Environmental Health 22(1), 44. https://doi.org/10.1186/s12940-023-00994-9

Moermond, C.T.A., Kase, R., Korkaric, M. and Ågerstrand, M. (2016) CRED: Criteria for reporting and evaluating ecotoxicity data. Environmental Toxicology and Chemistry 35(5), 1297-1309. https://doi.org/10.1002/etc.3259

Muñoz-Leoz, B., Garbisu, C., Charcosset, J.Y., Sánchez-Pérez, J.M., Antigüedad, I. and Ruiz-Romera, E. (2013) Non-target effects of three formulated pesticides on microbially-mediated processes in a clay-loam soil. Sci Total Environ 449, 345-354. https://doi.org/10.1016/j.scitotenv.2013.01.079

NEPC (2011) Schedule B5b - Guideline on Methodology to Derive Ecological Investigation Levels in Contaminated Soils. National Environment Protection Council, National Environment Protection (Assessment of Site Contamination) Measure. Australia, April 2011. https://www.nepc.gov.au/sites/default/files/2022-09/schedule-b5b-guideline-methodology-derive-eils-sep10.pdf.

OECD (2018) Revised Guidance Document 150 on standardised Test Guidelines for Evaluating Chemicals for Endocrine Disruption, OECD Series on Testing and Assessment, OECD Publishing, Paris. . https://doi.org/10.1787/9789264304741-en

Peijnenburg, W.J.G.M. (2020) Implementation of bioavailability in prospective and retrospective risk assessment of chemicals in soils and sediments. in Ortega-Calvo, J. J. and Parsons, J. R. (eds.), Bioavailability of organic chemicals in soil and sediment, Hdb Env Chem (2020) 100: 391-422, Springer Nature Switzerland AG 2020, Published online: 30 April 2020. https://doi.org/10.1007/698_2020_516

Polcher, A., Schlechtriem, C. and Hahn, S. (2023) Review of the OECD Test Guidelines relevant to environmental assessment with regard to the state of the art in science and technology. Texte 72/2023, Report No. FB001033 ENG, German Environment Agency. https://www.umweltbundesamt.de/sites/default/files/medien/11740/publikationen/2023-05-24_texte_72-2023_oecd_test-guidelines_0.pdf.

PSMV (2010) SR 916.161, Verordnung vom 12. Mai 2010 über das Inverkehrbringen von Pflanzenschutzmitteln (Pflanzenschutzmittelverordnung, PSMV) https://www.fedlex.admin.ch/eli/cc/2010/340/de.

RIVM (2007) Guidance for the derivation of environmental risk limits within the framework of 'International and national environmental quality standards for substances in the Netherlands' (INS). Authors: P.L.A. van Vlaardingen and E.M.J. Verbruggen, National Institute for Public Health and the Environment. Bilthoven, The Netherlands. RIVM report 601782001/2007. https://www.rivm.nl/bibliotheek/rapporten/601782001.pdf.

Rösch, A., Wettstein, F.E., Wächter, D., Reininger, V., Meuli, R.G. and Bucheli, T.D. (2023) A multi-residue method for trace analysis of pesticides in soils with special emphasis on rigorous quality control. Analytical and Bioanalytical Chemistry 415(24), 6009-6025. https://doi.org/10.1007/s00216-023-04872-8

Siqueira, J.O., Safir, G.R. and Nair, M.G. (1991) VA-mycorrhizae and mycorrhiza stimulating isoflavonoid compounds reduce plant herbicide injury. Plant and Soil 134(2), 233-242. https://doi.org/10.1007/bf00012041

Strandberg, M. and Scott-Fordsmand, J.J. (2004) Effects of pendimethalin at lower trophic levels — a review. Ecotoxicology and Environmental Safety 57(2), 190-201. https://doi.org/10.1016/j.ecoenv.2003.07.010

Toschki, A., Hammers-Wirtz, M., Possberg, C., Ross-Nickoll, M., Schäffer, A., Schmidt, B., Scholz Starke, B., Römbke, J., Scheffzyk, A., Klein, M. and Hommen, D. (2020) Evaluation of the risk for soil organisms under real conditions. Development of a national position for amending downstream legislations of the new EU Plant Protection Products Regulation. Texte 201/2020, Report No. EF001129-ENG, German Environment Agency.

https://www.umweltbundesamt.de/en/publikationen/evaluation-of-the-risk-for-soil-organisms-under.

UBA (2024) ETOX - Information System, Ecotoxicology and Environmental Quality Targets. Federal Environment Agency (Umweltbundesamt), Dessau-Roßlau, Germany. http://webetox.uba.de/webETOX/index.do.

US EPA (2017a) Pendimethalin - Draft Human Health Risk Assessment to Support Registration Review. DP No. 433641, Office of Chemical Safety and Pollution Prevention, Washington D.c. 20460. https://www.regulations.gov/document/EPA-HQ-OPP-2012-0219-0022

US EPA (2017b) Pendimethalin – Transmittal of the Preliminary Environmental Fate and Ecological Risk Assessment for Registration Review, United States Environmental Protection Agency, Office of chemical safety and pollution prevention, Memorandum, PC Code: 108501, DP Barcode: 438210, Washington D.C., 20460. https://www.regulations.gov/document/EPA-HQ-OPP-2012-0219-0020

US EPA (2023a) United States Environmental Protection Agency, Toxics Release Inventory (TRI) Program, Persistent Bioaccumulative Toxic (PBT) Chemicals Covered by the TRI Program, https://www.epa.gov/toxics-release-inventory-tri-program/persistent-bioaccumulative-toxic-pbt-chemicals-covered-tri (acessed 06.12.2023)

US EPA (2023b) United States Environmental Protection Agency, Endocrine Disruptor Screening Program (EDSP) Estrogen Receptor Bioactivity, https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-edsp-estrogen-receptor-bioactivity (accessed 09.01.2023).

US EPA (2024) ECOTOXicology Knowledgebase - curated toxicity data. US Environmetal Protection Agency. https://cfpub.epa.gov/ecotox/.

US EPA (no date-a) United States Environmental Protection Agency, Appendix F, Pendimethalin, Summary of submitted EcoToxicity Studies. https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/2012/pendimethalin/appendix-f.pdf

US EPA (no date-b) United States Environmental Protection Agency, Memorandum - EFED Science Chapter for Pendimethalin (Case # 0817). . https://www3.epa.gov/pesticides/endanger/litstatus/effects/pendimeth/attach-e.pdf

Vighi, M., Matthies, M. and Solomon, K.R. (2017) Critical assessment of pendimethalin in terms of persistence, bioaccumulation, toxicity, and potential for long-range transport. Journal of Toxicology and Environmental Health, Part B 20(1), 1-21. https://doi.org/10.1080/10937404.2016.1222320

Appendix 1 Considerations for the evaluation of the studies

General considerations

- ***Effects on target species*** (pests) against which the active substance can be used are not considered (they are not included in any of the data tables in the SGV dossier).
- ***Efficacy studies on terrestrial plants*** with the aim to evaluate the effectiveness of the chemical compound on target species (pests) are not considered for the evaluation (they are not included in any of the data tables). The potential increase of the plant health due to a reduction of the pest is unrelated to the ecotoxicological effects of the substance.
- Only the effects of the substance *via* ***soil exposure*** is considered relevant. Effects resulting from using sand or other material instead of soil, or from direct overspraying of the test organism instead of exposure through soil, are *not* considered *relevant* (**C3**).
- For ***seedling emergence tests*** following the standard OECD 208 guideline, the use of pots of 15 cm in diameter is recommended and followed by many of the contract labs. A 15-cm pot usually has a depth of approx. 13-14 cm and – based on photos of the test in contract labs (e.g. Ibacon, Eurofins etc.) – they usually fill it up to the lower end of the brim, i.e. approx. to 10-11-12 cm. In other studies it was specified that they used 11 cm diameter and 10 cm depth pots (see e.g. Anonymous (2016) cited in (BASF 2021). Therefore the use of an average soil depth of 10 cm for converting the applied rate of the test item to a concentration in the soil is considered reasonable and pragmatic. This is based on the guideline recommendation in conjunction with available information in standard regulatory study reports, information available on the methods used by contract laboratories as well as personal communication with experts conducting such studies. While the soil depth can slightly vary depending on the plant species/test facility, ten centimeters soil depth is considered as a reasonable average, which also allows comparability of the terrestrial plant results with other studies, where either the test item is mixed into the soil (most laboratory studies) or the upper 10 cm layer is sampled for analytical measurements (see e.g. field earthworm studies). If specific information is available for a certain study, the concentrations are calculated accordingly.

  It is noted that the behaviour of the test substances can vary and can result in different distributions in the soil in case of over-spraying. However, choosing and considering a certain soil depth is a pragmatic approach and a pragmatic solution that is already applied for the authorisation/registration of pesticides (but with different depths, i.e. 5 cm for permanent crops and 20 cm for crops where ploughing in the season takes place, even if the substance is actually not mixed into the soil after application, see e.g. FOCUS (1997) and EC (2002)) as well as of biocides (ECHA 2017).
- Reproductive endpoints are considered the most relevant endpoints as they are good indicators of the sustainability of the population in the long-term. Other endpoints affecting survival and growth (biomass) of individuals are also accepted, since they were traditionally measured endpoints frequently extrapolated to represent the impact at the population level. If multiple comparable toxicity values for the same species and the same measured effect with the same duration are available, the ***geometric mean of the effect*** values is calculated.
- Following a critical consideration (Azimonti *et al.* 2015a, EFSA 2019), the statistically more robust endpoint of ***EC10 vs NOEC*** is chosen. If both endpoints seem to be equally robust (e.g. details of statistical methods and results are reported; clear dose-response; descriptive statistics; NOEC: also statistically significant LOEC is reported; EC10: width/lower/higher limits of confidence intervals for EC10/20/50; steepness of curve etc. are available), then EC10 is preferred due to the general inherent uncertainties a NOEC is surrounded by (Azimonti *et al.* 2015b). When no or not statistically robust EC10median is available, the statistically robust NOEC is preferred. It is noted that statistically non-robust

(but "biologically significant") NOEC values are often preferred during the EU pesticide authorisation/renewal processes, to provide long-term endpoints with not higher than 10 % effects. However, such endpoints do not account for the variability of data in soil studies (where coefficient of variation in the control is accepted up to 15, 30 or 50 %). The uncertainty in a NOEC value with higher level of effects may need to be highlighted and discussed. In the absence of a statistically robust endpoint, the study results are considered *not reliable* (**R3**) or *not assignable* (**R4**) depending on the actual flaws.

- ***Regulatory studies and their endpoints*** (e.g. EFSA, US EPA) are either accepted without additional assessment (at face value) or partially re-considered if needed to set the endpoints in line with our criteria as summarised here and detailed above (Moermond *et al.* 2016, Marti-Roura *et al.* 2023). This is the case, for example, when organisms are not exposed through soil (e.g. plant vegetative vigour tests *via* foliar application); normalisation to a standard organic matter content is not possible due to lack of data; not the statistically most robust effect concentration is proposed/agreed upon as an endpoint etc. A full re-assessment may also be carried out for regulatory studies, where the study summary is not sufficiently detailed and we can get access to the original study report.
- Study ***endpoints from authorisation reports*** (e.g. EFSA, US EPA) are subjected to the same scrutiny as open literature data. These include but are not limited to careful consideration of the study design (e.g. number of replicates and test concentrations), the way the tests were conducted (e.g. environmental conditions, observations), their results (e.g. performance of control, validity criteria, dose-response, deviation) as well as the statistical analysis (e.g. methods and reported details). Authorisation reports are accepted at face value and used in the risk assessment if they meet the criteria of reliability and relevance as detailed above (Moermond *et al.* 2016, Marti-Roura *et al.* 2023, Casado-Martinez *et al.* 2024). If they have flaws in terms of reliability and relevance or other requirements as detailed here and in the above cited documents (e.g. validity criteria of the study were not met; no statistically robust EC10median could be derived; endpoint could not be standardised due to lacking information on OM/OC content of the test soil etc.), the regulatory endpoints are listed at face value and not considered further but not used in deriving an SGV.
- In general, ***biomarker studies*** are not included in the tables since they are based on endpoints, whose relationship to effects at population level is uncertain. However, some exo-enzymes produced by soil microorganisms can be used as biomarkers of soil fertility and are important in the ecological functioning of the soil (e.g. Filimon *et al.* 2015, NEPC 2011, RIVM 2007). For this reason, if they occur, microbial-mediated enzymatic activities are included in the assessment as "*relevant with restrictions*" (**C2**).
- The relationship between ***microbial biodiversity and function*** is quite complex. Although it cannot be denied that loss of microbial diversity can have an impact on function, the role of biodiversity in supporting microbial functions needs a better understanding (EFSA 2019). For this reason, in this report, microbial endpoints directly involved in soil functions are preferred over microbial diversity endpoints.
- For ***nitrogen transformation tests*** that follow the OECD 216 guideline the nitrification rate calculated for the 0-28 day interval (or longer if the study needed to be prolonged) is considered based on the latest discussion and information provided in an UBA report (Polcher *et al.* 2023).
- ***Recovery of effects*** – that can be seen e.g. in earthworm field studies – is not considered acceptable within the scope of SGV that is used in relation to long-term pesticide residues, not immediate effects after pesticide application.
- Long-term endpoints from ***field studies*** are considered as supportive information unless there is analytical verification. A robust effect concentration can only be derived when it is

confirmed by analytical verification and it should be within approximately a month of the assessment of the effect endpoint to ensure its reliability with regard to any potential loss of the test substance through degradation/dissipation and as a result to underestimate the risk. In order to derive effect concentration(s) for the whole duration of a field study, the test substance concentration should be monitored regularly until the end of the study. When the test substance concentrations are measured only at the beginning of the study, the derivation of an approx. one-month endpoint is considered reliable enough for a quantitative use (see e.g. field earthworm studies). As the actual degradation/dissipation of a pesticide can be affected by a mixture of various biotic and abiotic factors, without measured residues in the test site it is not possible to calculate a meaningful (time-weighted average) concentration in the soil and derive a robust endpoint (see e.g. concentration-dependent dissipation of pesticides in Muñoz-Leoz *et al.* (2013), but also the wide range of DissT50 values for pendimethalin in Section 1.5.2 above (EC 2019)). It is noted that, for instance, according to the often used field earthworm study guideline (ISO 2014) 50 % deviation from the nominal concentration is acceptable. However, as we compare the derived effect concentrations – and in turn the derived SGV – directly to the measured environmental concentrations, it is more reasonable to base the effect values on the measured amount of test substance present in the soil during the study. Altogether it is considered a pragmatic approach to use the analytical verification results for the upper 10-cm soil layer. It is noted that the sampled upper 10-cm soil layer does not cover the whole depth where earthworms can occur. However, a) while it is not ideal, it is usually the only analytical information available (see e.g. the respective requirement in ISO (2014)); b) depending on the ecological group (i.e. epigeic, endogeic or anecic species) the exposure of earthworms to pesticides can highly vary anyway. In a pilot study it was shown that even anecic species living usually in deep burrows can be affected by pesticide treatments due to their feeding and mating habits, i.e. gathering food and mating on the contaminated soil surface (Toschki *et al.* 2020). The abundance, diversity and activity of soil biota are in general the highest in the top soil layer (Toschki *et al.* 2020, Anderson *et al.* 2010).

Soil organic matter content

- When only ***total organic carbon*** is reported in a study, the total organic carbon value is transformed to organic matter by using a factor of 1:1.7.
- If only a ***percentage of sphagnum peat*** is reported in laboratory studies with artificial soil, the soil organic matter content is estimated assuming that the only source of organic matter in the soil comes from the sphagnum peat and that the organic matter content of the sphagnum peat is approximately 100 %.
- If ***no organic carbon/matter content*** is reported, the study endpoint cannot be normalised and thus is not suitable for further use. As a result the study is scored as *not assignable: Information needed to make an assessment of the study is missing* (**R4**; Moermond *et al.* 2016, Casado-Martinez *et al.* 2024).

For the adapted criteria – that were mainly based on the European technical guidance document (EC TGD 2003) – and further details on the parameters and methods that are used for the SGV derivation, please refer to Marti-Roura *et al.* (2023). The criteria beyond these resources will be included in an updated methodological report.

Appendix 2 Data on the active substance

Table A1: Soil effect data for pendimethalin from laboratory experiments. The lowest reliable and relevant effect data per species and effects per test setup are shown in bold (with the exception of non-target plants; for the reshuffled plant data per species per effect, please refer to Table 5 in the main part). Unreliable, not relevant and not assignable data are greyed out. Calculated data are rounded to three significant figures. Abbreviations: n.r. – not reported; n.a. – not applicable; cc. – concentration; MWHC – maximum water holding capacity; OC – organic carbon; OM – organic matter; CFU – colony forming units. Data were evaluated for reliability and relevance according to the modified CRED criteria (see R/C scores) or taken at face value from regulatory dossiers (Assessment score 1-3). For notes, please refer to the end of Appendix 2 (Notes A1).

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
***Eisenia fetida* (Earthworm)**	**Pendimethalin (a.s.)**	**adult mortality**	**14 d**	**LC50**	**> 933**	**5**	**> 634**	**Artificial soil: 5 % peat, pH 5.6-6.2, 57-58 % MWHC**	**A, F**	**1**	**Friedrich (2010b) cited in (EC 2021), Vol. 3CA B.9.4.1.1, p.230**
***Eisenia fetida* (Earthworm)**	**Pendimethalin (a.s.)**	**adult biomass change**	**14 d**	**NOEC**	**117**	**5**	**79.6**	**Artificial soil: 5 % peat, pH 5.6-6.2, 57-58 % MWHC**	**A, F**	**1**	**Friedrich (2010b) cited in (EC 2021), Vol. 3CA B.9.4.1.1, p.230**
***Eisenia fetida* (Earthworm)**	**BAS 455 48 H (455 g a.s./L nominal, 449 g a.s./L measured)**	**adult mortality**	**14 d**	**NOEC**	**190**	**5**	**129**	**Artificial soil: 5 % sphagnum peat, 20 % kaolin clay, 75 % industrial sand, 0.12 % $CaCO_3$, pH 6.1-6.8, MWHC 56-59 %**	**B**	**R1/C1**	**Vértesi (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.1, p.152; Anonymous (2008) cited in (BASF 2021), BASF DocID 2008/1035606**
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L **nominal, 449 g a.s./L measured**)	adult mortality	14 d	LC50	639	5	435	Artificial soil: 5 % sphagnum peat, 20 % kaolin clay, 75 % industrial sand, 0.12 % $CaCO_3$, pH 6.1-6.8, MWHC 56-59 %	B	R1/C1	Vértesi (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.1, p.152; Anonymous (2008) cited in (BASF 2021), BASF DocID 2008/1035606
***Eisenia fetida* (Earthworm)**	**BAS 455 48 H (455 g a.s./L nominal, 449 g a.s./L measured)**	**adult biomass change**	**14 d**	**NOEC**	**381**	**5**	**259**	**Artificial soil: 5 % sphagnum peat, 20 % kaolin clay, 75 % industrial sand, 0.12 % $CaCO_3$, pH 6.1-6.8, MWHC 56-59 %**	**B**	**R2/C1**	**Vértesi (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.1, p.152; Anonymous (2008) cited in (BASF 2021), BASF DocID 2008/1035606**

5 ^{M} – monocotyledonous, ^{D} – dicotyledonous plant species
6 ^{DE} – diversity endpoint, ^{EE} – enzymatic endpoint, ^{FE} – functional endpoint, d.w. – dry weight, p.h. – plant height

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida (Earthworm)	Pendimethalin (a.s.)	reproduction	56 d	NOEC	33.45	10	11.4	n.r.	C	R4/C1	Nienstedt *et al.* (2000) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.232
Eisenia fetida (Earthworm)	Pendimethalin (a.s.)	reproduction	56 d	EC10	49.0	10	16.7	n.r.	C	R4/C1	Nienstedt *et al.* (2000) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.232
Eisenia fetida (Earthworm)	Pendimethalin (a.s.)	adult mortality	28 d	NOEC	≥ 53.55	10	≥ 18.21	n.r.	C	R4/C2	Nienstedt *et al.* (2000) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.232
Eisenia fetida (Earthworm)	Pendimethalin (a.s.)	adult biomass change	28 d	NOEC	6.69	10	2.27	n.r.	C	R4/C2	Nienstedt *et al.* (2000) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.232
***Eisenia fetida* (Earthworm)**	**Stomp 400 SC (400 g a.s./L)**	**reproduction**	**56 d**	**NOEC**	**16.0**	**10**	**5.44**	**Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH 5.9-6.3, approx. 60 % MWHC**	**D**	**R2/C2**	**Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154; Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681**
Eisenia fetida (Earthworm)	Stomp 400 SC (400 g a.s./L)	reproduction	56 d	EC10	11.1	10	3.77	Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH 5.9-6.3, approx. 60 % MWHC	D	R3/C2	Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154; Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681
***Eisenia fetida* (Earthworm)**	**Stomp 400 SC (400 g a.s./L)**	**adult mortality**	**28 d**	**NOEC**	**≥ 80.0**	**10**	**≥ 27.2**	**Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH 5.9-6.3, approx. 60 % MWHC**	**D**	**R2/C2**	**Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154, Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681**
***Eisenia fetida* (Earthworm)**	**Stomp 400 SC (400 g a.s./L)**	**adult biomass change**	**28 d**	**NOEC**	**≥ 80.0**	**10**	**≥ 27.2**	**Artificial soil: 10 % sphagnum peat, 20 % kaolinite, 1 % $CaCO_3$, 69 % quartz sand, pH 5.9, approx. 60 % MWHC**	**D**	**R2/C2**	**Krieg (2001) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.1.2, p.154, Anonymous (2001) cited in (BASF 2021), BASF DocID 2001/1007681**

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida (Earthworm)	FSG 01100 H (Pendimethalin 400 SC, 400 g a.s./L)	adult mortality	28 d	NOEC	≥ 92.4	5	≥ 62.8	Artificial soil: 5 % peat, pH 6.0-6.2, 58-59 % MWHC	E, F	1	Friedrich (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.7.1.2, p.120
Eisenia fetida (Earthworm)	FSG 01100 H (Pendimethalin 400 SC, 400 g a.s./L)	adult biomass change	28 d	NOEC	≥ 92.4	5	≥ 62.8	Artificial soil: 5 % peat, pH 6.0-6.2, 58-59 % MWHC	E, F	1	Friedrich (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.7.1.2, p.120
Eisenia fetida (Earthworm)	FSG 01100 H (Pendimethalin 400 SC, 400 g a.s./L)	reproduction	56 d	NOEC	69.3	5	47.1	Artificial soil: 5 % peat, pH 6.0-6.2, 58-59 % MWHC	E, F	1	Friedrich (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.7.1.2, p.120
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 454.1 g a.s./L measured)	reproduction	56 d	NOEC	≥ 138 (≥ 358 mg product/kg soil)	10	≥ 46.9	Artificial soil: 10 % peat, pH 5.7-6.3, 60 % MWHC	L	R1/C1	Anonymous (2016) cited in (BASF 2021), BASF DocID 2016/1323860
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 454.1 g a.s./L measured)	adult mortality	28 d	NOEC	≥ 138 (≥ 358 mg product/kg soil)	10	≥ 46.9	Artificial soil: 10 % peat, pH 5.7-6.3, 60 % MWHC	L	R1/C1	Anonymous (2016) cited in (BASF 2021), BASF DocID 2016/1323860
Eisenia fetida (Earthworm)	BAS 455 48 H (455 g a.s./L nominal, 454.1 g a.s./L measured)	adult biomass change	28 d	NOEC	≥ 138 (≥ 358 mg product/kg soil)	10	≥ 46.9	Artificial soil: 10 % peat, pH 5.7-6.3, 60 % MWHC	L	R1/C1	Anonymous (2016) cited in (BASF 2021), BASF DocID 2016/1323860
Eisenia fetida (Earthworm)	Pendimethalin (98 % purity)	juvenile growth (weight gain)	21 d	NOEC	< 10	2.7	< 12.6	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R2/C2	Belden *et al.* (2005)
Eisenia fetida (Earthworm)	Pendimethalin (98 % purity)	juvenile growth (weight)	21 d	EC50	113	2.7	142	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C2	Belden *et al.* (2005)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Folsomia candida **(Collembola)**	**BAS 455 48 H (455 g a.s./L)**	**reproduction**	**28 d**	**NOEC**	**193 (500 mg product/kg soil)**	**5**	**131**	**Artificial soil: 5 % peat, pH 5.7-6.1, 58 % MWCH**	**H**	**R1/C1**	**Friedrich (2011c) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.169; Anonymous (2011b) cited in (BASF 2021), BASF DocID 2011/1067589**
Folsomia candida (Collembola)	BAS 455 48 H (455 g a.s./L)	reproduction	28 d	EC10	561	5	381	Artificial soil: 5 % peat, pH 5.7-6.1, 58 % MWCH	H	R4/C1	Friedrich (2011c) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.169; Anonymous (2011b) cited in (BASF 2021), BASF DocID 2011/1067589
Folsomia candida **(Collembola)**	**BAS 455 48 H (455 g a.s./L)**	**adult mortality**	**28 d**	**NOEC**	**193 (500 mg product/kg soil)**	**5**	**131**	**Artificial soil: 5 % peat, pH 5.7-6.1, 58 % MWCH**	**H**	**R1/C1**	**Friedrich (2011c) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.169; Anonymous (2011b) cited in (BASF 2021), BASF DocID 2011/1067589**
Folsomia candida **(Collembola)**	**Pendimethalin 400 SC (400 g a.s./L)**	**reproduction**	**28 d**	**NOEC**	**78.22**	**5**	**53.2**	**Artificial soil: 5 % peat, pH 5.6-6.1, 50 % MWHC**	**F**	**1**	**Vinall (2011) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.122**
Folsomia candida **(Collembola)**	**Pendimethalin 400 SC (400 g a.s./L)**	**adult mortality**	**28 d**	**NOEC**	**97.8**	**5**	**66.5**	**Artificial soil: 5 % peat, pH 5.6-6.1, 50 % MWHC**	**F**	**1**	**Vinall (2011) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.122**
Folsomia candida **(Collembola)**	**Pendimethalin (98 % purity)**	**reproduction**	**28 d**	**NOEC**	**≥ 30 (< 90)**	**2.7**	**≥ 37.8 (< 113)**	**Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0**	**G**	**R2/C1**	**Belden *et al.* (2005)**
Folsomia candida (Collembola)	Pendimethalin (98 % purity)	reproduction	28 d	EC50	47	2.7	59.2	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C1	Belden *et al.* (2005)
Xenilla welchi (Collembola)	Kristop 30 EC	adult mortality	24 h	LR50	(190 g a.s./ha)	(1.5 % OC)	n.a.	Natural grassland soil: sandy loam, pH 6.2, 34 % MWCH	J	R4/C2	Haque *et al.* (2011)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Xenilla welchi (Collembola)	Kristop 30 EC	reproduction	n.r.	NOER	(19 g a.s./ha)	(1.5 % OC)	n.a.	Natural grassland soil: sandy loam, pH 6.2, 34 % MWCH	J	R4/C1	Haque *et al.* (2011)
Hypoaspis aculeifer **(Mite)**	**BAS 455 48 H (455 g a.s./L)**	**reproduction**	**14 d**	**NOEC**	**≥ 384.6**	**5**	**≥ 262**	**Artificial soil: 5 % peat, pH 5.6-5.9, 51-56 % MWHC**	**F, K**	**1**	**Ganssmann (2013b) cited in) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.171; Anonymous (2013) cited in (BASF 2021), BASF DocID 2013/1132494**
Hypoaspis aculeifer (Mite)	BAS 455 48 H (455 g a.s./L)	reproduction	14 d	EC10	257	5	175	Artificial soil: 5 % peat, pH 5.6-5.9, 51-56 % MWHC	K	R3/C1	Ganssmann (2013b) cited in) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.171; Anonymous (2013) cited in (BASF 2021), BASF DocID 2013/1132494
Hypoaspis aculeifer **(Mite)**	**BAS 455 48 H (455 g a.s./L)**	**adult mortality**	**14 d**	**NOEC**	**≥ 384.6**	**5**	**≥ 262**	**Artificial soil: 5 % peat, pH 5.6-5.9, 51-56 % MWHC**	**F, K**	**1**	**Ganssmann (2013b) cited in) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.171; Anonymous (2013) cited in (BASF 2021), BASF DocID 2013/1132494**
Hypoaspis aculeifer **(Mite)**	**Pendimethalin 400 SC (400 g a.s./L)**	**reproduction**	**14 d**	**NOEC**	**≥ 381.5**	**5**	**≥ 259**	**Artificial soil: 5 % peat, pH 5.7-6.1, 47-49 % MWHC**	**F**	**1**	**Schulz (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.124**
Hypoaspis aculeifer **(Mite)**	**Pendimethalin 400 SC (400 g a.s./L)**	**adult mortality**	**14 d**	**NOEC**	**≥ 381.5**	**5**	**≥ 259**	**Artificial soil: 5 % peat, pH 5.7-6.1, 47-49 % MWHC**	**F**	**1**	**Schulz (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.7.2, p.124**
Armadillidium sp. (Woodlice)	Pendimethalin (98 % purity)	mortality	14 d	NOEC	≥ 200	2.7	≥ 252	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C2	Belden *et al.* (2005)
Armadillidium sp. (Woodlice)	Pendimethalin (98 % purity)	mortality	14 d	LC50	> 200	2.7	> 252	Natural agricultural soil: sandy loam, 60 % sand,	G	R4/C2	Belden *et al.* (2005)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
								22 % silt, 18 % clay, pH 7.0			
Microorganisms	**BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)**	**nitrogen transformation[FE]**	**28 d**	**≤ 25 % effect**	**≥ 13.2**	**2.33 (1.37 % OC)**	**≥ 19.3**	**Natural soil from untreated agricultural area: loamy sand, pH 6.6, 42-44 % MWCH**	**F, W**	**1**	**Schulz (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.9, p.181; Anonymous (2008a) cited in (BASF 2021), BASF DocID 2008/1034462**
Microorganisms	**Pendimethalin 400 SC (nominal 400 g a.s./L; measured 410.2 g a.s./L)**	**nitrogen transformation[FE]**	**28 d**	**≤ 25 % effect**	**≥ 10.9**	**2.35 (1.38 % OC)**	**≥ 15.8**	**Natural soil from untreated agricultural area: sandy loam, pH 6.5, 41-44 % MWCH**	**F, W**	**1**	**Schulz (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.9, p.128**
Microorganisms	**BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)**	**carbon transformation[FE]**	**28 d**	**≤ 25 % effect**	**≥ 13.2**	**2.33 (1.37 % OC)**	**≥ 19.3**	**Natural soil from untreated agricultural area: loamy sand, pH 6.2-6.4, 45 % MWCH**	**L**	**R1/C1**	**Anonymous (2008b) cited in (BASF 2021), BASF DocID 2008/1034461**
Microorganisms	pendimethalin (30 % a.s. in EC formulation)	microbial biomass C [FE], microbial biomass N [FE], microbial biomass P [FE]	75 d	NOER	< 1 kg a.s./ha < 1 kg a.s./ha < 1 kg a.s./ha	0.768 (0.452 % OC)	n.a. n.a. n.a.	Natural alluvial soil: Typic Orchraqualf, sandy loam, pH 5.2	M	R4/C1	Das & Dey (2013)
Microorganisms	pendimethalin (30 % a.s. in EC formulation)	population of N_2-fixing bacteria [FE], nitrification [FE]	60 d	NOER	< 1 kg a.s./ha < 1 kg a.s./ha	1.02 (0.600 % OC)	n.a. n.a.	Natural alluvial soil: Typic Haplustept, clay loam, pH 6.4	N	R4/C1	Das *et al.* (2012)
Microorganisms	pendimethalin (30 % a.s. in EC formulation)	microbial biomass C [FE], microbial biomass N [FE], microbial biomass P [FE]	80 d	NOER	< 10 kg a.s./ha < 10 kg a.s./ha ≥ 10 kg a.s./ha < 10 kg a.s./ha	n.r.	n.a.	Natural alluvial soil: fluvaquent, sandy clay loam, pH 6.8, oxidisable organic C 5.39 g/kg	NN	R4/C1	Barman & Das (2015)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
		population (CFU, total bacteria, actenomycetes, fungi [FE]									
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	urease activity [EE]	1 d	NOEC	≥ 50	0.680 (0.400 % OC)	≥ 250	Natural soil: Buckney Entic Hapludoll, pH 8.1	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	urease activity [EE]	1 d	NOEC	≥ 50	2.04 (1.20 % OC)	≥ 83.3	Natural soil: Dickinson Typic Hapludoll, pH 6.0	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	urease activity [EE]	1 d	NOEC	≥ 50	5.61 (3.3 % OC)	≥ 30.3	Natural soil: Webster Typic Haplaquoll, pH 7.3	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	urease activity [EE]	1 d	NOEC	≥ 50	7.14 (4.2 % OC)	≥ 23.8	Natural soil: Harps Typic Calciaquoll, pH 7.7	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	nitrification [FE]	21 d	NOEC	≥ 5 (< 50)	0.680 (0.400 % OC)	≥ 25 (< 250)	Natural soil: Buckney Entic Hapludoll, pH 8.1	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	nitrification [FE]	21 d	NOEC	≥ 50	2.04 (1.20 % OC)	≥ 83.3	Natural soil: Dickinson Typic Hapludoll, pH 6.0	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	nitrification [FE]	21 d	NOEC	≥ 50	5.61 (3.3 % OC)	≥ 30.3	Natural soil: Webster Typic Haplaquoll, pH 7.3	O	R4/C1	Martens & Bremner (1993)
Microorganisms	pendimethalin 480 EC formulation (480 g a.s./L)	nitrification [FE]	21 d	NOEC	≥ 50	7.14 (4.2 % OC)	≥ 23.8	Natural soil: Harps Typic Calciaquoll, pH 7.7	O	R4/C1	Martens & Bremner (1993)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Microorganisms	Stomp 330	total number of fungi/bacteria /spores/actinomycetes	38 d	NOER	≥ 3500 g a.s./ha	n.r.	n.a.	Natural soil: Haplic Chernozem, silt loam, pH 7.76	P	R4/C1	Kočárek *et al.* (2016)
Glomus intraradix (Vesicular-arbuscular mycorrhizae (VAM) fungi; Microorganisms)	(pendimethalin, not specified)	VAM root colonisation (growth)[FE]	28 d	NOEC	0.0875	n.r.	n.a.	Half natural soil: agricultural soil mixed with river sand, pH 8.1	Q	R4/C1	Siqueira *et al.* (1991)
Sorghum bicolor[M] (Terrestrial plant)	(pendimethalin, not specified) without VAM	shoot dry weight, leaf area, leaf injury, root fresh weight	28 d	NOEC	< 0.0875 < 0.0875 < 0.0875 < 0.0875	n.r.	n.a.	Half natural soil: agricultural soil mixed with river sand, pH 8.1	Q	R4/C1	Siqueira *et al.* (1991)
Sorghum bicolor[M] (Terrestrial plant)	(pendimethalin, not specified) with VAM	shoot dry weight, leaf area, leaf injury, root fresh weight	28 d	NOEC	< 0.0875 < 0.0875 < 0.0875 0.175	n.r.	n.a.	Half natural soil: agricultural soil mixed with river sand, pH 8.1	Q	R4/C1	Siqueira *et al.* (1991)
Daucus carota[D] *Lactuca sativa*[D] *Brassica napus*[D] *Beta vulgaris*[D] *Pisum sativum*[D] *Glycine max*[D] *Allium cepa*[M] *Lolium perenne*[M] *Avena sativa*[M] *Zea mays*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	mortality	21 d	NOER	≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.31 (0.77 % OC)	n.a.	Natural soil from agricultural area: medium silty sand soil pH 7.17 (oilseed rape, sugar beet); pH 4.99 (other species)	R	R1/C3	Strömel *et al*. (2013a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11, p.184; Anonymous (2013a) cited in (BASF 2021), BASF DocID 2012/1182238

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Daucus carota^{D} *Lactuca sativa*^{D} *Brassica napus*^{D} *Beta vulgaris*^{D} *Pisum sativum*^{D} *Glycine max*^{D} *Allium cepa*^{M} *Lolium perenne*^{M} *Avena sativa*^{M} *Zea mays*^{M} (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	mortality	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.31 (0.77 % OC)	n.a.	Natural soil from agricultural area: medium silty sand soil pH 7.17 (oilseed rape, sugar beet); pH 4.99 (other species)	R	R1/C3	Strömel *et al*. (2013a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11, p.184; Anonymous (2013a) cited in (BASF 2021), BASF DocID 2012/1182238
Daucus carota^{D} *Lactuca sativa*^{D} *Brassica napus*^{D} *Beta vulgaris*^{D} *Pisum sativum*^{D} *Glycine max*^{D} *Allium cepa*^{M} *Lolium perenne*^{M} *Avena sativa*^{M} *Zea mays*^{M} (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	NOER	≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.31 (0.77 % OC)	n.a.	Natural soil from agricultural area: medium silty sand soil pH 7.17 (oilseed rape, sugar beet); pH 4.99 (other species)	R	R1/C3	Strömel *et al*. (2013a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11, p.184; Anonymous (2013a) cited in (BASF 2021), BASF DocID 2012/1182238
Daucus carota^{D} *Lactuca sativa*^{D} *Brassica napus*^{D} *Beta vulgaris*^{D} *Pisum sativum*^{D} *Glycine max*^{D} *Allium cepa*^{M} *Lolium perenne*^{M} *Avena sativa*^{M} *Zea mays*^{M} (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	seedling growth (shoot height)	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.31 (0.77 % OC)	n.a.	Natural soil from agricultural area: medium silty sand soil pH 7.17 (oilseed rape, sugar beet); pH 4.99 (other species)	R	R1/C3	Strömel *et al*. (2013a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11, p.184; Anonymous (2013a) cited in (BASF 2021), BASF DocID 2012/1182238

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Daucus carota[D] *Lactuca sativa*[D] *Brassica napus*[D] *Beta vulgaris*[D] *Pisum sativum*[D] *Glycine max*[D] *Allium cepa*[M] *Lolium perenne*[M] *Avena sativa*[M] *Zea mays*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry weight)	21 d	NOER	≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha 0.988 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.31 (0.77 % OC)	n.a.	Natural soil from agricultural area: medium silty sand soil pH 7.17 (oilseed rape, sugar beet); pH 4.99 (other species)	R	R1/C3	Strömel *et al*. (2013a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11, p.184; Anonymous (2013a) cited in (BASF 2021), BASF DocID 2012/1182238
Daucus carota[D] *Lactuca sativa*[D] *Brassica napus*[D] *Beta vulgaris*[D] *Pisum sativum*[D] *Glycine max*[D] *Allium cepa*[M] *Lolium perenne*[M] *Avena sativa*[M] *Zea mays*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry weight)	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.31 (0.77 % OC)	n.a.	Natural soil from agricultural area: medium silty sand soil pH 7.17 (oilseed rape, sugar beet); pH 4.99 (other species)	R	R1/C3	Strömel *et al*. (2013a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11, p.184; Anonymous (2013a) cited in (BASF 2021), BASF DocID 2012/1182238
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d	NOER	≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.39 (0.82 % OC)	n.a.	Natural soil from agricultural area: silty sand, pH 6.04	R	R1/C3	Strömel *et al*. (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.186; Anonymous (2008d) cited in (BASF 2021), BASF DocID 2008/1025054
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.39 (0.82 % OC)	n.a.	Natural soil from agricultural area: silty sand, pH 6.04	R	R1/C3	Strömel *et al*. (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.186; Anonymous (2008d) cited in (BASF

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Avena sativa[M] (Terrestrial plant)					> 1.98 kg a.s./ha						2021), BASF DocID 2008/1025054
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	NOER	≥ 1.98 kg a.s./ha 0.494 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.39 (0.82 % OC)	n.a.	Natural soil from agricultural area: silty sand, pH 6.04	R	R1/C3	Strömel *et al*. (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.186; Anonymous (2008d) cited in (BASF 2021), BASF DocID 2008/1025054
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.39 (0.82 % OC)	n.a.	Natural soil from agricultural area: silty sand, pH 6.04	R	R1/C3	Strömel *et al*. (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.186; Anonymous (2008d) cited in (BASF 2021), BASF DocID 2008/1025054
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	NOER	≥ 1.98 kg a.s./ha 0.988 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.39 (0.82 % OC)	n.a.	Natural soil from agricultural area: silty sand, pH 6.04	R	R1/C3	Strömel *et al*. (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.186; Anonymous (2008d) cited in (BASF 2021), BASF DocID 2008/1025054
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.39 (0.82 % OC)	n.a.	Natural soil from agricultural area: silty sand, pH 6.04	R	R1/C3	Strömel *et al*. (2008a) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.186; Anonymous (2008d) cited in (BASF 2021), BASF DocID 2008/1025054
Daucus carota[D] *Lactuca sativa*[D]	BAS 455 48 H (nominal 455 g	seedling emergence	28 d 21 d	NOEC	≥ 1.32 ≥ 1.32	1.31	≥ 3.43 ≥ 3.43	Natural soil (LUFA Speyer): medium silty	F, S	1 (R1/C1)	Strömel *et al*. (2013b) cited in (EC 2021), Vol.

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Brassica napus[D]	a.s./L; measured		21 d		≥ 1.32	(0.77 %	≥ 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,
Glycine max[D]	449.2 g a.s./L)		21 d		≥ 1.32	OC)	≥ 3.43	OC; and silty loamy			p.188; Anonymous
Pisum sativum[D]			21 d		≥ 1.32	1.55	≥ 3.43	sand (only for			(2013b) cited in (BASF
Beta vulgaris[D]			21 d		≥ 1.32	(0.91 %	≥ 2.90	sugarbeet), pH 7.29,			2021), BASF DocID
Allium cepa[M]			28 d		≥ 1.32	OC)	≥ 3.43	0.91 % OC			2012/1182237
Lolium perenne[M]			21 d		0.329		0.855				
Avena sativa[M]			21 d		≥ 1.32		≥ 3.43				
Zea mays[M]			21 d		≥ 1.32		≥ 3.43				
(Terrestrial plant)											
Daucus carota[D]	BAS 455 48 H	seedling	28 d	EC50	> 1.32	1.31	> 3.43	Natural soil (LUFA	F, S	1	Strömel *et al*. (2013b)
Lactuca sativa[D]	(nominal 455 g	emergence	21 d		> 1.32	(0.77 %	> 3.43	Speyer): medium silty		(R1/C2)	cited in (EC 2021), Vol.
Brassica napus[D]	a.s./L; measured		21 d		> 1.32	OC)	> 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,
Glycine max[D]	449.2 g a.s./L)		21 d		> 1.32	1.55	> 3.43	OC; and silty loamy			p.188; Anonymous
Pisum sativum[D]			21 d		> 1.32	(0.91 %	> 3.43	sand (only for			(2013b) cited in (BASF
Beta vulgaris[D]			21 d		> 1.32	OC)	> 2.90	sugarbeet), pH 7.29,			2021), BASF DocID
Allium cepa[M]			28 d		> 1.32		> 3.43	0.91 % OC			2012/1182237
Lolium perenne[M]			21 d		1.21		3.14				
Avena sativa[M]			21 d		> 1.32		> 3.43				
Zea mays[M]			21 d		> 1.32		> 3.43				
(Terrestrial plant)											
Daucus carota[D]	BAS 455 48 H	mortality	28 d	NOEC	≥ 1.32	1.31	≥ 3.43	Natural soil (LUFA	F, S	1	Strömel *et al*. (2013b)
Lactuca sativa[D]	(nominal 455 g		21 d		≥ 1.32	(0.77 %	≥ 3.43	Speyer): medium silty		(R1/C1)	cited in (EC 2021), Vol.
Brassica napus[D]	a.s./L; measured		21 d		≥ 1.32	OC)	≥ 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,
Glycine max[D]	449.2 g a.s./L)		21 d		≥ 1.32	1.55	≥ 3.43	OC; and silty loamy			p.188; Anonymous
Pisum sativum[D]			21 d		≥ 1.32	(0.91 %	≥ 3.43	sand (only for			(2013b) cited in (BASF
Beta vulgaris[D]			21 d		≥ 1.32	OC)	≥ 2.90	sugarbeet), pH 7.29,			2021), BASF DocID
Allium cepa[M]			28 d		≥ 1.32		≥ 3.43	0.91 % OC			2012/1182237
Lolium perenne[M]			21 d		0.165		0.429				
Avena sativa[M]			21 d		≥ 1.32		≥ 3.43				
Zea mays[M]			21 d		≥ 1.32		≥ 3.43				
(Terrestrial plant)											
Daucus carota[D]	BAS 455 48 H	mortality	28 d	EC50	> 1.32	1.31	> 3.43	Natural soil (LUFA	F, S	1	Strömel *et al*. (2013b)
Lactuca sativa[D]	(nominal 455 g		21 d		> 1.32	(0.77 %	> 3.43	Speyer): medium silty		(R1/C2)	cited in (EC 2021), Vol.
Brassica napus[D]			21 d		> 1.32	OC)	> 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Glycine max[D]	a.s./L; measured		21 d		> 1.32	1.55	> 3.43	OC; and silty loamy			p.188; Anonymous
Pisum sativum[D]	449.2 g a.s./L)		21 d		> 1.32	(0.91 %	> 3.43	sand (only for			(2013b) cited in (BASF
Beta vulgaris[D]			21 d		> 1.32	OC)	> 2.90	sugarbeet), pH 7.29,			2021), BASF DocID
Allium cepa[M]			28 d		> 1.32		> 3.43	0.91 % OC			2012/1182237
Lolium perenne[M]			21 d		1.29		3.35				
Avena sativa[M]			21 d		> 1.32		> 3.43				
Zea mays[M]			21 d		> 1.32		> 3.43				
(Terrestrial plant)											
Daucus carota[D]	BAS 455 48 H	seedling growth (shoot height)	28 d	NOEC	≥ 1.32	1.31	≥ 3.43	Natural soil (LUFA	F, S	1	Strömel *et al*. (2013b)
Lactuca sativa[D]	(nominal 455 g		21 d		0.329	(0.77 %	0.855	Speyer): medium silty		(R1/C1)	cited in (EC 2021), Vol.
Brassica napus[D]	a.s./L; measured		21 d		≥ 1.32	OC)	≥ 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,
Glycine max[D]	449.2 g a.s./L)		21 d		≥ 1.32	1.55	≥ 3.43	OC; and silty loamy			p.188; Anonymous
Pisum sativum[D]			21 d		≥ 1.32	(0.91 %	≥ 3.43	sand (only for			(2013b) cited in (BASF
Beta vulgaris[D]			21 d		0.329	OC)	0.723	sugarbeet), pH 7.29,			2021), BASF DocID
Allium cepa[M]			28 d		≥ 1.32		≥ 3.43	0.91 % OC			2012/1182237
Lolium perenne[M]			21 d		0.165		0.429				
Avena sativa[M]			21 d		≥ 1.32		≥ 3.43				
Zea mays[M]			21 d		≥ 1.32		≥ 3.43				
(Terrestrial plant)											
Daucus carota[D]	BAS 455 48 H	seedling growth (shoot height)	28 d	EC50	> 1.32	1.31	> 3.43	Natural soil (LUFA	F, S	1	Strömel *et al*. (2013b)
Lactuca sativa[D]	(nominal 455 g		21 d		1.13	(0.77 %	2.94	Speyer): medium silty		(R1/C2)	cited in (EC 2021), Vol.
Brassica napus[D]	a.s./L; measured		21 d		> 1.32	OC)	> 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,
Glycine max[D]	449.2 g a.s./L)		21 d		> 1.32	1.55	> 3.43	OC; and silty loamy			p.188; Anonymous
Pisum sativum[D]			21 d		> 1.32	(0.91 %	> 3.43	sand (only for			(2013b) cited in (BASF
Beta vulgaris[D]			21 d		> 1.32	OC)	> 2.90	sugarbeet), pH 7.29,			2021), BASF DocID
Allium cepa[M]			28 d		> 1.32		> 3.43	0.91 % OC			2012/1182237
Lolium perenne[M]			21 d		0.519		1.35				
Avena sativa[M]			21 d		> 1.32		> 3.43				
Zea mays[M]			21 d		> 1.32		> 3.43				
(Terrestrial plant)											
Daucus carota[D]	BAS 455 48 H	biomass (dry shoot weight)	28 d	NOEC	≥ 1.32	1.31	≥ 3.43	Natural soil (LUFA	F, S	1	Strömel *et al*. (2013b)
Lactuca sativa[D]	(nominal 455 g		21 d		0.329	(0.77 %	0.855	Speyer): medium silty		(R1/C1)	cited in (EC 2021), Vol.
Brassica napus[D]	a.s./L; measured		21 d		≥ 1.32	OC)	≥ 3.43	sand, pH 7.17, 0.77 %			3CP (BAS) B.9.11.2,
Glycine max[D]	449.2 g a.s./L)		21 d		≥ 1.32	1.55	≥ 3.43	OC; and silty loamy			p.188; Anonymous

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Pisum sativum[D] *Beta vulgaris*[D] *Allium cepa*[M] *Lolium perenne*[M] *Avena sativa*[M] *Zea mays*[M] (Terrestrial plant)			21 d 21 d 28 d 21 d 21 d 21 d		≥ 1.32 0.659 ≥ 1.32 0.165 ≥ 1.32 ≥ 1.32	(0.91 % OC)	≥ 3.43 1.45 ≥ 3.43 0.429 ≥ 3.43 ≥ 3.43	sand (only for sugarbeet), pH 7.29, 0.91 % OC			(2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Daucus carota[D] *Lactuca sativa*[D] *Brassica napus*[D] *Glycine max*[D] *Pisum sativum*[D] *Beta vulgaris*[D] *Allium cepa*[M] *Lolium perenne*[M] *Avena sativa*[M] *Zea mays*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	biomass (dry shoot weight)	28 d 21 d 21 d 21 d 21 d 21 d 28 d 21 d 21 d 21 d	EC50	> 1.32 0.747 > 1.32 > 1.32 > 1.32 > 1.32 > 1.32 0.357 > 1.32 > 1.32	1.31 (0.77 % OC) 1.55 (0.91 % OC)	> 3.43 1.94 > 3.43 > 3.43 > 3.43 > 2.90 > 3.43 0.927 > 3.43 > 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17, 0.77 % OC; and silty loamy sand (only for sugarbeet), pH 7.29, 0.91 % OC	F, S	1 (R1/C2)	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Daucus carota[D] *Lactuca sativa*[D] *Brassica napus*[D] *Glycine max*[D] *Pisum sativum*[D] *Beta vulgaris*[D] *Allium cepa*[M] *Lolium perenne*[M] *Avena sativa*[M] *Zea mays*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449.2 g a.s./L)	phytotoxicity	28 d 21 d 21 d 21 d 21 d 21 d 28 d 21 d 21 d 21 d	NOEC	≥ 1.32 0.329 ≥ 1.32 ≥ 1.32 ≥ 1.32 0.658 ≥ 1.32 0.0827 ≥ 1.32 ≥ 1.32	1.31 (0.77 % OC) 1.55 (0.91 % OC)	≥ 3.43 0.855 ≥ 3.43 ≥ 3.43 ≥ 3.43 1.71 ≥ 3.43 0.215 ≥ 3.43 ≥ 3.43	Natural soil (LUFA Speyer): medium silty sand, pH 7.17, 0.77 % OC; and silty loamy sand (only for sugarbeet), pH 7.29, 0.91 % OC	S	R4/C1	Strömel *et al*. (2013b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.188; Anonymous (2013b) cited in (BASF 2021), BASF DocID 2012/1182237
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M]	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d 21 d 21 d 21 d 28 d	NOEC	≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32	1.39 (0.82 % OC)	≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Avena sativa[M] (Terrestrial plant)			21 d		≥ 1.32		≥ 3.22				2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling emergence	21 d 21 d 21 d 21 d 28 d 21 d	EC50	> 1.32 > 1.32 > 1.32 > 1.32 > 1.32 > 1.32	1.39 (0.82 % OC)	> 3.22 > 3.22 > 3.22 > 3.22 > 3.22 > 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C2)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d 21 d 21 d 21 d 28 d 21 d	NOEC	≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32	1.39 (0.82 % OC)	≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	mortality	21 d 21 d 21 d 21 d 28 d 21 d	EC50	> 1.32 > 1.32 > 1.32 > 1.32 > 1.32 > 1.32	1.39 (0.82 % OC)	> 3.22 > 3.22 > 3.22 > 3.22 > 3.22 > 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C2)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d 21 d 21 d 21 d 28 d 21 d	NOEC	0.659 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32	1.39 (0.82 % OC)	1.61 ≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22 ≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	seedling growth (shoot height)	21 d 21 d 21 d 21 d 28 d 21 d	EC50	> 1.32 > 1.32 > 1.32 > 1.32 > 1.32 > 1.32	1.39 (0.82 % OC)	> 3.22 > 3.22 > 3.22 > 3.22 > 3.22 > 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C2)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d 21 d 21 d 21 d 28 d 21 d	NOEC	0.659 0.659 0.165 ≥ 1.32 0.659 ≥ 1.32	1.39 (0.82 % OC)	1.61 1.61 0.402 ≥ 3.22 1.61 ≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C1)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	biomass (fresh shoot weight)	21 d 21 d 21 d 21 d 28 d 21 d	EC50	> 1.32 > 1.32 > 1.32 > 1.32 > 1.32 > 1.32	1.39 (0.82 % OC)	> 3.22 > 3.22 > 3.22 > 3.22 > 3.22 > 3.22	Natural soil from agricultural area: silty sand, pH 6.04	F, S	1 (R1/C2)	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Lactuca sativa[D] *Brassica napus*[D] *Beta vulgaris*[D] *Glycine max*[D] *Allium cepa*[M] *Avena sativa*[M] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L; measured 449 g a.s./L)	phytotoxicity	21 d 21 d 21 d 21 d 28 d 21 d	NOEC	0.165 0.659 ≥ 1.32 ≥ 1.32 0.165 ≥ 1.32	1.39 (0.82 % OC)	0.402 1.61 ≥ 3.22 ≥ 3.22 0.402 ≥ 3.22	Natural soil from agricultural area: silty sand, pH 6.04	S	R4/C1	Strömel *et al*. (2008b) cited in (EC 2021), Vol. 3CP (BAS) B.9.11.2, p.189; Anonymous (2008c) cited in (BASF 2021), BASF DocID 2008/1025055
Bellis perennis[D] *Centaurea cyanus*[D] *Inula helenium*[D] *Rudbeckia hirta*[D]	Stomp SC (nominal 36 % a.s., 400 g a.s./L)	biomass (dry shoot weight)	21 d	ER50	1200 g a.s./ha 8281 g a.s./ha 304 g a.s./ha 8966 g a.s./ha	n.r.	n.a.	Commercial potting soil with high peat content	T	R4/C3	Boutin *et al*. (2004)

Species (Taxonomic group)[5]	**Test substance**	**Measured effect**[6]	**Duration**	**Type of effect concentration**	**Effect concentration [mg a.s./kg soil]**	**Total OM [%]**	**Normalised effect value [mg a.s./kg soil] 3.4 % OM**	**Test soil**	**Notes**	**Assessment score**	**Source**
Solidago canadensis[D]					1069 g a.s./ha						
Leonorus cardiaca[D]					44.2 g a.s./ha						
Mentha spicata[D]					4.24 g a.s./ha						
Nepeta cataria[D]					16.3 g a.s./ha						
Prunella vulgaris[D]					8.46 g a.s./ha						
Polygonum convolvulus[D]					344 g a.s./ha						
Rumex crispus[D]					53.5 g a.s./ha						
Anagallis arvensis[D]					4.38 g a.s./ha						
Digitalis purpurea[D]					16.1 g a.s./ha						
Sinapsis arvensis[D]					301 g a.s./ha						
Papaver rhoeas[D] (Terrestrial plant)					14.3 g a.s./ha						
Avena sativa[M]	Stomp SC (300 g a.s./L)	phytotoxicity	46 d	NOER	≥ 600 g a.s./ha	n.r.	n.a.	Natural red earth soil (Gn2.12, Australia): pH 5.5, 25 % clay	U	R4/C1	Dear *et al.* (2006)
Lolium rigidum[M]					< 600 g a.s./ha						
Dactylis glomerata[M]					< 600 g a.s./ha						
Austrodanthonia richardsonii[M]					< 600 g a.s./ha						
Festuca arundinacea[M]					< 600 g a.s./ha						
Lolium perenne[M]					< 600 g a.s./ha						
Phalaris aquatica[M]					< 600 g a.s./ha						
Trifolium subterraneum[M]					≥ 600 g a.s./ha						
Triticum aestivum[M] (Terrestrial plant)					≥ 600 g a.s./ha						

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Avena sativa[M] *Lolium rigidum*[M] *Dactylis glomerata*[M] *Austrodanthonia richardsonii*[M] *Festuca arundinacea*[M] *Lolium perenne*[M] *Phalaris aquatica*[M] *Trifolium subterraneum*[M] *Triticum aestivum*[M] (Terrestrial plant)	Stomp SC (300 g a.s./L)	growth (No. of leaves/plant)	46 d	NOER	≥ 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha < 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha	n.r.	n.a.	Natural red earth soil (Gn2.12, Australia): pH 5.5, 25 % clay	U	R4/C1	Dear *et al.* (2006)
Avena sativa[M] *Lolium rigidum*[M] *Dactylis glomerata*[M] *Austrodanthonia richardsonii*[M] *Festuca arundinacea*[M] *Lolium perenne*[M] *Phalaris aquatica*[M] *Trifolium subterraneum*[M] *Triticum aestivum*[M] (Terrestrial plant)	Stomp SC (300 g a.s./L)	biomass (dry shoot weight)	46 d	NOER	≥ 600 g a.s./ha < 600 g a.s./ha < 600 g a.s./ha ≥ 600 g a.s./ha < 600 g a.s./ha ≥ 600 g a.s./ha < 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha	n.r.	n.a.	Natural red earth soil (Gn2.12, Australia): pH 5.5, 25 % clay	U	R4/C1	Dear *et al.* (2006)
Avena sativa[M] *Lolium rigidum*[M]	Stomp SC (300 g a.s./L)	biomass (dry root weight)	46 d	NOER	≥ 600 g a.s./ha < 600 g a.s./ha < 600 g a.s./ha	n.r.	n.a.	Natural red earth soil (Gn2.12, Australia): pH 5.5, 25 % clay	U	R4/C1	Dear *et al.* (2006)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Dactylis glomerata^{M} *Austrodanthonia richardsonii*^{M} *Festuca arundinacea*^{M} *Lolium perenne*^{M} *Phalaris aquatica*^{M} *Trifolium subterraneum*^{M} *Triticum aestivum*^{M} (Terrestrial plant)					≥ 600 g a.s./ha ≥ 600 g a.s./ha < 600 g a.s./ha < 600 g a.s./ha ≥ 600 g a.s./ha ≥ 600 g a.s./ha						
Avena sativa^{M} *Allium cepa*^{M} *Beta vulgaris*^{D} *Brassica napus*^{D} *Daucus carota*^{D} *Glycine max*^{D} (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	phytotoxicity	21 d	NOER	0.297 kg a.s./ha ≥ 1.98 kg a.s./ha 0.149 kg a.s./ha < 0.149 kg a.s./ha ≥ 1.98 kg a.s./ha < 0.149 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130
Avena sativa^{M} *Allium cepa*^{M} *Beta vulgaris*^{D} *Brassica napus*^{D} *Daucus carota*^{D} *Glycine max*^{D} (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	mortality	21 d	NOER	≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130
Avena sativa^{M} *Allium cepa*^{M} *Beta vulgaris*^{D} *Brassica napus*^{D} *Daucus carota*^{D}	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	mortality	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Glycine max[D] (Terrestrial plant)					> 1.98 kg a.s./ha						
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling growth (shoot height)	21 d	NOER	0.297 kg a.s./ha ≥ 1.98 kg a.s./ha 0.992 kg a.s./ha < 0.149 kg a.s./ha ≥ 1.98 kg a.s./ha < 0.149 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling growth (shoot height)	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (fresh shoot weight)	21 d	NOER	≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha ≥ 1.98 kg a.s./ha < 0.149 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (fresh shoot weight)	21 d	ER50	> 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha > 1.98 kg a.s./ha	1.30 (0.763 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	R	R1/C3	Fiebig (2008) cited in cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.130

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	mortality	21 d	NOER	≥ 2.02 kg a.s./ha ≥ 2.02 kg a.s./ha ≥ 2.02 kg a.s./ha ≥ 2.02 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	mortality	21 d	ER50	> 2.02 kg a.s./ha > 2.02 kg a.s./ha > 2.02 kg a.s./ha > 2.02 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	phytotoxicity	21 d	NOER	≥ 2.02 kg a.s./ha ≥ 2.02 kg a.s./ha 0.253 kg a.s./ha 0.00833 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	seedling growth (shoot height)	21 d	NOER	≥ 2.02 kg a.s./ha ≥ 2.02 kg a.s./ha 0.126 kg a.s./ha 0.225 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D]	Pendimethalin 400 SC (404.4 g a.s./L)	seedling growth (shoot height)	21 d	ER50	> 2.02 kg a.s./ha > 2.02 kg a.s./ha > 2.02 kg a.s./ha 1.29 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Lycopersicon esculentum[D] (Terrestrial plant)											
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	21 d	NOER	≥ 2.02 kg a.s./ha ≥ 2.02 kg a.s./ha 0.253 kg a.s./ha 0.0748 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	21 d	ER50	> 2.02 kg a.s./ha > 2.02 kg a.s./ha > 2.02 kg a.s./ha 0.845 kg a.s./ha	1.87 (1.1 % OC)	n.a.	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	R	R1/C3	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.132
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling emergence	21 d 23 d 21 d 21 d 23 d 21 d	NOEC	≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32 ≥ 1.32	1.30 (0.763 % OC)	≥ 3.46 ≥ 3.46 ≥ 3.46 ≥ 3.46 ≥ 3.46 ≥ 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling emergence	21 d 23 d 21 d 21 d 23 d 21 d	EC50	> 1.32 > 1.32 > 1.32 > 1.32 > 1.32 > 1.32	1.30 (0.763 % OC)	> 3.46 > 3.46 > 3.46 > 3.46 > 3.46 > 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C2)	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134

Species (Taxonomic group)[5]	**Test substance**	**Measured effect**[6]	**Duration**	**Type of effect concentration**	**Effect concentration [mg a.s./kg soil]**	**Total OM [%]**	**Normalised effect value [mg a.s./kg soil] 3.4 % OM**	**Test soil**	**Notes**	**Assessment score**	**Source**
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	phytotoxicity	21 d 23 d 21 d 21 d 23 d 21 d	NOEC	0.441 0.441 0.148 0.0495 ≥ 1.32 0.441	1.30 (0.763 % OC)	1.16 1.16 0.388 0.130 ≥ 3.46 1.16	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	R4/C1	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling growth (shoot height)	21 d 23 d 21 d 21 d 23 d 21 d	NOEC	0.441 0.148 0.0495 0.148 ≥ 1.32 ≥ 1.32	1.30 (0.763 % OC)	1.16 0.388 0.130 0.388 ≥ 3.46 ≥ 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	seedling growth (shoot height)	21 d 23 d 21 d 21 d 23 d 21 d	EC50	> 1.32 > 1.32 0.632 0.344 > 1.32 > 1.32	1.30 (0.763 % OC)	> 3.46 > 3.46 1.66 0.902 > 3.46 > 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C2)	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D] *Glycine max*[D] (Terrestrial plant)	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (shoot fresh weight)	21 d 23 d 21 d 21 d 23 d 21 d	NOEC	0.441 ≥ 1.32 0.148 0.148 ≥ 1.32 ≥ 1.32	1.30 (0.763 % OC)	1.16 ≥ 3.46 0.388 0.388 ≥ 3.46 ≥ 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134
Avena sativa[M] *Allium cepa*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Daucus carota*[D]	Pendimethalin 400 SC (FSG 01100H, 396.6 g a.s./L)	biomass (shoot fresh weight)	21 d 23 d 21 d 21 d 23 d	EC50	> 1.32 > 1.32 0.351 0.373 > 1.32	1.30 (0.763 % OC)	> 3.46 > 3.46 0.920 0.978 > 3.46	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.4, 2.16 % OC) and quartz sand	F, S	1 (R1/C2)	Fiebig (2008) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.134

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Glycine max[D] (Terrestrial plant)			21 d		> 1.32		> 3.46				
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	seedling emergence	21 d 21 d 35 d 21 d	NOEC	≥ 1.35 ≥ 1.35 ≥ 1.35 ≥ 1.35	2.04 (1.2 % OC)	≥ 2.25 ≥ 2.25 ≥ 2.25 ≥ 2.25	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	seedling emergence	21 d 21 d 35 d 21 d	EC50	> 1.35 > 1.35 > 1.35 > 1.35	2.04 (1.2 % OC)	> 2.25 > 2.25 > 2.25 > 2.25	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C2)	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	phytotoxicity	21 d 21 d 35 d 21 d	NOEC	0.337 0.0138 0.0840 0.0860	2.04 (1.2 % OC)	0.562 0.0230 0.140 0.143	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	S	R4/C1	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	seedling growth (shoot height)	21 d 21 d 35 d 21 d	NOEC	0.674 0.0863 0.0840 0.0345	2.04 (1.2 % OC)	1.12 0.144 0.140 0.0575	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	seedling growth (shoot height)	21 d 21 d 35 d 21 d	EC50	> 1.35 0.423 > 1.35 0.477	2.04 (1.2 % OC)	> 2.25 0.705 > 2.25 0.795	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C2)	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	21 d 21 d 35 d 21 d	NOEC	≥ 1.35 0.216 0.169 0.0863	2.04 (1.2 % OC)	≥ 2.25 0.360 0.282 0.144	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C1)	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136
Zea mays[M] *Lolium perenne*[M] *Capsicum annuum*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	Pendimethalin 400 SC (404.4 g a.s./L)	biomass (shoot fresh weight)	21 d 21 d 35 d 21 d	EC50	> 1.35 0.340 0.909 0.268	2.04 (1.2 % OC)	> 2.25 0.567 1.52 0.447	2:1 mixture of natural soil (LUFA 2.2, loamy sand, pH 5.5, 1.77 % OC) and quartz sand	F, S	1 (R1/C2)	Fiebig (2013) cited in (EC 2015), Vol. 3CP (AG) B.9.11.2, p.136
Allium cepa[M] *Lolium perenne*[M] *Triticum aestivum*[M] *Zea mays*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Brassica oleracea*[D] *Glycine max*[D] *Lactuca sativa*[D] *Lycopersicon esculentum*[D]	BAS 455 48 H (nominal 455 g a.s./L, measured 461.8 g a.s./L)	seedling growth (shoot height)	21 d Tier I test (limit test)	NOER	≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha	1.3	n.a.	Artificial soil: sand; 95 % sand, 1 % silt, 4 % clay, pH 6.7	L, R	R1/C3	Anonymous (2016a) cited in (BASF 2021), BASF DocID 2016/7004211

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
(Terrestrial plant)											
Allium cepa[M] *Lolium perenne*[M] *Triticum aestivum*[M] *Zea mays*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Brassica oleracea*[D] *Glycine max*[D] *Lactuca sativa*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L, measured 461.8 g a.s./L)	biomass (dry weight)	21 d Tier I test (limit test)	NOER	≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha < 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha < 6.73 kg a.s./ha	1.3	n.a.	Artificial soil: sand; 95 % sand, 1 % silt, 4 % clay, pH 6.7	L, R	R1/C3	Anonymous (2016a) cited in (BASF 2021), BASF DocID 2016/7004211
Allium cepa[M] *Lolium perenne*[M] *Triticum aestivum*[M] *Zea mays*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Brassica oleracea*[D] *Glycine max*[D] *Lactuca sativa*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L, measured 461.8 g a.s./L)	mortality	21 d Tier I test (limit test)	NOER	≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha	1.3	n.a.	Artificial soil: sand; 95 % sand, 1 % silt, 4 % clay, pH 6.7	L, R	R1/C3	Anonymous (2016a) cited in (BASF 2021), BASF DocID 2016/7004211
Allium cepa[M] *Triticum aestivum*[M] *Beta vulgaris*[D] *Brassica napus*[D]	BAS 455 48 H (nominal 455 g a.s./L, measured 461.8 g a.s./L)	seedling growth (shoot height)	21 d Tier II test (5 test cc.)	NOER	≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha	1.8	n.a.	Artificial soil: loamy sand; 85 % sand, 6 % silt, 9 % clay, pH 6.4	L, R	R1/C3	Anonymous (2016a) cited in (BASF 2021), BASF DocID 2016/7004211

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Brassica oleracea[D] *Glycine max*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)					≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha						
Allium cepa[M] *Triticum aestivum*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Brassica oleracea*[D] *Glycine max*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L, measured 461.8 g a.s./L)	biomass (dry weight)	21 d Tier II test (5 test cc.)	NOER	≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha 1.68 kg a.s./ha 1.68 kg a.s./ha	1.8	n.a.	Artificial soil: loamy sand; 85 % sand, 6 % silt, 9 % clay, pH 6.4	L, R	R1/C3	Anonymous (2016a) cited in (BASF 2021), BASF DocID 2016/7004211
Allium cepa[M] *Triticum aestivum*[M] *Beta vulgaris*[D] *Brassica napus*[D] *Brassica oleracea*[D] *Glycine max*[D] *Lycopersicon esculentum*[D] (Terrestrial plant)	BAS 455 48 H (nominal 455 g a.s./L, measured 461.8 g a.s./L)	mortality	21 d Tier II test (5 test cc.)	NOER	≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha ≥ 6.73 kg a.s./ha	1.8	n.a.	Artificial soil: loamy sand; 85 % sand, 6 % silt, 9 % clay, pH 6.4	L, R	R1/C3	Anonymous (2016a) cited in (BASF 2021), BASF DocID 2016/7004211
Andropogon gerardii[M] *Sorghastrum nutans*[M] *Panicum vergatum*[M]	Pendimethalin (98 % purity)	seedling emergence	14 d 14 d 14 d	NOEC	n.a. n.a. n.a.	2.7	n.a. n.a. n.a.	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R3/C1	Belden *et al.* (2005)

Species (Taxonomic group)[5]	Test substance	Measured effect[6]	Duration	Type of effect concentration	Effect concentration [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
(Terrestrial plant)											
Andropogon gerardii[M] *Sorghastrum nutans*[M] *Panicum vergatum*[M] (Terrestrial plant)	Pendimethalin (98 % purity)	seedling growth (whole plant length)	14 d 14 d 14 d	NOEC	< 1 < 1 1	2.7	< 1.26 < 1.26 1.26	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C2	Belden *et al.* (2005)
Andropogon gerardii[M] *Sorghastrum nutans*[M] *Panicum vergatum*[M] (Terrestrial plant)	Pendimethalin (98 % purity)	seedling growth (whole plant length)	14 d 14 d 14 d	EC50	1.09 1.33 6.23	2.7	1.37 1.67 7.85	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C2	Belden *et al.* (2005)
Lactuca sativa[D] (Terrestrial plant)	Pendimethalin (98 % purity)	seedling emergence	7 d	NOEC	≥ 64 (< 256)	2.7	≥ 80.6 (< 322)	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C4	Belden *et al.* (2005)
Lactuca sativa[D] (Terrestrial plant)	Pendimethalin (98 % purity)	seedling growth (whole plant length)	7 d	NOEC	≥ 1 (< 4)	2.7	≥ 1.26 (< 5.4)	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C4	Belden *et al.* (2005)
Lactuca sativa[D] (Terrestrial plant)	Pendimethalin (98 % purity)	seedling growth (whole plant length)	7 d	EC50	7.74	2.7	9.75	Natural agricultural soil: sandy loam, 60 % sand, 22 % silt, 18 % clay, pH 7.0	G	R4/C4	Belden *et al.* (2005)
Glycine max[D] *Lactuca sativa*[D] *Rhaphanus sativus*[D]	Pendimethalin (92.98 % purity)	seedling emergence (dry weight) (dry weight) (plant height)	n.r.	NOAER	2.24 kg a.s./ha 0.0706 kg a.s./ha 0.146 kg a.s./ha	n.r.	n.a.	n.r.	X	R4/C4	Chetram & Gagne (1992), MRID 42372201 cited in (US EPA no date-a) Appendix F, Pendimethalin, Summary of Submitted EcoToxicity Studies; (US EPA no date-

Species (Taxonomic group)[5]	**Test substance**	**Measured effect**[6]	**Duration**	**Type of effect concentration**	**Effect concentration [mg a.s./kg soil]**	**Total OM [%]**	**Normalised effect value [mg a.s./kg soil] 3.4 % OM**	**Test soil**	**Notes**	**Assessment score**	**Source**
Lycopersicon esculentum[D]		(dry weight)			0.146 kg a.s./ha						b) EFED Science Chapter for Pendimethalin (Case # 0817) and (US EPA 2017b)
Cucumis sativus[D]		(plant height)			0.280 kg a.s./ha						
Brassica oleracea[D]		(plant height)			0.280 kg a.s./ha						
Avena sativa[M]		(plant height)			0.280 kg a.s./ha						
Lolium perenne[M]		(dry weight), (plant height)			0.0112 kg a.s./ha						
Zea mays[M]		(plant height)			0.560 kg a.s./ha						
Allium cepa[M]		(dry weight)			0.0673 kg a.s./ha						
Lolium perenne[M]	Pendimethalin (92.98 % purity)	seedling germination	n.r.	NOER	0.280 kg a.s./ha	n.r.	n.a.	n.r.	X	R4/C4	White & Gagne (1992), MRID 42372202 cited in (US EPA no date-b) EFED Science Chapter for Pendimethalin (Case # 0817) and (US EPA 2017b)
	Pendimethalin (92.98 % purity)	vegetative vigour	n.r.	NOAER		n.r.	n.a.	n.r.	X	R4/C4	Canez & Gagne (1992), MRID 42372203 cited in (US EPA no date-a) Appendix F, Pendimethalin, Summary of Submitted EcoToxicity Studies; (US EPA no date-b) EFED Science Chapter for Pendimethalin (Case # 0817) and (US EPA 2017b)
Glycine max[D]		(dry weight)			0.146 kg a.s./ha						
Lactuca sativa[D]		(dry weight)			0.00336 kg a.s./ha						
Rhaphanus sativus[D]		n.a.			≥ 4.48 kg a.s./ha						
Lycopersicon esculentum[D]		(dry weight)			0.146 kg a.s./ha						
Cucumis sativus[D]		n.a.			≥ 4.48 kg a.s./ha						
Brassica oleracea[D]		(dry weight)			2.24 kg a.s./ha						
Avena sativa[M]		(dry weight)			0.560 kg a.s./ha						
Lolium perenne[M]		(dry weight)			0.000897 kg a.s./ha						
Zea mays[M]		(plant height)			2.24 kg a.s./ha						
Allium cepa[M]		(plant height)			0.560 kg a.s./ha						

Table A2: Soil effect data for pendimethalin from field studies. Abbreviations: n.r. – not reported; n.a. – not applicable; WHC – water holding capacity; OC – organic carbon; OM – organic matter; CFU – colony forming units. Values resulting from calculations are rounded to three significant figures.

Species (Taxonomic group)	Test substance	Measured effect[7]	Duration	Type of effect concentration	Effect value [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Earthworms (EW)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance total [individual/m²] abundance adult [individual/m²] abundance juvenile [individual/m²] biomass total [g/m²] biomass adult [g/m²] biomass juvenile [g/m²]	1 y 1 y 1 y 1 y 1 y 1 y	NOEC NOEC NOEC NOEC NOEC NOEC	≥ nominal 7.55 (Nominal appl. rate of 11 323 g a.s./ha, 25 L product/ha); ≥ measured 4.85 (Measured appl. rate based on 64.3 % of mean recovery of nominal 25 L product/ha)	1.31 (0.77 % TOC)	≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6	Field study/natural soil (Germany, Brandenburg): medium silty sand, 0.77 % mean TOC (0.73-0.81 %; 0-20 cm), 3.2-4.3 % clay, 26.4-27.7 % silt, 68.8-70.2 % sand, pH 4.66-5.34, 35.1-36.8 % MWHC	Y	R3/C1	Strömel & Teresiak (2011) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.155; Anonymous (2011) cited in (BASF 2021), BASF DocID 2010/1000044
Aporrectodea caliginosa (Earthworm)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance total [individual/m²] abundance adult [individual/m²] abundance juvenile [individual/m²] biomass total [g/m²] biomass adult [g/m²] biomass juvenile [g/m²]	1 y 1 y 1 y 1 y 1 y 1 y	NOEC NOEC NOEC NOEC NOEC NOEC	≥ measured 4.85 ≥ measured 4.85 ≥ measured 4.85 ≥ measured 4.85 ≥ measured 4.85 ≥ measured 4.85	1.31 (0.77 % TOC)	≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6 ≥ measured 12.6	Field study/natural soil (Germany, Brandenburg): medium silty sand, 0.77 % mean TOC (0.73-0.81 %; 0-20 cm), 3.2-4.3 % clay, 26.4-27.7 % silt, 68.8-70.2 % sand, pH 4.66-5.34, 35.1-36.8 % MWHC	Y	R3/C1	Strömel & Teresiak (2011) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.155; Anonymous (2011) cited in (BASF 2021), BASF DocID 2010/1000044

[7] DE – diversity endpoint, EE – enzymatic endpoint, FE – functional endpoint

Species (Taxonomic group)	Test substance	Measured effect[7]	Duration	Type of effect concentration	Effect value [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Lumbricus terrestris (Earthworm)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance total [individual/m²]	1 y	NOEC	≥ measured 4.85	1.31 (0.77 % TOC)	≥ measured 12.6	Field study/natural soil (Germany, Brandenburg): medium silty sand, 0.77 % mean TOC (0.73-0.81 %; 0-20 cm), 3.2-4.3 % clay, 26.4-27.7 % silt, 68.8-70.2 % sand, pH 4.66-5.34, 35.1-36.8 % MWHC	Y	R3/C1	Strömel & Teresiak (2011) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.155; Anonymous (2011) cited in (BASF 2021), BASF DocID 2010/1000044
		abundance adult [individual/m²]	1 m	NOEC	< measured 0.971		< measured 2.52				
		abundance juvenile [individual/m²]	1 y	NOEC	≥ measured 4.85		≥ measured 12.6				
		biomass total [g/m²]	1 y	NOEC	≥ measured 4.85		≥ measured 12.6				
		biomass adult [g/m²]	1 m	NOEC	< measured 0.971		< measured 2.52				
		biomass juvenile [g/m²]	1 y	NOEC	≥ measured 4.85		≥ measured 12.6				
Earthworms (endpoints for total population)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance total [individual/m²]	1 y	NOEC	≥ nominal 7.55 (Nominal appl. rate of 11 323 g a.s./ha, 25 L product/ha); ≥ measured 5.74 (Measured appl. rate based on 76 % of mean recovery of nominal 25 L product/ha)	1.96 (1.15 % TOC)	≥ measured 9.98	Field study/natural soil (Southern France): clay silt; 1.15 % TOC (0-10 cm), 8.4 % sand, 72.2 % silt, 19.6 % clay; 36.6 % MWHC, pH 6.26	Z	R3/C1	Hamberger (2011a) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.162; Anonymous (2011a) cited in (BASF 2021), BASF DocID 2011/1000044
		abundance adult [individual/m²]	1 y	NOEC			≥ measured 9.98				
		abundance juvenile [individual/m²]	1 y	NOEC			≥ measured 9.98				
		biomass total [g/m²]	1 y	NOEC			≥ measured 9.98				
		biomass adult [g/m²]	1 y	NOEC			≥ measured 9.98				
		biomass juvenile [g/m²]	1 y	NOEC			≥ measured 9.98				
Earthworms (endpoints to ecological groups)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance anecic adult [individual/m²]	1 m	NOEC	nominal 3.02*	1.96 (1.15 % TOC)	measured 4.00*	Field study/natural soil (Southern France): clay silt; 1.15 % TOC (0-10 cm), 8.4 % sand, 72.2 % silt, 19.6 % clay; 36.6 % MWHC, pH 6.26	Z	R3/C1	Hamberger (2011a) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.162; Anonymous (2011a) cited in (BASF 2021), BASF DocID 2011/1000044
		abundance endogeic adult [individual/m²]	1 y	NOEC	≥ nominal 7.55		≥ measured 9.98				

Species (Taxonomic group)	Test substance	Measured effect[7]	Duration	Type of effect concentration	Effect value [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
		biomass anecic adult [g/m²]	1 m	NOEC	nominal 3.02*		measured 4.00*				
		biomass endogeic adult [g/m²]	1 y	NOEC	≥ nominal 7.55		≥ measured 9.98				
Earthworms (endpoints to anatomical groups)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance epilobous juvenile [individual/m²]	1 y	NOEC	≥ nominal 7.55	1.96 (1.15 % TOC)	≥ measured 9.98	Field study/natural soil (Southern France): clay silt; 1.15 % TOC (0-10 cm), 8.4 % sand, 72.2 % silt, 19.6 % clay; 36.6 % MWHC, pH 6.26	Z	R3/C1	Hamberger (2011a) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.162; Anonymous (2011a) cited in (BASF 2021), BASF DocID 2011/1000044
		abundance tanylobous juvenile [individual/m²]	1 y	NOEC	≤ nominal 1.51		≤ measured 2.00				
		biomass epilobous juvenile [g/m²]	1 y	NOEC	≥ nominal 7.55		≥ measured 9.98				
		biomass tanylobous juvenile [g/m²]	1 y	NOEC	≤ nominal 1.51*		≤ measured 2.00*				
Allolobophora chlorotica (Earthworm)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance adult [individual/m²]	1 y	NOEC	≥ nominal 7.55	1.96 (1.15 % TOC)	≥ measured 9.98	Field study/natural soil (Southern France): clay silt; 1.15 % mean TOC (0-10 cm), 8.4 % sand, 72.2 % silt, 19.6 % clay; 36.6 % MWHC, pH 6.26	Z	R3/C1	Hamberger (2011a) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.162; Anonymous (2011a) cited in (BASF 2021), BASF DocID 2011/1000044
		biomass adult [g/m²]		NOEC	≥ nominal 7.55		≥ measured 9.98				
Aporrectodea caliginosa (Earthworm)	BAS 455 48 H (452.9 g/L pendimethalin, measured)	abundance adult [individual/m²]	1 y	NOEC	≥ nominal 7.55	1.96 (1.15 % TOC)	≥ measured 9.98	Field study/natural soil (Southern France): clay silt; 1.15 % mean TOC (0-10 cm), 8.4 % sand, 72.2 % silt, 19.6 % clay; 36.6 % MWHC, pH 6.26	Z	R3/C1	Hamberger (2011a) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.162; Anonymous (2011a) cited in (BASF 2021), BASF DocID 2011/1000044
		biomass adult [g/m²]		NOEC	≥ nominal 7.55		≥ measured 9.98				
Lumbricus friendi (Earthworm)	BAS 455 48 H (452.9 g/L	abundance adult [individual/m²]	1 m	NOEC	nominal 3.02*	1.96 (1.15 % TOC)	measured 4.00*	Field study/natural soil (Southern France): clay silt; 1.15 % mean TOC (0-	Z	R3/C1	Hamberger (2011a) cited in (EC 2021), Vol. 3CP B.9.7.1.3, p.162;

Species (Taxonomic group)	Test substance	Measured effect[7]	Duration	Type of effect concentration	Effect value [mg a.s./kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
	pendimethalin, measured)	biomass adult [g/m²]		NOEC	nominal 3.02*		measured 4.00*	10 cm), 8.4 % sand, 72.2 % silt, 19.6 % clay; 36.6 % MWHC, pH 6.26			Anonymous (2011a) cited in (BASF 2021), BASF DocID 2011/1000044
Soil macro and microorganisms	BAS 455 48 H (452.9 g/L pendimethalin, measured)	organic matter breakdown (mean mass loss)	1 y	NOEC	< 1.66 (Appl. rate: 1 L product/ha incorporated in 10 cm + 4.5 L product/ha oversprayed)	1.13 (mean 0.665 % TOC)	< 4.99	Field study/natural soil (Brandenburg, Germany): loamy sand, pH 4.95-5.13, 26.9-27.9 % MWCH, 0.65-0.68 % TOC, 7.0-7.4 % clay, 21.2-24.5 % silt, 68.5-71.4 % sand	V	R3/C2	Brockmann (2011a) cited in (EC 2021), Vol. 3CP (BAS) B.9.7.2, p.172; Anonymous (2011c) cited in (BASF 2021), BASF DocID 2010/1000121

Notes A1: Notes on soil studies for pendimethalin.

A	The results are corrected to the purity of the test item (93.3 %).
B	Full study report is available in the newly submitted dossier (BASF 2021). The study summary has not been commented on in the dRAR (EC 2021), therefore the evaluation was conducted by the Ecotox Centre. The density of the formulation was not reported. The concentrations as mg a.s./kg soil are based on a formulation density of 1.179 kg/L that was taken from the nitrogen transformation study (Schulz 2008a) that used the same batch of the same formulation.
C	A poorly summarised study in the dRAR (EC 2021). OM content is listed in the LoEP only. There is a statistically significant NOEC, but its reliability cannot be checked in the absence of detailed results. EC10 of 49.0 mg a.s./kg soil is reported in section B.9 – based on the colour-coding – as a change that was made in September 2015. The endpoint first appeared in the revised RAR (2021) as a corrected value (to 24.5 mg a.s./kg soil), but the correction is not noted in the LoEP. Confidence intervals, EC20/50 values, detailed results are not reported (effects per cc.). Curves were not provided and the fits could therefore not be checked (not even by the RMS). The study was not submitted in the new dossier (BASF 2021).
D	The application was sprayed over the surface of the 5 cm deep wet soil layer in the containers, without mixing, after the earthworms had been added and let burrow into the soil. This is not considered as a worst-case scenario that would involve homogenous incorporation. The study was refused for use in the prospective risk assessment. No adult mortality occurred (28 d). No effects on adult growth (28 d). Statistically robust reproduction NOEC (13 % effects) at 12 L/ha = 4.8 kg a.s./ha = 16 mg a.s./kg soil (based on 402 g a.s./L, 200 cm^2 surface of the vessels with 600 g soil dw in each). Mean reproduction effects at the highest cc. > 50 %, but probably not high enough for calculating a statistically robust EC50. Only EC10 and EC20 are reported. The confidence intervals are very wide and they very much overlap (EC20low < EC10median) thus the EC10 is not considered reliable.
E	The application was sprayed over the surface of the 5 cm deep soil layer in the containers, without mixing, after the earthworms had been added and let burrow into the soil. This is not considered as a worst-case scenario that would involve homogenous incorporation. In the 2015 version of the dRAR (EC 2015) it was still considered acceptable for use in the

	RA. There is no updated version from 2021 for this product dossier. The effect concentrations are based on the actually measured a.s. content of the product used in the study (396.6 g a.s./L).
F	The assessment from the (EC 2021) report was adopted and accepted without additional assessment (i.e. at face value). The results were re-calculated according to the actual measured active substance content of the applied formulation (if it was available) thus slight differences to the EU-listed endpoints may occur (if they used the nominal a.s. content).
G	Four tests are included in the study, one each with earthworms, springtails, woodlice and non-target plants (Belden *et al.* 2005). The applied methods and the results are not reported in sufficient detail to consider reliability of the data on woodlice and plants. The detailed results at different concentrations, also the details of the statistical analysis (e.g. fitted curves) were not reported, therefore the EC50 results cannot be confirmed. Along with the wide spacing of the test concentrations, the reliability of the EC50 results cannot be considered. Altogether they are scored as not assignable (R4). Pendimethalin concentrations were verified in the tests according to the Materials and Methods section but the results were not reported. It is noted though that analytical verification is not a requirement in the respective OECD guidelines for soil macroorganisms. Furthermore, the available pdf of the article is faulty, one result page appears twice, while another one is missing (including the figure of the earthworm and probably the analytical results). Unfortunately neither the authors nor the journal has an archive copy with the original content. ***Earthworms:*** The tested concentrations were 10, 40 and 160 mg a.s./kg soil and solvent control. There was 1500 % growth of juveniles in the control, while statistically significant reduction of weight gain (17%) was observed even at 10 mg a.s./kg soil. No mortality occurred in the control and at 10 mg a.s./kg soil, while 5 and 10 % mortality could be observed at 40 and 160 mg a.s./kg soil concentrations, respectively. Due to the low number of test concentrations along with the high spacing factor, the EC50 result cannot be considered reliable. On the other hand, the 21-day juvenile growth does not cover long-term effects and its relevance at population level is not clear. Therefore it is considered as a short-term endpoint in between the acute (mortality, 14 d) and chronic (28-d adult mortality, 56-d reproduction) test protocols. Considering the unusual type of measured effect along with the fact that there was significant effects even at the lowest test concentrations, the NOEC is not considered directly appropriate for SGV derivation. ***Springtails:*** The tested concentrations were 10, 30 and 90 mg a.s./kg soil and solvent control. Although the detailed numbers were not reported, it looks from the presented figure that the test likely met the validity criteria of the respective OECD 232 guideline – with modifications considering that the test used solo females per jar (i.e. in the control no mortality occurred; approx. 60-75 offspring/female were produced; based on the deviation in the control, the CV must have been < 30 %). While the reproduction was highly reduced at 90 mg a.s./kg soil, no mortality occurred in the treatments and the control. Due to the wide spacing of the test concentrations, the NOEC cannot be used directly for SGV derivation and the EC50 is not considered reliable. ***Woodlice:*** Wild-caught animals with unknown background and age were used, therefore the results are not considered reliable. Likely due to the faulty pdf version published online, the woodlice results are not discussed. As no LOEC could be reported it is deemed that the 200 mg a.s./kg soil was the highest concentration tested. Therefore the respective NOEC is included here as an equal-to/higher-than value. ***Non-target plants:*** Low/varying seedling emergence was reported at the lower test concentrations for the prairie grasses, therefore no reliable NOEC could be derived for seedling emergence and growth for these species. It seems that the tested concentrations were as follows: 1, 4, 16, 64, 256 mg a.s./kg soil. While the spacing between the test concentrations is somewhat wider than recommended in the respective OECD 208 guideline, it is not unsreasonable (4x instead of ≤ 3x). The seedling emergence was above 90 % for lettuce up to 64 mg a.s./kg soil and no germination occurred at 256 mg a.s./kg soil. The germination time of lettuce is usually 7-14 days depending on the soil temperature. Due to the short test duration (7 d) it is not clear if germination was fully prevented or just delayed at the highest test concentration. Thus the short test duration questions both the relevance and the reliability of the lettuce results.
H	As the reproduction effects just reached 50 % at the highest test concentration along with mortality of 20 %, no EC50 and in turn no statistically robust EC10 could be calculated. Also the fit of the curves for the EC10 and EC20 values calculated by the applicant could not be checked as the fitted curves were not provided. As a result, the statistically robust NOEC is considered as the most reliable endpoint (with no re-calculation of the ECx values).

	It is noted that the reproduction NOEC was used in the EU risk assessement according to the EFSA conclusion (EFSA 2016, but probably based on results earlier from 2015), but that was changed to the EC10 at the end of 2015 (according to the green colour-coding) as appeared in the updated dRAR in 2021.
J	The study is not well-reported with lots of missing information, e.g. the length of the chronic test, the amount of soil used in the test (that would be needed to convert the rate to concentration) etc.
K	There was no dose-response for any of the measured effects, there are no significant effects at the highest test cc. (with 16 % effects at the second highest cc. as the overall highest effect occurred). Therefore it is not clear how EC10 and EC20 values could be calculated and accepted (ECx values were calculated and submitted separately, they are not included in the study report nor in the newly submitted dossier). The confidence intervals of the EC10 and EC20 values are largely overlap. Overall the EC10 is not considered reliable. It was noted in the dRAR that “The curves were not provided and the fits could therefore not be checked by the RMS.” Additionally it must be noted that the EC10 value was accepted and considered further in the EU risk assessment.
L	Study not included in the dRAR (EC 2015, 2021), but in the newly submitted dossier (BASF 2021), therefore the evaluation was conducted by the Ecotox Centre.
M	The study is not well reported. Concentration in terms of mg a.s./kg soil dw cannot be calculated as the given information does not allow it: at the recommended field application rate (1 kg a.s./ha for pendimethalin) it was mixed in 1 kg air-dried soil. Significant increase in the measured parameters at all sampling points.
N	Study is not well reported. Concentration in terms of mg a.s./kg soil dw cannot be calculated. (The amount of a.s. corresponding to 1 kg a.s./ha was incorporated in 250 g soil.) The higher N_2-fixation in pendimethalin treatment from 30th to 60th day of sampling, despite lower number of bacteria as compared to quizalofop and their combined application, indicated that pendimethalin induced the efficiency of the bacteria rather than their growth and multiplication.
NN	Instead of organic matter content, only percent of oxidisable organic carbon is provided. The history of the sampled sites, i.e. the previous possible contamination of the soil, was not reported.
O	Measured effects: Urease activity and nitrification of urea nitrogen in soil. As long-term effects are considered the most relevant, only the nitrification results after 21 d are reported here. It is noted that the test is still shorter than the OECD guideline requirement (28 d plus extension if there are effects > 25 % after 28 d). The contamination status of the natural soils used is not reported.
P	Not reported in sufficient detail (i.e. methods, results, statistics). Based on the product (Stomp 330, BASF) for which the BASF Safety Data Sheet provides 31.55 % (w/w) pendimethalin content, in the test 1.67 and 3.34 kg a.s./ha was used. However, as the results cannot be calculated in the absence of the soil OM content and used in a meaningful way, the rate is listed in the table as given in the paper.
Q	Study is not well reported, information on test item, test soil etc. is incomplete.
R	The test item was applied post emergence via over-spraying the seedlings, therefore it is not relevant for deriving a soil-exposure based SGV. Also the cc. cannot be determined due to the uncertain amount of interception, even if 10 cm soil layer would have been assumed. (The study report was additionally checked for details of the method and the results.)
S	The test item was applied onto the soil surface shortly after placing the seeds into the soil. (The scoring in brackets means that study report was additionally checked for details of the method and the results by the Ecotox Centre.) If the application was given in rates (e.g. as g a.s./ha), the respective effect concentration (as mg a.s./kg soil) was calculated using the reported depth or assuming an average 10 cm depth of the containers. For further explanation on the parameters used, please refer to Appendix 1.

	Phytotoxicity effects are measured half-quantitatively by subjective visual assessment. The reliability of the subjective visual assessment cannot be determined therefore the reliability of these results cannot be assigned (R4). The symptoms included chlorosis, stunting, deformation and necrosis at various levels.
T	Non-crop plant study from literature. It is noted by the RMS in the BAS PPP document (2021), that the study endpoints are much (100x) lower than the regulatory endpoints. Although the endpoints are of questionable quality they still can indicate that non-crop plants may exhibit higher sensitivity than crop species. Issues: non-crop seedlings were oversprayed - not relevant route of exposure; no NOECs/detailed results are reported for the definitive test; the range-finding test was evaluated qualitatively; the soil used in the test was not characterised; the pendimethalin product used in the test was not properly characterised.
U	Non-target grass study from literature. Limit test with one concentration. The study is not reported in sufficient detail (no OM/OC for the soil, also the depth of soil is missing). The following is included in the dRAR (EC 2021): “The endpoints may not be of sufficient quality to be used in a quantititative risk assessment. However, clear effects on several species of grasses were seen at the tested dose of 300 g a.s./ha”. It was also concluded that the regulatory studies potentially underestimate the risk to NTPs. – It should be noted, however, that for the SGV derivation the in-crop data is considered relevant and that would be covered by the results on the tested crop species.
V	The applied plateau concentration was calculated for the 0-20 cm soil layer, while the actual application for the 0-10 cm soil layer. The analytical verification for this litterbag test was based on the upper 10 cm soil layer, therefore this depth was used also for the calculation of nominal concentrations in the soil. The analytical recovery was 56 % on average (47-67 %) for applying the plateau concentration and 87 % (71-100 %) after the main application (i.e. the second application applied after applying the plateau concentration). The treatment significantly enhanced the organic matter breakdown compared to the control after 3, 6 and 12 months (by 16.3, 10.0 and 14.0 %, respectively). Slightly higher moisture content of the treated site (mean 9.2 vs 8.6 %) was observed that could be caused by the higher amount of roots in the layer of litterbags in the control plot. According to the study author the differences observed in soil moisture content and root penetration indicate that the differences in the organic matter breakdown were not directly related to the treatment. Due to lack of repeated analytical verification at later sampling times, the results are not considered suitable for use in a retrospective risk assessment.
W	In the OECD 216 nitrogen transformation study the 0-28 d nitrogen transformation rates are compared to the control (see explanation provided in Appendix 1). The deviations in percentage are expected to be < 25 %. In the Schulz (2008a) study there were 7 and 10 % deviation from the control for the 0-28 d interval at 6.91 and 34.55 mg product/kg soil concentrations (corresponding to 13.3 and 2.66 mg a.s./kg soil). In the Schulz (2013) study, there were 4.5 and 7.5 % deviation from the control for the 0-28 d interval at 5.73 and 28.67 mg product/kg soil concentrations (corresponding to 2.20 and 11.0 mg a.s./kg soil).
X	Details of the methods and results to the US EPA studies are not available therefore their relevance and reliability cannot be determined.
Y	One spray application on bare soil following the seeding of sunflower as green cover at rates of 5.0, 10 and 25 L formulation/ha. As the initial analytical verification of the test item was based on the upper 10 cm layer, the nominal and measured test concentrations are calculated based on the measured a.s. content of the test item used and the upper 10 cm soil layer. Reference item: instead of carbendazim, thiophanate-methyl was used. Carbendazim is the major metabolite of thiophanate-methyl with 76 % max. formation after 7 days. However, there is no official reference values of the toxic effects of thiophanate-methyl should result in. Mean TOC calculated for 0-20 cm soil layer, no information on the 0-10 cm soil layer. Using a less representative TOC value (it is usually lower including lower soil layers) makes the normalised endpoints higher and as a result the toxicity of the substance can be underestimated.

	Significant effects of the test item on adult *L. terrestris* abundance and//or biomass after one month at all test concentrations. Although recovery occurred later, recovery is not acceptable for retrospective risk assessment thus the study results are not suitable for further consideration.
Z	One-year long field study with three rates of 5, 10 and 25 L formulation/ha. Deviations within control/treatments were sometimes very high, around 50 % that can prevent showing statistically significant effects. This could lead to statistically non-significant but considerable ~ 40 % effects on tanylobous juvenile abundance and biomass, on anecic adult abundance and biomass as well as on *L. friend* abundance and biomass. These statistically non-significant effects are still considered in the tabled results but marked with an asterisk. In this study tanylobous juveniles could mostly be the *Lumbricus friendi* specimen that were almost solely identified as tanylobous adults. There was statistically non-significant but > 40 % decrease in abundance and biomass of adult *L. friendi* as well as non-significant but > 50 % decrease in abundance of tanylobous juveniles at the two lower concentrations and > 40 % decrease in biomass of tanylobous juveniles at all three concentrations after a year. At the highest concentration there were statistically significant effects on tanylobous juvenile abundance after a year. The relevant TOC for 0-10 cm (i.e. 1.15 %) was given and thus used for normalisation of the results. As there were significant and non-significant but high (> 40 %) effects after one month and significant effects even after a year, the results are not considered suitable for SGV derivation. For further general consideration on field studies and their potential use for SGV derivation, please refer to Appendix 1.

Appendix 3 Data on the metabolites

Table A3: Soil effect data for M455H001 (P44, CL99900, Reg. No. 4108474), a transformation product of pendimethalin. Values resulting from calculations are shown with three significant figures. The lowest effect datum per organism is shown in bold. Unreliable, not relevant and not assignable data are greyed out. Abbreviations: n.r. – not reported; n.a. – not applicable; WHC – water holding capacity; OC – organic carbon; OM – organic matter; CFU – colony forming units. For notes, please refer to the end of Appendix 3 (Notes A2).

Species (Taxonomic group)	Measured effect[8]	Duration	Type of effect concentration	Effect value [mg metabolite/kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida (Earthworm)	mortality	28 d	NOEC	≥ 64	5	≥ 43.5	Artificial soil: 57-58 % MWHC, pH 5.7-6.0	F, XX	1	Friedrich (2011a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.233
Eisenia fetida (Earthworm)	adult biomass change	28 d	NOEC	≥ 64	5	≥ 43.5	Artificial soil: 57-58 % MWHC, pH 5.7-6.0	F, XX	1	Friedrich (2011a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.233
Eisenia fetida (Earthworm)	reproduction	56 d	NOEC	32	5	21.8	Artificial soil: 57-58 % MWHC, pH 5.7-6.0	F, XX	1	Friedrich (2011a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.233

[8] DE – diversity endpoint, EE – enzymatic endpoint, FE – functional endpoint

Species (Taxonomic group)	Measured effect[8]	Duration	Type of effect concentration	Effect value [mg metabolite/kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida **(Earthworm)**	**reproduction**	**56 d**	**EC10**	**24.0**	**5**	**16.3**	**Artificial soil: 57-58 % MWHC, pH 5.7-6.0**	**F, XX**	**1 (R2/C1)**	**Friedrich (2011a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.233**
Microorganisms	**nitrogen transformation[FE]**	**28 d**	**≤ 25 % effect**	**5.02**	**2.31 (1.36 % OC)**	**7.38**	**Natural soil from untreated agricultural area: sandy loam, pH 6.3, 46-49 % MWCH**	**F**	**1**	**Schulz (2011a) cited in (EC 2021), Vol. 3CA B.9.5, p.240**
Microorganisms	**carbon transformation[FE]**	**28 d**	**≤ 25 % effect**	**5.02**	**2.31 (1.36 % OC)**	**7.38**	**Natural soil from untreated agricultural area: sandy loam, pH 6.3, 47-50 % MWCH**	**F**	**1**	**Schulz (2011b) cited in (EC 2021), Vol. 3CA B.9.7.1, p.244**

Table A4: Soil effect data for M455H033 (P48, former M12, Reg. No. 4295966), a transformation product of pendimethalin. Values resulting from calculations are shown with three significant figures. The lowest effect datum per organism is shown in bold. Unreliable, not relevant and not assignable data are greyed out. Abbreviations: n.r. – not reported; n.a. – not applicable; WHC – water holding capacity; OC – organic carbon; OM – organic matter; CFU – colony forming units. For notes to the studies, please refer to the end of Appendix 3 (Notes A2).

Species (Taxonomic group)	Measured effect[9]	Duration	Type of effect concentration	Effect value [mg metabolite/kg soil]	Total OM [%]	Normalised effect value [mg a.s./kg soil] 3.4 % OM	Test soil	Notes	Assessment score	Source
Eisenia fetida (Earthworm)	mortality	28 d	NOEC	≥ 200	10	≥ 68.0	Artificial soil: 54-55 % MWCH, pH 5.7-6.1	F, XX	1	Friedrich (2013a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.235
Eisenia fetida (Earthworm)	adult biomass change	28 d	NOEC	100	10	34.0	Artificial soil: 54-55 % MWCH, pH 5.7-6.1	F, XX	1	Friedrich (2013a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.235
Eisenia fetida (Earthworm)	reproduction	56 d	NOEC	25	10	8.50	Artificial soil: 54-55 % MWCH, pH 5.7-6.1	F, XX	1	Friedrich (2013a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.235
***Eisenia fetida* (Earthworm)**	**reproduction**	**56 d**	**EC10**	**14.9**	**10**	**5.07**	**Artificial soil: 54-55 % MWCH, pH 5.7-6.1**	**F, XX**	**1 (R2/C1)**	**Friedrich (2013a) cited in (EC 2021), Vol. 3CA B.9.4.1.2, p.235**
Microorganisms	**nitrogen transformation[FE]**	**42 d**	**≤ 25 % effect**	**5**	**2.04 (1.2 % OC)**	**8.33**	**Natural soil from untreated agricultural area: sandy loam, pH 7.05, 38-41 % MWCH**	**F**	**1**	**Schöbinger (2012a) cited in (EC 2021), Vol. 3CA B.9.5, p.237**
Microorganisms	**carbon transformation[FE]**	**28 d**	**≤ 25 % effect**	**5**	**2.04 (1.2 % OC)**	**8.33**	**Natural soil from untreated agricultural area: sandy loam, pH 7.00, 37-40 % MWCH**	**F**	**1**	**Schöbinger (2012b) cited in (EC 2021), Vol. 3CA B.9.7.1, p.242**

Notes A2: Notes on soil effect data for pendimethalin metabolites.

F	The assessment from the (EC 2021) report was adopted and accepted without additional assessment (i.e. at face value).
XX	It was noted by the RMS that curves were not provided and thus the fitting could not be checked. Based on the summarised data, it is not possible to re-calculate the EC10. EC20 low is above the median EC10. The normalised width of the EC10 is "fair" (EFSA 2019). In addition, EC50 was also calculated and summarised. In general the study endpoints are accepted based on the study summary and the RMS' evaluation, but EC10 is surrounded by some uncertainties.

[9] DE – diversity endpoint, EE – enzymatic endpoint, FE – functional endpoint