The EU Pesticide Blacklist

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Content

Acronyms

ARfD	Acute Reference Dose
AOEL	Acceptable Operator Exposure Level
a.i.	(pesticide) active ingredient
ADI	Acceptable Daily Intake
BCF	Bioconcentration Factor
Cal P65	California's Proposition 65 - the Safe Drinking Water and Toxic Enforcement Act
CMR	Carcinogenicity, Mutagenicity, Reproductive and developmental toxicity
DAR	Draft Assessment Reports
EC50	Effective Concentration, 50%
ECHA	European Chemical Agency
EFSA	European Food Safety Authority
EU	European Union
EUDB	EU Pesticide Database
FAO	United Nation Food and Agriculture Organization
GHS	Globally Harmonized System
GUS	Groundwater Ubiquity Score
HHPs	Highly Hazardous Pesticides
IARC	International Agency for Research on Cancer
JMPM	The FAO/WHO Joint Meeting on Pesticide Management
LC50	Lethal Concentration, 50%
LD50	Lethal Dose, 50%
LOAEL	Lowest observed adverse effect
LR50	Lethal Rate, 50%
NOAEL	No Observed Adverse Effect Levels
NOEL	No Observed Effect Levels
PAN	Pesticide Action Network
POEA	Polyethoxylated Tallow Amines
SDS	Safety Data Sheet
TLI	Toxic Load Indicator
US-EPA	United States Environmental Protection Agency
WHO	World Health Organization

Foreword by publisher

The third edition of "The Blacklist of Pesticides" focuses on the 520 active ingredients authorized for use in the European Union. This catalogue of pesticides is not just a list of substances classified according to their potential human health and environmental hazard but foremost a tool to identify and discourage the use of pesticides with high toxicity. Since no criteria has been adopted yet to define endocrine disrupting chemical (EDC) pesticides the blacklist could not cover all potentially EDC pesticides. The list will in the future be broadened to include all pesticides with endocrine disrupting properties.

The study is an essential tool for producers, retailers and others in the food chain to immediately ban the most hazardous pesticide agents from the production chain. This first step is a vital one towards minimizing and ultimately replacing synthetic pesticides in farming with non-chemical practices where pests and diseases can be effectively managed.

Compared to the two previous versions of "The Blacklist of Pesticides", this new one takes into account extra criteria for hazard evaluation, updates all existing data and supplements the content with new material. For instance, further criteria to assess environmental impacts such as toxicity to aquatic and beneficial organisms have been added. New criteria have been included to judge pesticides' environmental fate, such as plant half life, leaching potential and volatility.

Greenpeace is active in putting pressure to reduce pesticide contamination of our food and the environment. Exceedances of the maximum residue levels have decreased but there are still several reasons for concern. Greenpeace and food safety agencies have repeatedly detected highly hazardous substances in end-products and the environment.

The overall use of pesticides in agriculture has not decreased at all, with overwhelming consequences for the environment. Numerous hazardous active substances are still being used on a large scale in European fields. Substances that can cause cancer, damage genes or disrupt the hormonal balance keep contaminating our soils and waters and affecting biodiversity and people, especially pesticides users, who are directly exposed to them.

Greenpeace has been calling for years to end the use of synthetic chemical pesticides in agriculture, starting from the most hazardous ones. This present study identifies which of the many pesticide agents currently authorized in the European market are the most dangerous and should be replaced as a matter of priority.

Another growing problem is multiple contamination by different pesticides. No toxicologist is able to predict now what kind of impact such pesticide cocktails of potentially harmful substances could have on human health or the environment. Such a striking lack of scientific knowledge about these risks highlights the need for urgent application of the precautionary principle. Multiple contamination must be avoided and, as an immediate first step, significantly reduced.

Unless under specific circumstances few of the pesticides on the blacklist are allowed in organic farming, but as Greenpeace recognizes that those which are used could cause problems it has called for more research so they can be replaced ecologically. Despite these concerns Greenpeace strongly believes that organic farming is on a progressive path towards effective sustainable farming, positively contributing to better soil, water, wildlife, environment and health compared to industrial agricultural practices.

Greenpeace regularly conducts testing of pesticide residues from our fields to the plate, working with farmers, retailers and politicians to reduce the overall use of pesticides and boost the adoption of ecological farming practices.

1. As a first step phasing out the 111 pesticides with at least 1 cut-off criteria for human health
2. As a second step phasing out the 62 pesticides with at least 2 cut-off environmental criteria
3. As a third step phasing out the remaining 36 pesticides, which are listed because of their high overall score.

Phasing out the most damaging pesticides must be seen only as a first move in the right direction. Long term we urgently need to move away from chemical pesticides. It is of great importance to avoid simplistic substitution effects such as using a less harmful substance, but in higher quantities. Pesticides should not be substituted with other pesticides but with better, more ecological farming practices.

Greenpeace calls on politicians, market actors, farmers and the research community to adopt the necessary changes that would drive agriculture away from its current dependency on synthetic chemical pesticides and fertilizers towards ecological farming practices.

Only ecological farming is able to protect ecosystems, food diversity and security.

01

Introduction

In February 2008, Greenpeace Germany published for the first time an evaluation of basically all marketed pesticide active ingredients globally. In 2010, the list was updated and evaluation parameters were added and modified. One of the objectives for developing such a list was to provide the organization with the necessary scientific basis to campaign on the reduction of pesticide residues in food. The list was aimed at German retailers which internally maintain negative/positive lists.

The initial idea was to have only one list with a scoring system (highest score= highest overall toxicity), with a pesticide with one unwanted property e.g. mutagenicity, but a low score for acute toxicity and environmental parameters would score better than a pesticide with higher scores in less severe categories.

According to this, the outcome of the Greenpeace evaluation was three different lists:

- a black list where a pesticide met one of several toxicity cut-off criteria or scored very high in the total ranking
- a grey list where pesticides, which did not meet cut-off criteria, were evaluated by a complex scoring system based upon 17 parameters
- a yellow list which contained all pesticides where not enough data was available.

After 2010, the original scoring system was used independently from Greenpeace by Lars Neumeister to develop an instrument called "Toxic Load Indicator" (TLI). The TLI is designed as an open source scoring system.

For the creation of a revised European Pesticide Blacklist for Greenpeace, the scoring system as applied for determining the Toxic Load Indicator and two additional criteria previously used (endocrine disruption, immunotoxicity [Sensitization]) are assessed to evaluate pesticides authorized for use in the European Union. The highest possible score for a pesticide active ingredient would be 176 points (see Annex 2).

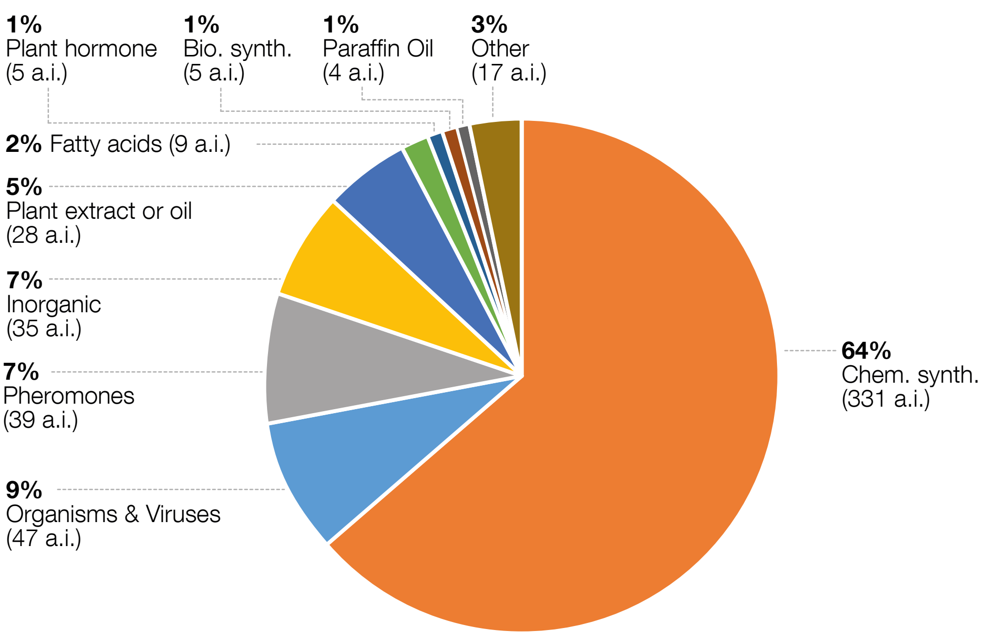
02

Database

The European Commission maintains an online pesticide database (EC 2016), which allows a complete data download and contains numerous information such as the authorization status, the hazard classification and data on some toxicological parameters (ADI, ARfD and AOEL values). A complete list of authorized pesticide active ingredients is also available in Annex I of the consolidated version (17th of September 2015) of Regulation (EU) No 540/2011. The Annex contains chemical identifiers such as CAS number, CIPAC number and the chemical name. Both data references were merged to create a starting list of EU approved pesticides. They usually do not contain all commonly marketed derivates (salts, esters, isomers etc.)[1]. Therefore, the list was edited accordingly using national authorization data.

Currently, about 520[2] active ingredients (a.i.)are authorized for used in the European Union. As can be seen in Figure 1, the majority of all authorized pesticides are of chemical-synthetic origin (64%). Inorganic substances, organisms and viruses, plant extract and pheromones together represent about 28%. The following figure shows the distribution of the currently approved pesticide by "chemical" type.

Figure 1: Distribution of all 520 currently approved pesticides (EU) by "chemical" type (own evaluation)

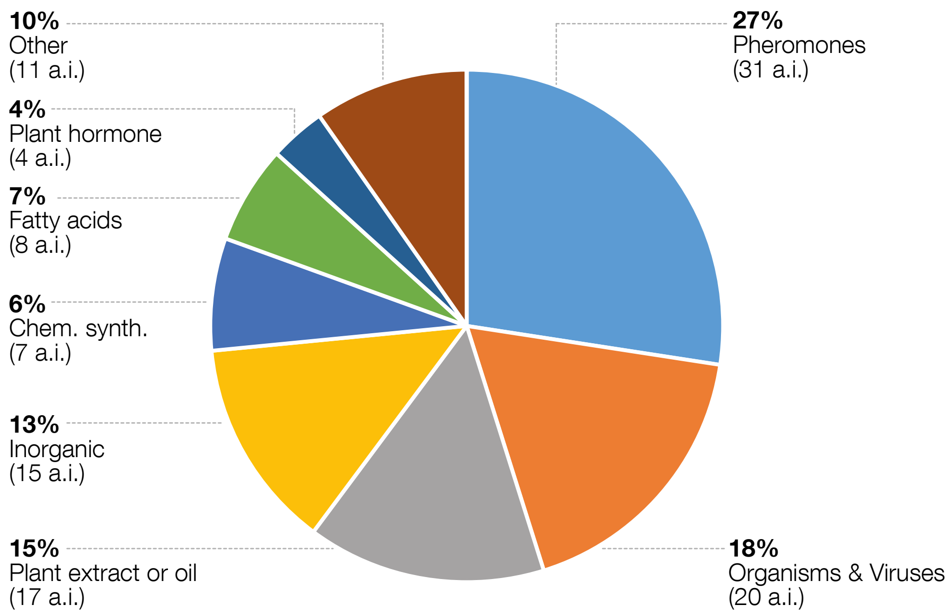


1 For example: glufosinate is listed, but the marketed formulation contains the salt glufosinate-ammonium.
2 The number depends on how the active ingredients are counted. The EU tables do not contain all marketed derivatives but in some cases the basic substance is not market relevant. We identified 520 relevant substances, including several marketed derivates and provisional authorizations.

The current list of approved pesticide active ingredients contains about[3] 110 “low risk”[4] pesticides. “Low risk” pesticide is the short term for pesticides active ingredients which either fulfill the criteria for indications of no harmful effects set by Commission Regulation (EC) No 1095/2007 or meet requirements set in point 5 of Annex II of Regulation (EC) 1107/2009 and were which were authorized under the former Directive 91/414/EEC (about 105 pesticides, mainly through Directive 2008/127/EC and 2008/113/EC) or under the current Regulation (EC) No 1107/2009 (five pesticides). With Regulation (EC) No 1107/2009 “Low-risk active substances” became a regulatory term.

Most of these “low risk” pesticides are pheromones, plant extracts or oils, organisms/viruses and inorganic substances, which together constitute over 70% of the “low risk” pesticides. Altogether, about 21% of all authorized pesticides are authorized as “low risk” pesticides.

Figure 2: Distribution of the currently approved “low risk” pesticides (EU) by “chemical” type (own evaluation)



3 There are several groups which may contain several substances like “Repellents by smell of animal or plant origin/ fish oil”, “Fat distillation residues” or “Straight Chain Lepidopteran Pheromones”.

4 Commission Regulation (EC) No 1095/2007 (4) as well as Annex II of Council Regulation (EC) No 1107/2009 define criteria for “low-risk active substances”.

03

Blacklist Criteria

Compared to the previous version of the Blacklist, the criteria/parameters for defining a black listed pesticide and for the scoring system are different. Table 1 shows a comparison between the previous and the revised parameters.

Table 1 Parameters evaluated by Greenpeace 2010 and 2016

Nr.	Criteria	Indicator	Applied 2010 (black listed [BL] and/or score)	Applied 2016 (black listed [BL] and/or score)
1	Health hazards	Acute toxicity (short term toxicity user)	BL & Scoring	BL & Scoring
2		Carcinogenicity	BL & Scoring	BL & Scoring
3		Mutagenicity	BL & Scoring	BL & Scoring
4		Reproductive and Developmental toxicity	BL & Scoring	BL & Scoring
5		Operator Toxicity (Acceptable Operator Exposure Level) and/ or Chronic Toxicity (long term toxicity, expressed as ADI) (minimum value)	Scoring	BL & Scoring
6		Immunetoxicity	Scoring	Scoring
7		Acute toxicity (short term toxicity consumer expressed as ARfD)	BL & Scoring	No
8		Neurotoxicity	BL	No
9		Corrosive properties	Scoring	No
10		Explosive properties	Scoring	No
11	Endocrine Disruption	Endocrine effects on human health and environment	BL & Scoring	BL & Scoring
12	Environmental toxicity	Aquatic toxicity (Algea)	No	BL & Scoring
13		Aquatic toxicity (Invertebrate, Fish)	BL & Scoring	BL & Scoring
14		Toxicity to birds	BL & Scoring	BL & Scoring
15		Toxicity to beneficial organism (predator, parasitoid)	No	BL & Scoring

16	Environmental toxicity	Toxicity to honey bees	BL & Scoring	BL & Scoring
17		Toxicity to earth worm (indicator for soil dwelling organisms)	BL & Scoring	No
18	Environmental fate	Bioaccumulation	BL & Scoring	BL & Scoring
19		Persistence	BL & Scoring	BL & Scoring
20		Leaching potential	No	Scoring
21		Volatility	No	Scoring
22		Plant Halflife	No	Scoring

Similar to the previous approach, a pesticide rating the maximum of ten (blacklist criterion) in one of the health hazard categories is black listed.

In the category "Environmental toxicity" and "Environmental fate", the previous approach used in 2010 is maintained: A pesticide qualifies as a black list pesticide when it scores highest of ten (cut-off criterion) in at least two of the following categories:

- Aquatic toxicity (Algae)
- Aquatic toxicity (Invertebrate [Daphnia], Fish)
- Toxicity to birds
- Toxicity to honey bees
- Toxicity to beneficial organism (commonly insect predators, parasitoids)
- Persistence
- Bioaccumulation

The criteria are revised as follows:

1. In the previous evaluation system, the environmental toxicity and the environmental behavior of pesticides were, compared to human health, under-represented. Now more information on ecotoxicity and environmental behavior is considered.

2. The evaluation for the acute toxicity has changed to the new GHS (as implemented by EU Regulation (EC) No 1272/2008) and the changed WHO classification (WHO 2009). Instead of individual GHS hazard classifications, the Acute Risk Category is used for the assessment. The highest Acute Risk Category for a given pesticide reflects the highest toxicity among all exposure pathways (oral, dermal, inhalation) and is used for the blacklist assessment. In the criterion acute toxicity, these adjustments generate for some highly toxic substances a lower score than before. However, the high toxicity of these substances (specifically to pesticides users) is now reflected in the new criterion "Acceptable Operator Exposure Level" (AOEL) (see below).

3 Neurotoxicity is not directly reflected anymore because of a lack of consistent data especially in the field of developmental neurotoxicity and a lack of specificity. About 30% of all newly authorized active ingredients appeared on the market after 2005 and they are not reflected by older or newer reviews on neurotoxicity (see for example Mokarizadeh et al. 2015; Corsini et al 2012; Grandjean 2013; Bjørling-Poulsen et al. 2008). Furthermore, scientific articles on neurotoxicity often assign specific effects to a whole group of pesticides (such as organophosphate, pyrethroids, dithiocarbamates etc. – see for example Shelton et al. 2014, Bjørling-Poulsen et al. 2008). That ample approximation only allows a "Yes" or "No" evaluation and does not reflect that individual pesticides within these groups may be more toxic than others.

An internal comparison of NOELs (No Observed Effect Levels) for effects on the nervous system and/or the thyroid[5] (based on the Draft Assessment Reports (DARs) created for the authorization procedure, EFSA 2014) with the EU ADI (EU DB (2016)) values showed that the ADIs seem to represent a useful indicator for specific neurotoxic effects under investigation (see Annex 3). The ADI is therefore used to reflect known neurotoxic effects, but also other potential chronic effects since it is based on results of a large number of toxicity tests.

In addition, the ADI is set for almost all active ingredients (while the ARfD is not), and the ADI is generally lower than the ARfD and thus more protective in most cases. The AOEL is newly introduced as evaluation criterion, it is derived in a very similar way to the ADI and correlates well with it. The ADI is in most cases (>75%[6]), lower than or equal to the AOEL, but in some cases ADI are not set, if consumer exposure is not anticipated. The AOEL presents risks to pesticides users better than the ADI. When both values exist, the lower value is used for the evaluation.

4 The acute earthworm toxicity was replaced by toxicity to beneficial organisms (parasitoids, invertebrate predator) important for natural pest control. Pesticides disrupting natural pest control can have severe effects on the agro-ecosystem and lead to even more pesticide use (see Reuter & Neumeister 2015). Additionally, the data on acute earthworm toxicity are less differentiated: Most values for Active Ingredients authorized in the EU given are ">500" or ">1000" (mg/kg; LC50 14 days) and the commonly tested compost worm (*Eisenia fetida*) is a rather insensitive test species (Shahla & D'Souza 2010, Pelosi et al. 2014).

5 Regarding the acute bird toxicity, the oral lethal dose for 50% of the tested bird population is used. The previously applied Hazardous Dose developed by Mineau et al. 2001 was not updated since its publication, and thus does not reflect pesticide newly marketed since 2001.

6 The evaluation for the aquatic toxicity is now based on lethal concentration for 50% of the tested populations (fish or invertebrate) and reduction of algae growth for 50% of the tested populations. For the ranking, the toxicity scale of the US EPA[7] is used. The previously applied Risk Phrases according to Directive 67/548/EEC were not very differentiated and did not allow a ranking below an LC/EC50 of 1 mg/L.

5 Bjørling-Poulsen et al. 2008 relates changes in the thyroid function to neurotoxicity.
6 ADI and AOEL values were downloaded from the EU Pesticide Database (EU DB 2016) and compared.
7 https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

7. The criterion "Explosive" became obsolete in the EU context, explosive pesticides are not authorized.

8. The scaling changes from a 0-5 ranking to the 1-2-5-8-10. That emphasizes higher toxicity and gives less weight to data gaps which have the default value of 5 out of 10 instead of 3 out of 5.

9. The previous Greenpeace blacklists evaluated pesticides marketed globally, for example in the USA. In order to achieve a good data coverage for the global list, some reference lists from US governmental or state authorities had been used (EPA TRI List; California's Proposition 65 List). These lists do not match completely with the list of EU authorized pesticides[8]. In addition, the EPA-TRI (2016) listings represent the lowest LOAEL in a specific effect category independent from the height of the dose causing that critical effect[9]. Reference doses (such as the ADI) derived from a NOAEL allow a better evaluation, because they are based on studies which delivered doses without an observed effect. The new Blacklist criteria apply the ADI instead of EPA-TRI and Californian Proposition 65 (OEHHA 2015) listings. A pre-check showed that all pesticides classified as "developmental toxin" by OEHHA (2015) or by EPA-TRI (2016) score "high" to "very high" under the criterion ADI/AOEL.

   For the new Blacklist, all underlying data can be found in publicly available online databases and lists – the Pesticide Properties Database maintained by the University of Hertfordshire (Lewis et al. 2016) as well as the EU Pesticide Database are accessible online (refer to EU DB (2016)) and contain all data used for the Blacklist evaluation[10].

8 Only 61 EU authorized pesticide are on the US EPA TRI List: https://www.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals and only 40 EU authorized pesticide are on the Prop 65 List http://oehha.ca.gov/prop65/prop65_list/Newlist.html.

9 The primary purpose of the US Toxic Release Inventory is the monitoring of emissions; the categorization of potential health effects serves as additional information.

10 For this evaluation a Microsoft Access Database containing the pesticides property database and the bio-pesticides property database was obtained (on 25.02.2016) from University of Hertfordshire.

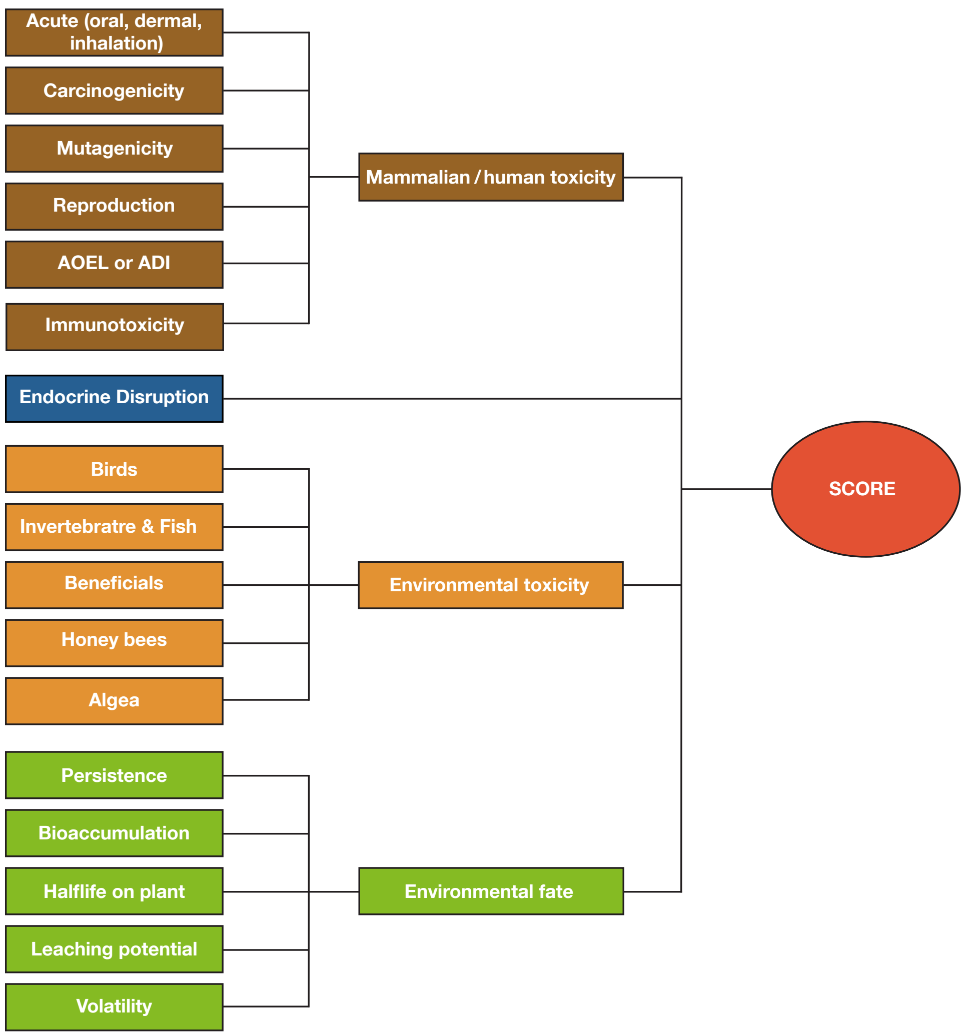
04

Scoring

In order to identify pesticides which may have a high total toxicity, but do not meet blacklist criteria, the scoring system is used to calculate a sum of scoring points based on toxicological and environmental data for all authorized pesticide active ingredients. The scoring system is described in detail in Annex 2.

Figure 3 gives a graphical overview of the criteria used for the scoring.

Figure 3: Criteria evaluated in the scoring system



05

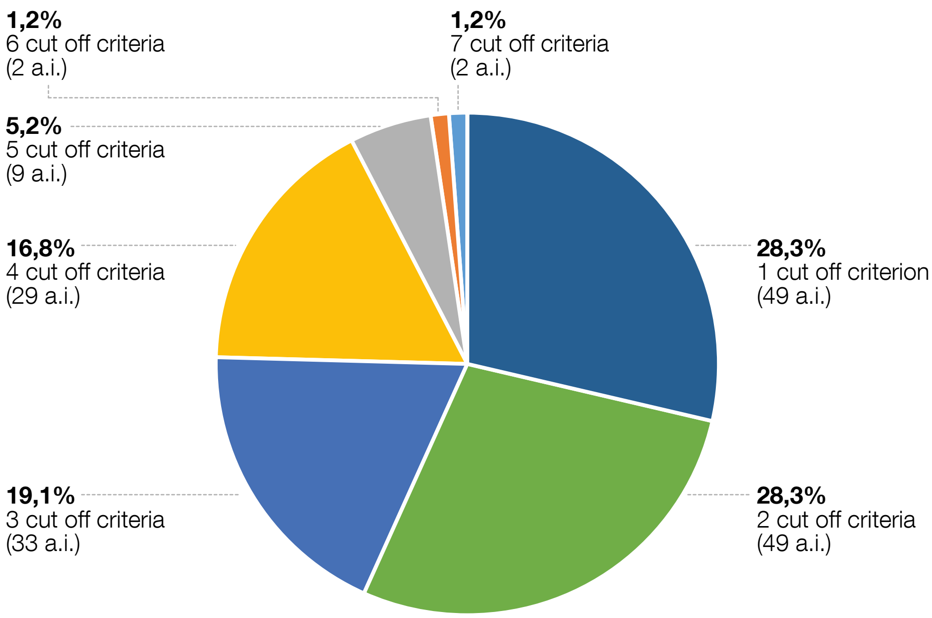
Results

Overall, the Blacklist contains 209 pesticide active ingredients (a.i.), which represent about 40% of all authorized pesticides in the European Union. Among these, 173 pesticides have such a high toxicity in at least one category that they meet the Blacklist cut-off criteria. Of these, 35 active ingredients meet at least one health cut-off criterion, 62 active ingredients meet at least two of the six selected environmental criteria and 76 active ingredients meet health and environmental criteria.

The following graph shows the number of pesticides by number of cut-off criteria, for example:

- two pesticides meet seven cut-off criteria,
- another two pesticides meet six cut-off criteria,
- and another nine pesticides meet five cut-off criteria.

Figure 4: Number of pesticide meeting "cut-off" criteria



Pesticides not meeting cut-off criteria were evaluated using the scoring system (see Annex 2) and were sorted by the total score. As in the previous blacklist the ten percent (n = 36 pesticides) with the highest score were added to the Blacklist. All pesticides classified as "Blacklist" pesticides are listed in Annex 1.

06

Limitations

The parameters to identify a Blacklist pesticide are limited to those for which data are publicly available and standardized testing procedures exist. That ensures maximum transparency, but has some limitations:

Scope

Adverse effects of pesticide use occur mainly through three factors or a combination thereof:

1. Scale of usage
2. Misuse and
3. Chemical properties including toxicity.

The first two factors are not addressed by this Blacklist, and a Blacklist is not the most suitable instrument to address these factors. A Blacklist is just one tool in a "pesticide reduction toolbox" and needs to be accompanied by other measurements (see for example Reuter & Neumeister 2015, Chapter Pesticide use and risk reduction).

Reliance on authorization data

The scoring of the Blacklist is largely based on the outcome of the European pesticide authorization and chemical registration process. Many data for these assessments derive originally from manufacturers who are obliged to submit data dossiers. The involved governmental risk assessment in these processes has some serious flaws (see for example: Knäbel et al. (2012); Knäbel et al. (2014) and Stehle & Schulz 2015 and further below). In some areas (eco-toxicity, environmental fate) independent research and regional monitoring, but also commonly observed effects (like the bee population decline) can trigger re-assessment of substances or the adjustment of the risk assessment. The attention to neo-nicotinoid pesticides due to their high bee toxicity caused, for example, a re-evaluation of imidacloprid and acetamiprid which resulted in the knowledge that both are developmental neurotoxins and require lower toxicological thresholds (EFSA 2013).

The situation is more complicated regarding potential chronic effects on human health. In order to observe such effects long term tests with mammals are usually needed, but these tests are not common among independent researchers (also for ethical reasons). Sometimes they conduct a long-term experiment with one particular pesticide, but a systematic independent assessment of all pesticides is not available.

The IARC assesses existing evidence on potential carcinogenic effects from independent research, but that is a very slow process: In the last 16 years only five pesticides were evaluated and at the time this was done all of them had been on the market for several decades.

Endocrine disruption

In 2000, the European Commission published a screening of chemicals for their potential to disrupt the endocrine system (EC 2000). The list was later prioritized (EC 2004, EC 2007) but never updated. In Regulation (EC) No 1107/2009 a preliminary identification of endocrine disruptors was published. For the assessment of effects of the endocrine system, the old list and the preliminary "definition" by Regulation (EC) No 1107/2009 are used. That is a rather limited approach, because pesticides entering the market after 2000 were not included in the early screening and the preliminary "definition" by Regulation (EC) No 1107/2009 has a narrow scope. However, validated data which would allow a better ranking of endocrine disrupting effects do not exist. The TEDX List of Potential Endocrine Disruptors[11] presents results from literature reviews and "should not be used as a method of ranking or prioritizing."

Developmental Immuno- and Neurotoxicity

Developmental Immunotoxicity (DIT) and Developmental Neurotoxicity (DNT) - while recognized to be of high importance – are not covered by risk assessment required for authorization (Hessel et al. 2015, Grandjean 2013, EFSA 2013). There are no systematic data on these two effects, therefore the Blacklist cannot consider these for evaluation today. A better risk assessment and more data are urgently needed in these areas. Developmental neurotoxicity can cause very serious effects on brain development, including learning and behavior, and adverse effects on the developing immune system can lead to life-long health problems.

Aquatic toxicity

The data for the environmental toxicity are based on endpoints for acute toxicity for a limited number of species. These species might not be the most sensitive species. Daphnia magna for example, as a standard test species for aquatic toxicity, seems to be particularly insensitive against neonicotinoids, which show high toxicity to other aquatic invertebrates (Morissey et al. 2015).

Insect toxicity

The evaluation for the Blacklist is reduced to a few species (usually one predatory mite and one parasitoid). That is not representative for all other species. Prabhaker et al. (2007 & 2011) tested the acute toxicity of nine insecticides to four parasitoid species, and it seems toxicity is species and pesticide specific. The toxicity to the most sensitive species compared to the most insensitive species can vary by a factor of more than 20.000, and a pesticide with lower toxicity to three parasitoids can show very high toxicity to the fourth.

Pesticide preparations

While the active ingredient is usually the effective (and most toxic) compound in a pesticide product, adjuvants added to the tank or "inert[12]" ingredient can enhance toxicity and change environmental behavior. Bonmatin et al. (2015) showed that commercial formulations may contain "inerts" that increase the solubility of the active substance, and one research group consistently found commercial pesticides products to have a higher leaching potential than the actual active ingredient (ibid. see also Krogh et al. 2003).

Brühl et al. (2013) have recently shown that juvenile frogs oversprayed with a fungicide product at recommended label rates caused surprisingly high mortality rates. The commercially available product Headline (pyraclostrobin and 67% naphta solvent) caused 100% mortality just after 1 hour

11 http://endocrinedisruption.org/endocrine-disruption/tedx-list-of-potential-endocrine-disruptors/overview

12 "Inert Ingredients" are for example: solvents, surfactants, and emulsifiers. They have a big variety of functions like preventing caking or foaming, extending product shelf-life, or allowing herbicides to penetrate plants to maintain and enhance the effect of the active ingredient.

at the label rate, the formulation with the lower (< 25%) naphta content revealed 20% mortality at the label rate. Other products caused 40% mortality in only 10% of the label rate. Earlier investigations confirm the relatively high amphibian toxicity of certain strobilurin fungicides (Hooser et al. 2012; Belden et al. 2010). Both studies show the outstandingly high toxicity of the product “Headline“. Publicly available toxicity information for pesticide formulations is generally limited to some acute effects. Information about the inert ingredients in pesticide formulations is not publicly available due to corporate confidentiality. In the EU, only ingredients classified as dangerous substances according to Regulation (EC) No 1272/2008 have to be specified, e.g. in the Safety Data Sheet (SDS) of the formulation.

Co-formulants (adjuvants) of glyphosate, polyethoxylated tallow amines (POEA) are long known to be of high toxicity and Germany decided to withdraw authorization for such substances[13].

Human chronic toxicity

Pesticide classification for human chronic toxicity is often retrospective. Epidemiological evidence for chronic effects of pesticides exists only for pesticides which are on the market for longer. That means pesticides which are not on the Blacklist are not automatically “harmless” – in many cases science has not yet focused on them.

Classification data delay

The process of classification and labeling by the European Chemical Agency (ECHA) seems to be particularly slow. More than 130 synthetic pesticides authorized for use in the EU are not classified according to Regulation (EC) No 1272/2008/EC[14] (incl. amendments). Among those unclassified pesticides are some which are on the market for decades (terbuthylazine, oxyfluorfen, bromadiolone, metiram) and some newer ones which seem to pose severe risks for human health and/or the environment (thiacloprid, emamectin benzoate). Missing classifications can lead to an over- or underestimation in the scoring system, because a default score of five is applied.

Cumulative Effects

The assessment for the Blacklist focuses on the individual pesticide active ingredients. Cumulative effects of marketed products containing one or several active ingredients, inerts, co-formulants, and/or tank mixes which may contain even more chemicals are excluded. Pesticides and other chemicals commonly occur together in the human body as well as in the environment (e.g. Reuter & Neumeister 2015), but an evaluation of potential cumulative effects would require an exposure assessment, because it is impossible to evaluate each combination of each chemical.

13 BVL: http://www.bvl.bund.de/DE/04_Pflanzenschutzmittel/06_Fachmeldungen/2011/2011_12_05_Fa_streichung_zusatzstoffe.html

14 Regulation (EC) No. 1272 / 2008 on the classification, labelling and packaging of substances and mixtures.

07

Literature

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Annex 1:

Greenpeace Blacklist 2016

			Mammal toxicity						Environmental Toxicity, Bioaccumulation, Persistence						
	Active Ingredient	**Score**	**Acute Tox.**	**Carcinogenicity**	**Repro. Tox.**	**Mutagenicity**	**AOEL /ADI**	**EDC**	**Algae**	**Daphnia/Fish**	**Birds**	**Bee**	**Beneficial**	**Bioaccumulation**	**Persistence**
	Fumigants														
1	Aluminum phosphide									10		10			
2	Metam-Potassium			10											
3	Metam-sodium			10			10	10							
4	Phosphine	**82,8**													
5	Sulfuryl fluoride	**77,5**													
	Fungicides														
6	Ametoctradin; BAS 650 F									10			10		
7	Amisulbrom									10					10
8	Benthiavalicarb-isopropyl			10											
9	Bixafen									10				10	10
10	Bordeaux mixture									10					10
11	Boscalid	**80,1**													
12	Bupirimate	**74,7**													
13	Captan	**77**													
14	Carboxin						10								
15	Chlorothalonil			10			10			*10*					
16	Copper hydroxide								10	10					10
17	Copper oxychloride												10		10
18	Cyflufenamid	**78,7**													
19	Cyproconazole	**82,4**													
20	Cyprodinil	**80,4**													
21	Difenoconazole	**80,7**													
22	Dimoxystrobin						10	10		10					10
23	Disodium phosphonate												10		10
24	Dodine								10	10					
25	Epoxiconazole			10	10		10								*10*
26	Famoxadone						10		10	10			10	10	
27	Fenbuconazole						10								
28	Fenpropidin								10				10		
29	Fenpropimorph						10								
30	Fluazinam						10			10				10	
31	Fludioxonil	**77,6**													

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Total # Pesticides: 209

Greenpeace Blacklist 2016

			Mammal toxicity						Environmental Toxicity, Bioaccumulation, Persistence						
	Active Ingredient	**Score**	**Acute Tox.**	**Carcinogenicity**	**Repro. Tox.**	**Mutagenicity**	**AOEL /ADI**	**EDC**	**Algae**	**Daphnia/Fish**	**Birds**	**Bee**	**Beneficial**	**Bioaccumulation**	**Persistence**
32	Fluopicolide	**81,6**													
33	Fluopyram	**76,6**													
34	Fluoxastrobin	**74,7**													
35	Fluquinconazole						10								*10*
36	Fluxapyroxad												10		10
37	Fuberidazole						10								
38	Imazalil			10											*10*
39	Ipconazole	**74,4**													
40	Iprodione			10											
41	Iprovalicarb			10											*10*
42	Isopyrazam			10						10					10
43	Kresoxim-methyl			10											
44	Mancozeb			10				10		*10*					
45	Maneb			10				10	10	10					
46	Mepanipyrim			10											
47	Meptyldinocap						10			10				10	
48	Metalaxyl	**77,9**													
49	Metiram			10				10							
50	Metrafenone													10	10
51	Myclobutanil	**79,9**													
52	Penconazole	**84,9**													
53	Pencycuron	**73,6**													
54	Picoxystrobin									10			10		
55	Prochloraz								10						10
56	Propiconazole												10		10
57	Propineb			10			10								
58	Proquinazid	**78,2**													
59	Pyraclostrobin									10				10	
60	Pyrimethanil	**74,7**													
61	Quinoxyfen									10			10	10	10
62	Sedaxane			10											*10*
63	Spiroxamine								10				10		
64	Tebuconazole	**78,9**													

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Total # Pesticides: 209

Greenpeace Blacklist 2016

	Active Ingredient	Score	Mammal toxicity						Environmental Toxicity, Bioaccumulation, Persistence						
			Acute Tox.	Carcinogenicity	Repro. Tox.	Mutagenicity	AOEL /ADI	EDC	Algae	Daphnia/Fish	Birds	Bee	Beneficial	Bioaccumulation	Persistence
65	Terrazole; Etridiazole			10									*10*		
66	Tetraconazole						10						10		10
67	Thiophanate-methyl			10											
68	Thiram							10		*10*					
69	Tolclofos-methyl	**77,2**													
70	Triadimenol	**80,6**													
71	Triazoxide						10			10					10
72	Trifloxystrobin								10	10			10		
73	Triflumizole												10	10	
74	Triticonazole												10		10
75	Ziram						10			*10*					
	Herbicides														
76	2,4-DB							10							
77	Aclonifen													10	10
78	Amitrole*						10	10					10		10
79	Benfluralin						10			10			10	10	
80	Bifenox								10				10	10	
81	Bromoxynil	**78,2**													
82	Chlorotoluron							10							*10*
83	Cyhalofop-butyl						10						*10*		
84	Diclofop						10								
85	Diflufenican								10	10				10	10
86	Diquat dibromide						10						10		10
87	Diuron			10			10		*10*						
88	Ferrous sulfate									10				10	10
89	Flufenacet						10		10				10		10
90	Flumioxazin				10		10		*10*						
91	Fluometuron						10								*10*
92	Fluorochloridone								10						10
93	Foramsulfuron												10		10
94	Glufosinate-ammonium				10		10						*10*		
95	Glyphosate			10											
96	Haloxyfop-R						10						*10*		

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* Authorization expired. Maximal period of grace: 30.09.2017

Total # Pesticides: 209

Greenpeace Blacklist 2016

	Active Ingredient	Score	Mammal toxicity						Environmental Toxicity, Bioaccumulation, Persistence						
			Acute Tox.	Carcinogenicity	Repro. Tox.	Mutagenicity	AOEL /ADI	EDC	Algae	Daphnia/Fish	Birds	Bee	Beneficial	Bioaccumulation	Persistence
97	Haloxyfop-R-methyl						10			10			10		
98	Imazaquin												10		10
99	Isoproturon*	**73,7**													
100	Isoxaflutole			10											
101	Lenacil								10						10
102	Linuron				10		10	10					*10*		
103	Metazachlor	**77,2**													
104	Metobromuron						10								
105	Metribuzin							10							
106	Oryzalin			10											
107	Oxadiazon			10			10		10						10
108	Oxyfluorfen			10			10							*10*	
109	Pendimethalin								10				10	10	
110	Penoxsulam	**74,7**													
111	Picloram							10							*10*
112	Picolinafen								10					10	
113	Profoxydim						10	10							
114	Propaquizafop	**75,7**													
115	Propyzamide												10		10
116	Prosulfocarb						10							10	10
117	Prosulfuron								10						10
118	Pyraflufen-ethyl			10					10				10		
119	Quinoclamine						10			10		10			
120	Quizalofop-P-ethyl						10								
121	Quizalofop-p-tefuryl				10										
122	Sulcotrione						10								
123	Tembotrione						10						10		10
124	Terbuthylazine						10								
125	Topramezone						10								*10*
126	Tralkoxydim						10								*10*
127	Tri-allate								10	10				10	10
128	Triclopyr	**74,6**													

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* Authorization expired. Maximal period of grace: 30.09.2017

Total # Pesticides: 209

Greenpeace Blacklist 2016

	Active Ingredient	Score	Mammal toxicity: Acute Tox.	Carcinogenicity	Repro. Tox.	Mutagenicity	AOEL /ADI	EDC	Environmental Toxicity, Bioaccumulation, Persistence: Algae	Daphnia/Fish	Birds	Bee	Beneficial	Bioaccumulation	Persistence
	Insecticides; Acaricides														
129	Abamectin		10				10			*10*					
130	Acrinathrin						10		10	10		10	10	10	
131	Beta-cyfluthrin						10			10		10	10	10	
132	Bifenazate						10								
133	Bifenthrin						10	10		10		10	10	10	10
134	Buprofezin	**86,6**													
135	Chlorantraniliprole									10					10
136	Chlorpyrifos						10			10		10	10	10	
137	Chlorpyrifos-methyl									10		10	10	10	
138	Clofentezine									10					10
139	Clothianidin											10	10		10
140	Cyhalothrin, gamma						10			10		10	10	10	
141	Cypermethrin									10		10	10	10	
142	Cypermethrin, alpha									10		10	10	10	
143	Cyromazine	**73,6**													
144	Deltamethrin						10	10		10		10	10	10	
145	Diflubenzuron									10			10		
146	Dimethoate						10					10	10		
147	Emamectin benzoate						10		10	10		10			10
148	Esfenvalerate								10	10		10	10	10	
149	Ethoprophos		10	10			10				10		10		
150	Etofenprox									10		10	10		
151	Etoxazole									10				10	
152	Fenamiphos						10			10	10	10	10		
153	Fenazaquin						10			10		10		10	
154	Fenoxycarb			10											
155	Fenpyroximate						10			10			10	10	
156	Fipronil						10					10	10		10
157	Flubendiamide						10			10					10
158	Flupyradifurone	**74,2**													
159	Formetanate						10			10		10	10		
160	Hexythiazox			10			10							*10*	

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Total # Pesticides: 209

Greenpeace Blacklist 2016

	Active Ingredient	Score	Mammal toxicity						Environmental Toxicity, Bioaccumulation, Persistence						
			Acute Tox.	Carcinogenicity	Repro. Tox.	Mutagenicity	AOEL /ADI	EDC	Algae	Daphnia/Fish	Birds	Bee	Beneficial	Bioaccumulation	Persistence
161	Imidacloprid											10	10		10
162	Indoxacarb						10					10	10	10	
163	Lambda-cyhalothrin						10	10		10		10	10	10	10
164	Lufenuron									10				10	10
165	Malathion			10						10		10	10		
166	Metaflumizone											10	10	10	10
167	Methiocarb									10	10	10	10		
168	Methomyl						10			10		10	10		
169	Methoxyfenozide	**75,1**													
170	Milbemectin									10		10	10		
171	Paraffin oil (cont. >3% DMSO)			10											
172	Phosmet									10		10	10		
173	Pirimicarb			10						10					10
174	Pirimiphos-methyl						10			10		10	10	10	
175	Pymetrozine			10											
176	Pyrethrum									10		10			
177	Pyridaben						10			10		10	10		
178	Pyridalyl									10				10	10
179	Pyriproxyfen	**73,8**													
180	Spinetoram						10					10	10		10
181	Spinosad											10	10		
182	Spirodiclofen			10			10			10			10		
183	Spiromesifen									10				10	
184	Sulfoxaflor											10	10		
185	Tau-fluvalinate						10			10			10	10	
186	Tebufenozide						10								*10*
187	Tebufenpyrad									10			10	10	
188	Teflubenzuron									10			10	10	10
189	Tefluthrin						10			10		10		10	
190	Thiacloprid			10									*10*		
191	Thiamethoxam											10	10		
192	Triflumuron									10				10	
193	zeta-Cypermethrin									10		10			

A grey italic 10 is for information only - no cut-off criterion (see Chapter "Blacklist Criteria").

Total # Pesticides: 209

Greenpeace Blacklist 2016

			Mammal toxicity						Environmental Toxicity, Bioaccumulation, Persistence						
	Active Ingredient	Score	Acute Tox.	Carcinogenicity	Repro. Tox.	Mutagenicity	AOEL /ADI	EDC	Algae	Daphnia/Fish	Birds	Bee	Beneficial	Bioaccumulation	Persistence
	Nematicides														
194	Fosthiazate						10				10	10			
195	Oxamyl						10				10	10	10		
	Plant Growth Regulators														
196	1-methylcyclopropene						10								
197	Aluminum sulfate						10								*10*
198	Chlorpropham												10		10
199	Clodinafop-propargyl						10						*10*		
200	Daminozide			10											
201	Flumetralin									10				10	10
202	Paclobutrazol	**82,7**													
203	Sodium 2-nitrophenoxide						10								
204	Sodium 4-nitrophenoxide						10								
205	Sodium 5-nitroguaiacolate						10								
206	Sodium silver thiosulfate						10								
	Rodenticides														
207	Bromadiolone		10				10							*10*	
208	Calcium phosphide	**80,3**													
209	Difenacoum						10			10				10	10

A grey italic 10 is for information only - no cut-off criterion (see Chapter "Blacklist Criteria").

Total # Pesticides: 209

Annex 2

The Pesticide Blacklist Scoring System

The scoring system translates classification and/or toxicological endpoints or certain chemical properties into a numerical score. The scoring is usually 1-2-5-8-10 and relates to the toxicity or the chemical properties/environmental behavior of the pesticides. A high score relates high toxicity or a critical classification or in the case of environmental fate to critical effects (mobility, persistence).

Without balanced weighting, the highest possible score for a pesticide active ingredient would be 168 points (16 parameters with the highest possible score of 10 plus one parameter with maximum score of 8). The lowest possibly score would be 17. However, because the mammalien/human toxicity group includes one more criterion for evaluation (immunotoxicity), a factor of 1,16 was applied to the ecotoxicity to outweight the inbalance between ecotoxicity and human toxicity. The highest possible score for a pesticide active ingredient is therefore 176 points.

Mammalian toxicity

Acute Toxicity Score

All Exp.	Oral		Inhalation			
GHS Acute Cat.	**WHO***	**LD50 (mg/kg bw)**	**Gases (ppm/V)**	**Vapours (mg/l)**	**Dusts and Mists (mg/l)**	**Score**
1	Ia	≤ 5	LD50 ≤ 100	LD50 ≤ 0,5	LD50 ≤ 0,05	**10 BL**
2	Ib	5 < LD50 ≤ 50	100 < LD50 ≤ 500	0,5 < LD50 ≤ 2	0,05 < LD50 ≤ 0,5	8
3	II	50 < LD50 ≤ 300	500 < LD50 ≤ 2500	2 < LD50 ≤ 10	0,5 < LD50 ≤ 1	5
4	III	300 < LD50 ≤ 2000	2500 < LD50 ≤ 2000	10 < LD50 ≤ 20	1 < LD50 ≤ 5	2
**	U	> 2000	> 2000	> 20	> 5	1
ACTIVE INGREDIENTS WITHOUT DATA						**5**

* The WHO Classification includes **dermal** toxicity, if higher than oral toxicity.

** Active ingredients evaluated by GHS Regulation (EC) No 1272/2008 and not classified in any acute toxicity category.

The GHS Classification reflects three exposures: oral, **dermal** and inhalation. The highest toxicity across all pathways is used.

GHS Classification supersedes WHO and other LD50 data.

References

EC (2008): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments.

IPCS/WHO (2009): The WHO recommended classification of pesticides by hazard and guidelines to classification 2009, International Programme on Chemical Safety (IPCS) & World Health Organization (WHO), Geneva.

Carcinogenicity Classification and Scoring

GHS CLASSIFI-CATION	EPA CLASSIFI-CATION 2005	EPA CLASSI-FICATION 1999 DRAFT	EPA CLASSIFI-CATION 1996	EPA CLASSIFI-CATION 1986	IARC CANCER CLASSIFI-CATION	SCORE
Known human carcinogens' (category 1a)	Carcinogenic to humans	Carcinogenic to humans	Known/likely	Human carcinogen	Group 1 The agent (mixture) is carcinogenic to humans.	**10 BL**
Presumed human carcinogens' (category 1b)	Likely to be carcinogenic to humans	Likely to be carcinogenic to humans		Group B – probable human carcinogen Group B1 is reserved for agents for which there is limited evidence of car-cinogenicity from epidemiologic studies Group B2 is used for agents for which there is „sufficient: evidence from animal studies and for which there is "inade-quate evidence" or „no data" from epidemiologic studies.	Group 2a The agent (mixture) is probably carcinogenic to humans.	**10 BL**
Suspected human carcinogens (category 2)	Suggestive evidence of carcinogenic potential	Suggestive evidence of carcinoge-nicity, but not sufficient to assess human carcinogenic potential		Group C – possible human carcinogen	Group 2b The agent (mixture) is possibly car-cinogenic to humans.	8
	Inadequate information to assess carcinogenic potential	Data are inadequate for an assessment of human carcinogenic potential.	Cannot be determined	Group D – not classifiable as to human carcinogenicity	Group 3 The agent (mixture or exposure circum-stance) is not classifiable as to its car-cinogenicity to humans.	5

Active ingredients evaluated by ghs regulation 1272/2008/ ec and not classified in any carci-nogenicity category.	Not likely to be carcino-genic to humans.	Not likely to be carcinoge-nic to humans	Not likely	Group E – evidence of non-carcinogenicity for humans	Group 4 The agent (mixture) is probably not carcinogenic to humans.	1
ACTIVE INGREDIENTS WITHOUT DATA						**5**

References:

EC (2008): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments.

IARC (2015): Agents reviewed by the IARC Monographs, Volumes 1– 112 (by CAS Numbers). International Agency for Research on Cancer (IARC). Last updated: 7.April 2015. Lyon, France.

US EPA (2006–2014): Chemicals Evaluated for Carcinogenic Potential. Science Information Management Branch, Health Effects Division Office of Pesticide Programs, U.S. Environmental Protection Agency (US EPA). April 26 2006; September 12 2007, September 24 2008; September 03 2009, November 2012, September 2013, October 2014.

US EPA (2015): Annual Cancer Report 2015. Chemicals Evaluated for Carcinogenic Potential. Office of Pesticide Programs, U.S. Environmental Protection Agency (US EPA).

Mutagenicity

GHS	Description	Score
Category 1A	The classification in Category 1A is based on positive evidence from human epidemiological studies. Substances to be regarded as if they induce heritable mutations in the germ cells of humans.	**10 BL**
Category 1B	The classification in Category 1B is based on: • positive result(s) from in vivo heritable germ cell mutagenicity tests in mammals; or • positive result(s) from in vivo somatic cell mutagenicity tests in mammals, in combination with some evidence that the substance has potential to cause mutations to germ cells. It is possible to derive this supporting evidence from mutagenicity/genotoxicity tests in germ cells in vivo, or by demonstrating the ability of the substance or its metabolite(s) to interact with the genetic material of germ cells; or • positive results from tests showing mutagenic effects in the germ cells of humans, without demonstration of transmission to progeny; for example, an increase in the frequency of aneuploidy in sperm cells of exposed people.	**10 BL**
Category 2	Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans	8
	Active ingredients evaluated by GHS Regulation 1272/2008/EC and not classified in any mutagenicity category.	1
ACTIVE INGREDIENTS WITHOUT DATA		**5**

Reference:

EC (2008): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments.

Reproductive and developmental toxicity

GHS	Description	Score
Category 1A	Known human reproductive toxicant The classification of a substance in Category 1A is largely based on evidence from humans	**10 BL**
Category 1B	Presumed human reproductive toxicant The classification of a substance in Category 1B is largely based on data from animal studies.	**10 BL**
Category 2	Suspected human reproductive toxicant Substances are classified in Category 2 for reproductive toxicity when there is some evidence from humans or experimental animals, possibly supplemented with other information.	8
	Active ingredients evaluated by GHS Regulation (EC) No 1272/2008 and not classified in any category for reproductive toxicity.	1
	ACTIVE INGREDIENTS WITHOUT DATA	**5**

Reference:

EC (2008): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments

Operator Toxicity AOEL/ADI (Acceptable Operator Exposure Level/Acceptable Daily Intake)

AOEL/ADI-Wert [mg/kg body weight]	Score
AOEL/ADI < 0,01	**10 BL**
0,01 ≤ AOEL/ADI < 0,1	8
0,1 ≤ AOEL/ADI < 1	5
1 ≤ AOEL/ADI < 10	2
AOEL/ADI >= 10 or "not appl." or. "n.n."	1
ACTIVE INGREDIENTS WITHOUT DATA	**5**

References:

EC (2016) : EU Pesticides database. European Commission. http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.selection&language=EN

EC (2015) EU Pesticides database. European Commission. http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.selection&language=EN

Immunotoxicity

GHS	Score
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled. H317: May cause an allergic skin reaction.	8
Active ingredients evaluated by GHS Regulation (EC) No 1272/2008 and not classified as H317 or H343.	2
Active ingredients without data	5

Reference:

EC (2008): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments.

Endocrine Disruption

EU Classification	Score
Endocrine disruptor or potential endocrine disruptor according to EU Category 1 ("At least one study showing endocrine disruption in an intact organism") or 'Suspected human reproductive toxicant' (Category 2) AND 'Suspected human carcinogens' (Category 2) according to Regulation (EC) No 1272/2008.	10 BL
Endocrine disruptor or potential endocrine disruptor according to EU Category 2 ("Potential for endocrine disruption")	8
EU Category 3 (No scientific basis for inclusion in list)	1
Active ingredients without data	5

References:

EC (2000): Towards the establishment of a priority list of substances for further evaluation of their role in endocrine disruption - preparation of a candidate list of substances as a basis for priority setting. European Commission. Delft.

EC (2004): Commission Staff Working Document SEC (2004) 1372 on implementation of the Community Strategy for Endocrine Disrupters - a range of substances suspected of interfering with the hormone systems of humans and wildlife (COM (1999) 706). Europäische Kommission. Brüssel.

EC (2007): Commission staff working document on the implementation of the „Community Strategy for Endocrine Disrupters" - a range of substances suspected of interfering with the hormone systems of humans and wildlife (COM (1999) 706), (COM (2001) 262) and (SEC (2004) 1372), SEC(2007) 1635. European Commission (EC), Brussels, 30.11.2007.

EC (2008): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments.

Environmental toxicity

Acute toxicity Algae

EC50 (growth) mg/l (ppm)	Footprint 'narrative'	Score
≤ 0,01	Highly toxic	10
> 0,01 - ≤ 10	Moderately toxic	5
>10	Low toxicity	1
ACTIVE INGREDIENTS WITHOUT DATA		5

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

Acute toxicity Daphnia and Fish*

LC50 or EC50 (acute) mg/l (ppm)	US EPA 'narrative'	Score
≤ 0,1	very highly toxic	10
> 0,1 - ≤ 1	highly toxic	8
>1 - ≤ 10	moderately toxic	5
> 10 - ≤ 100	slightly toxic	2
> 100	practically nontoxic	1
ACTIVE INGREDIENTS WITHOUT DATA		5

*The highest score is applied, when scores differ between the two species groups.

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

Acute toxicity birds

LD50 (oral)	US EPA 'narrative'	Score
≤ 10	very highly toxic	10
> 10 to ≤ 50	highly toxic	8
> 50 to ≤ 500	moderately toxic	5
> 500 to ≤ 2000	slightly toxic	2
> 2000	practically nontoxic	1
ACTIVE INGREDIENTS WITHOUT DATA		5

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015

Beneficial organisms

Lethal Rate (50%) in gramm/hectar	Percent effect (mortality, beneficial capacity)	Footprint 'narrative'	Score
< 5	> 79	Harmful	10
> 5 to ≤ 40	-	-	8
> 40 to ≤ 110	30 - 79	Moderately harmful	5
> 110 to ≤ 500	-	-	2
> 500	< 30	Harmless	1
ACTIVE INGREDIENTS WITHOUT DATA			5
Data for most sensitive species are used for the TLI			

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

Honey bees (Apis mellifera)

LD50 (µg/bee)	US EPA 'narrative'	Score
< 2	Highly toxic	10
2 – 11	Moderately toxic	5
> 11	Practically nontoxic	1
ACTIVE INGREDIENTS WITHOUT DATA		**5**

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

Environmental fate and transport

Bioaccumulation

Bioconcentration Factor (BCF)	LogP KOW	Score*
> 500	> 5	10
> 400 - ≤ 500	> 3 - ≤ 5	8
> 300 - ≤ 400	> 2 - ≤ 3	5
> 200 - ≤ 300	> 1 - ≤ 2	2
≤ 200	< 1	1
ACTIVE INGREDIENTS WITHOUT DATA		**5**
*Bioconcentration Factor (BCF) supersede Log P KOW data		

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2013.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2013.

Persistence in soil, sediments and water

Halflife soil and/or sediment (days)	Halflife in Water (days)	Score
> 90	> 50	10
> 80 ≤ 90	> 40 ≤ 50	8
> 70 ≤ 80	> 30 ≤ 40	5
> 60 ≤ 70	> 20 ≤ 30	2
> 50 ≤ 60	> 10 ≤ 20	1
≤ 50	≤ 10	1
Elements		1
ACTIVE INGREDIENTS WITHOUT DATA		5

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

Leaching potential

GUS Index (function of soil half-life and soil binding)	Footprint 'narrative'	Score
> 2,8	High leachability	10
2,8 – 1,8	Transition state	5
< 1,8	Low leachability	1
ACTIVE INGREDIENTS WITHOUT DATA		5

Primary References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2015.

Secondary reference (when data are not available in Primary Reference):

CDPR (2015): 2014 Status Report Pesticide Contamination Prevention Act. California Environmental Protection Agency.- California Department of Pesticide Regulation. Environmental Monitoring Branch.

Volatility

Vapour pressure (mm HG) at 20-25°C	Score
> 0,01	10
< 0,01 to > 0,0001	5
< 1×10^{-4} - > 1×10^{-6}	5
< 1×10^{-6} - > 1×10^{-8}	2
< 1×10^{-8}	1
ACTIVE INGREDIENTS WITHOUT DATA	**5**

References:

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

University of Hertfordshire (2015): The Bio-Pesticides Database (BPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2013.

University of Hertfordshire (2015): The Veterinary Substance Database (VSDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, 2011-2013.

Half-life on plants

Half-life on plant (days)	Score
> 3,8	10
> 1 – < 3,8 (or post-emergency herbicide)	5
< 1 (or pre-emergency herbicide)	1
ACTIVE INGREDIENTS WITHOUT DATA	**5**

Primary Reference:

Fantke P & Juraske R (2013): Variability of Pesticide Dissipation Half-Lives in Plants. Environ. Sci. Technol. (47): 3548–3562. dx.doi.org/10.1021/es303525x

Secondary Reference (when data are not available in Primary Reference):

Lewis KA, Tzilivakis J, Warner D & Green A (2016): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242.

Scoring for "low risk" compounds

EU Commission Regulation (EC) No 1095/2007 (4) as well as Annex II of Regulation (EC) No 1107/2009 define criteria for "low-risk active substances". Pesticides which were authorized in the EU because they meet these criteri receive a default total score of 17 in the Blacklist Scoring System – the lowest possible total score. The score cannot be lower, because even a low-risk substance may present some potential risk.

Annex 3

Comparison of toxicological thresholds for specific effects with the ADI as used for the Blacklist

Database

NOEL ("*No Observed Effect Level*") values for repeated dosing for selected effects on the nervous system and the thyroid collated by EFSA in the framework of the "cumulative risk assessment". The goal of that assessment was to identify pesticides with common toxicological mechanisms, and presents a review of all data from the authorization process regarding specific endpoints and specific target organisms.

All data are available at: http://www.efsa.europa.eu/en/efsajournal/pub/3293

Pesticides active ingredients (a.i.) were investigated with the following results:

- 84 a.i. with effects on nervous system (517 studies delivered NOELs, repeated dose)
- 110 a.i. with effect on thyroid (745 studies delivered NOELs, repeated dose)

Important note:

NOEL ("*No Observed Effect Level*") values are normally more protective than NOAEL ("*No Observed* ***Adverse*** *Effect Level*") values. ADI values are commonly derived by dividing NOAEL values by two uncertainty factors 10 and 10 (=100).

Methods

Comparison of the EFSA NOELs for specific effects with the ADI as used for the Blacklist. The EFSA NOELs (repeated dose) were divided by 100 to create values ("NOEL-ADIs") comparable with the ADIs.

For comparison, the Blacklist scoring system for the ADI (refer to Annex 2, table AOEL/ADI) was applied to the NOEL-ADIs, and then divided by the scores for the ADIs used for the Blacklist. Results greater than 1 would mean that the ADI used for the Blacklist is weaker than the NOEL-ADI. Results smaller than 1 would mean that the Blacklist ADIs are stricter than the "NOEL-ADI"so they would be more protective for the effects under scope.

Results

In 98% of all studies analyzed by EFSA the blacklist score is equal (66%) or stricter (32%) than the score for the NOEL-ADI. For 2% of the studies, the NOEL-ADI results in a stricter score than the blacklist ADI which concerns 10 pesticides. The reason for this is that for these 10 pesticides very different results for the NOEL values were found by EFSA (between 5 and 35).

For Buprofezin for example, 15 NOELs were found, they range from 0.9 mg/kg bw per day to 1000 mg/kg bw per day for the same target organ Since EFSA reviewed all available data for the focus of the project, the cumulative risk assessment, also studies were considered which would not be part of standard risk assessment, e.g. studies with humans. For that reason, the stricter NOEL-ADIs for 10 pesticides found by EFSA are not used for the Blacklist.

Conclusion

The ADIs used as Blacklist Criteria seem to be strict enough for covering effects on the nervous system concerning selected repeated dose effects derived from EU Draft Assessment Reports (DARs).

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