Pesticide application as routine in EU apple production

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Content

Pesticide application as routine in EU apple production

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Executive Summary

126 samples of dessert apples were obtained from 11 European countries and of these, 17 samples were of declared organic provenance. The samples were analysed at an independent laboratory in Germany using a multiresidue analytical technique capable of targeting a wide range of pesticides and their metabolites (500 parameters).

Results showed that none of the organic samples contained detectable residues.

Of the 109 conventionally grown apple samples, 91 (83%) contained one or more detectable residues, with the maximum number of 8 residues being detected in a sample from Bulgaria. The highest mean numbers of residues per sample were found in samples from Spain (4.3) followed by Bulgaria (4.0) and the Netherlands (3.4).

Numerically, the most frequent pesticide types found were fungicides (20) and insecticides (16), with the remainder made up of acaricides (2) and the Captan metabolite THPI. THPI was the most frequently detected substance (76) followed by Captan (20), Boscalid (19), Pirimicarb (18) and Chlorpyrifos-ethyl (15).

Two pesticides not approved for use in the EU were found: Diphenylamin in one sample from Spain and Ethirimol in one sample from Poland. In this latter case it is possible that this residue was a result of degradation of Bupirimate. Diphenylamin is allowed as a post-harvest treatment in countries outside the EU. Accordingly the low level found may have arisen as a result of cross-contamination during storage or packaging of apples from both EU and non-EU sources.

Analysis of the results using the German Toxic Load Indicator database[1] showed that 14 of the detected pesticides warranted the highest possible ranking of 10 for their toxicity to aquatic organisms. 15 residues warranted a ranking of 10 for their toxicity to beneficial insects, and a subset of 8 of these were ranked at 10 due to their specific toxicity to bees. 13 detected pesticides had the highest possible score in relation to persistence, while 7 had the highest possible rating in relation to their potential for bioaccumulation.

In many cases a clear and comprehensive analysis of possible health impacts cannot be carried out. From examining the Pesticide Properties Database (PPDB), it is apparent that there are large knowledge gaps in the information available to assess pesticides' health impacts. There are important uncertainties and indeterminacies associated with the various possible hazards posed. Of particular concern are data gaps related to carcinogenesis, mutagenesis and potential endocrine disruption for a significant proportion of the pesticides detected in the apples analysed in this study.

In addition, reflecting a more general gap in the types of information available, no information could be found on the possible environmental or health implications of the presence of the detected pesticides as mixtures. Taken together with the known hazards, the information gaps on impacts of single substances and of mixtures represent critical failings of the current regulatory regime for pesticides. The continued failure to address these gaps suggests that the current regulatory system is not fit for purpose.

1 See section on environmental assessment for further details

Finally, it should be emphasised that none of the residues found in the samples collected exceeded Maximum Residue Levels (MRL) for apples. The study illustrates that marketed products show the use of a huge diversity of pesticides, reflecting pre-harvest and any post-harvest pesticide applications which are the norm in the conventional growing of apples. This, taken together with the many knowledge gaps on the impacts of these pesticides, either alone or in mixtures, is a reason for considerable concern.

Greenpeace Recommendations

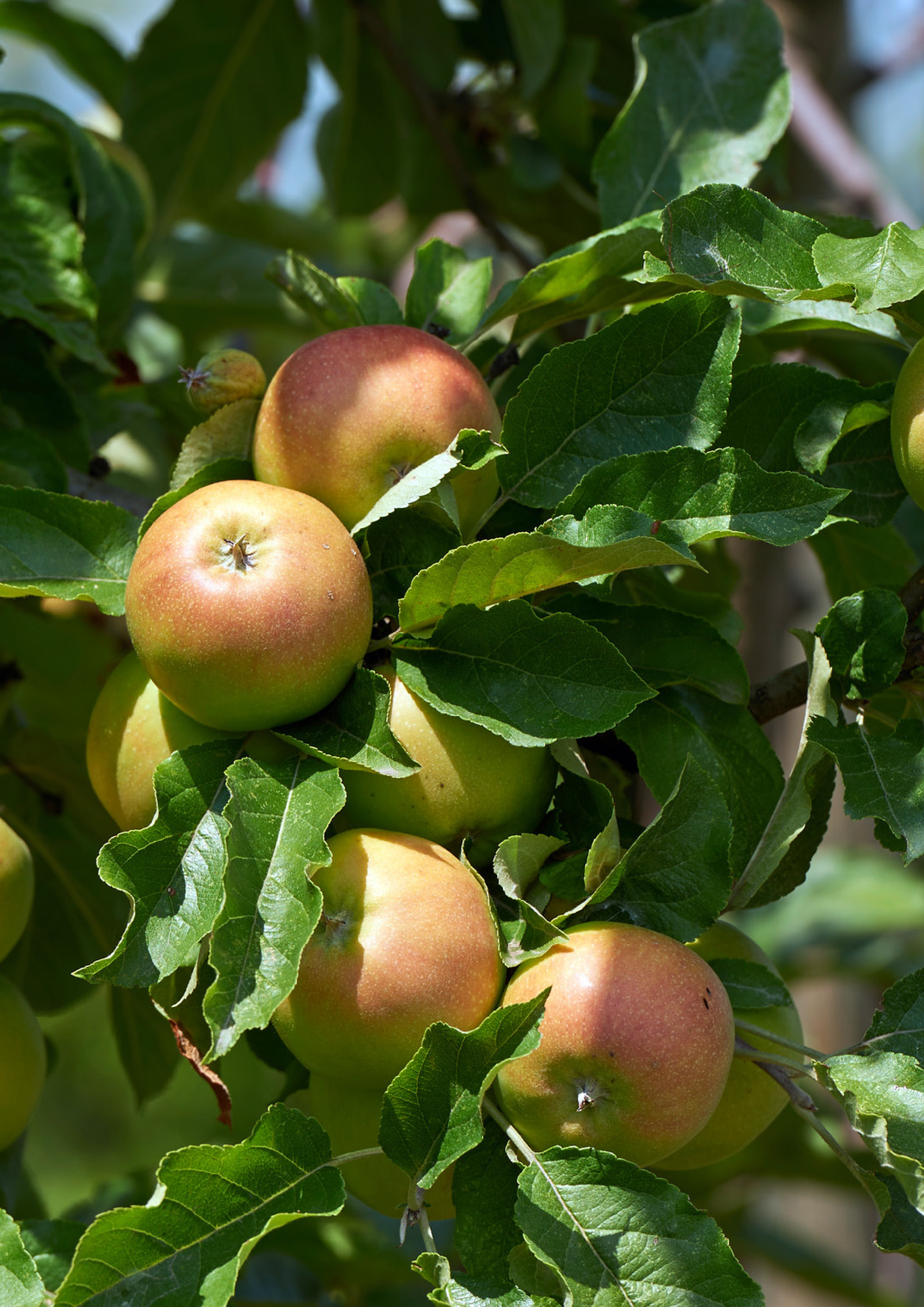
The results obtained in this study, from analysing conventionally produced apples sourced from various retailers for pesticide residues, provide a further illustration of the urgent need to move away from the current chemically intensive agricultural paradigm. Specifically, there is a need to reduce and ultimately to eliminate the use of pesticides. This will involve shifting away from industrial agriculture systems by implementing ecological farming practices. This, in turn, will allow the ecological and economic problems currently facing the agricultural sector to be effectively and holistically addressed.

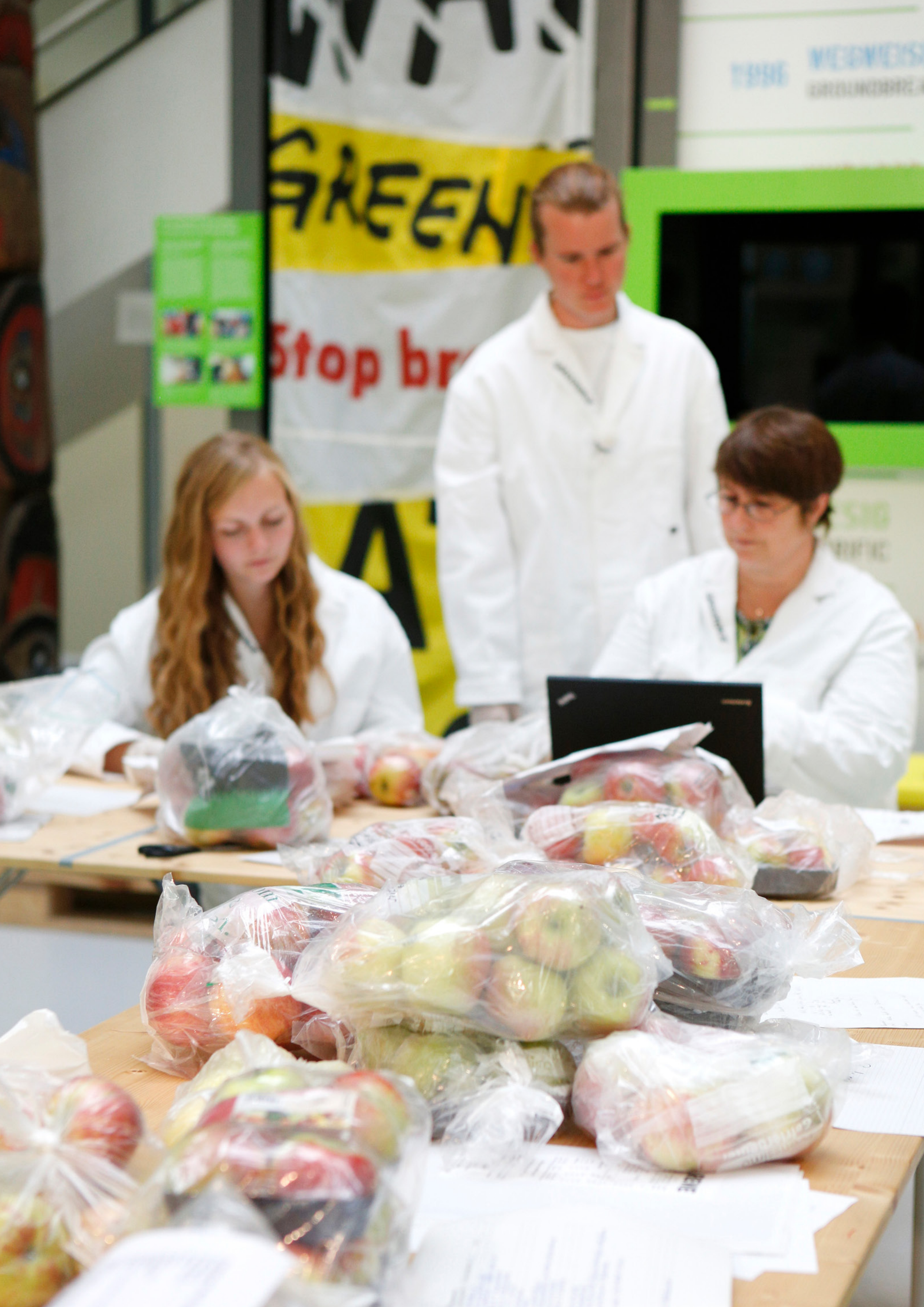
Accordingly efforts should be directed at:

- **Breaking the vicious circle of pesticide use.** Focus on functional agrobiodiversity is key. It is fundamentally necessary to
    1. improve soil management,
    2. implement biological control of pests,
    3. choose resistant varieties adapted to local conditions,
    4. set up schemes for proper crop rotation and
    5. diversify agricultural systems in order to facilitate the replacement of pesticides in agricultural production.

- **Ensuring proper implementation of the EU Directive on the sustainable use of pesticides.** Concrete measures and ambitious targets need to be put in place by EU member states in order to move towards a substantial reduction in pesticide usage as required by relevant EU Directives.

- **Overhauling regulatory controls for pesticide risk assessment.** There is an urgent need to resolve indeterminacies and uncertainties around health and environmental impacts of pesticides.
    1. The effects of cocktails of agro-chemicals on human health and the wider environment also need to be investigated and monitored. Relevant findings need to be translated into an effective regulatory framework. In the absence of such information, regulation of pesticides needs to take place on a strictly precautionary basis.
    2. In addition, whole formulations of pesticides need to be assessed, rather than the active ingredients alone.
    3. There is a need to make regulation of pesticides responsive to new information, which may emerge after the approval process. All information used in the approval process should be placed immediately in the public domain as a matter of routine.

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Methods and Materials

A total of 126 samples of apples were obtained from 11 European countries and, of these, 17 samples were declared to be of organic provenance. Samples were bought between the 24th of August and the 17th of September, depending on the local conditions and with the aim to coincide sampling with entry of the new season's crop coming from national production into the retail chain. All of the apples were dessert apples grown for human consumption and covered 43 different varieties, from the more common ones like Elstar or Royal Gala to less well known varieties like Gravensteiner or Summerred. The number of samples collected in each country were as follows:

Austria 10 samples; Belgium 4 samples; Bulgaria 5 samples; Switzerland 8 samples; Germany 39 samples; France 13 samples; Italy 10 samples; Netherlands 5 samples; Poland 10 samples; Slovakia 8 samples; Spain 14 samples

Analysis of apples was carried out at an independent laboratory in Germany, using a modified QuEChERS (DIN EN 15662) analytical protocol. Pesticides were analysed using a multiresidue GC-MS/MS and LC-MS/MS method covering 500 different substances, with a detection limit (LOD) of 3µg/kg and a limit of quantification (LOQ) of 10µg/kg for most compounds.

In summary, 10ml of acetonitrile (HPLC Gradient Grade, VWR) was added to 10g of sample, together with an internal standard solution (containing isoproturon-d6 for LC-MS/MS analysis, and anthracene-d10 for GC-MS/MS analysis). After addition of 4g of anhydrous magnesium sulphate, 1g of sodium chloride, 1g of trisodium citrate dihydrate, and 0.5g of disodium hydrogen citrate sesquihydrate, the whole mixture was shaken and was then separated using a refrigerated centrifuge.

7ml of the supernatant was transferred to a tube containing 1g of anhydrous magnesium sulphate and was then briefly shaken by hand and centrifuged again. An aliquot of the supernatant was removed and, after addition of 10µl of 5% formic acid solution per ml of extract as an analyte preservative, was analysed by LC-MS/MS.

300mg of PSA cleanup sorbent were added to the remaining solution, and the mixture was then shaken and centrifuged in a refrigerated centrifuge. Two aliquots of the supernatant were then transferred to two vials, and, after addition of 10µl 5% formic acid solution per ml of extract, were used for GC-MS/MS analyses.

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Results

Of the 126 individual samples analysed, no substances were detected in the 17 samples declared to be of organic provenance. Of the remaining 109 samples, 91 (83%) contained one or more detected substances while 65 (59.6%) of the samples contained 2 or more detected substances. Pesticide residues could not be detected in only 18 (16.5%) of these conventionally grown samples.

A total of 39 individual pesticides/pesticide metabolites were isolated from the conventionally grown merchandise. The ranges of concentrations found for each pesticide are shown in Table 2. None of the substances detected were found to exceed MRLs specified for apples sold in the open marketplace. Subsequent discussion of the results is limited to the 91 conventionally grown samples in which residues were detected and quantified. The numbers of residues found in samples from each country are summarised in Table 1 below.

Table 1: Number of residues found in samples from each country

			Number of residues found in conventionally grown apples									
	No. of samples	Organic samples (without residues)	0	1	2	3	4	5	6	7	8	Mode of residues / mean number of residues found per conventional sample for each specified country
Austria	10	1	1	1	1	3	2	1	0	0	0	3 / 2.8
Belgium	4	1	0	0	1	0	2	0	0	0	0	4 / 3.3
Bulgaria	5	2	0	0	2	0	0	0	0	0	1	2 / 4.0
Switzerland	8	2	1	3	0	1	0	1	0	0	0	1 / 1.8
Germany	39	6	4	12	7	5	3	1	0	1	0	1 / 2.0
France	13	1	6	3	0	0	3	0	0	0	0	0 / 1.3
Italy	10	1	1	5	2	1	0	0	0	0	0	1 / 1.3
Nether-lands	5	0	0	0	1	2	1	1	0	0	0	3 / 3.4
Poland	10	0	0	3	2	2	1	2	0	0	0	1 / 2.7
Slovakia	8	0	0	3	2	1	0	2	0	0	0	1 / 2.5
Spain	14	3	0	1	0	3	3	1	1	2	0	3 / 4.3

Table 2: Ranges of concentrations of pesticides detected in apple samples and their current approval status within the EU

Pesticide name	Number of detections	Frequency of detection in %	Concentration range in mg/kg where found (min – max)	Approved for use in the EU	Pesticide type
Acetamiprid	2	1.8	0.022-0.056	Y	I
Boscalid	19	17.4	0.012-0.163	Y	F
Bupirimate	1	0.9	0.011	Y	F
Captan	20	18.4	0.01-0.106	Y	F
Chlorantraniliprole	7	6.4	0.012-0.042	Y	I
Chlorpyrifos(-ethyl)	15	13.8	0.015-0.209	Y	I
Chlorpyrifos(-methyl)	3	2.8	0.016-0.179	Y	I; A
Chlorothalonil	1	0.9	0.013	Y	F
Cyhalothrin, lambda-	1	0.9	0.019	Y	I
Cypermethrin	1	0.9	0.023	Y	I
Cyprodinil	5	4.6	0.011-0.06	Y	F
Difenoconazole	1	0.9	0.065	Y	F
Diflubenzuron	1	0.9	0.03	Y	I
Diphenylamine	1	0.9	0.017	N	GR; F; I
Dithianon	4	3.6	0.013-0.057	Y	F
Ethirimol	1	0.9	0.036	N (but metabolite of Bupirimate)	F
Fenoxycarb	1	0.9	0.031	Y	I
Fenpyroximate	1	0.9	0.01	Y	A
Flonicamid	7	6.4	0.01-0.059	Y	I
Fludioxonil	8	7.3	0.017-0.111	Y	F
Fluopyram	3	2.8	0.012-0.078	Y	F
Folpet	2	1.8	0.768-0.938	Y	F
Imazalil	1	0.9	0.777	Y	F
Imidacloprid	1	0.9	0.045	Y	I
Indoxacarb	2	1.8	0.012-0.023	Y	I
Iprodione	1	0.9	0.023	Y	F
Methoxyfenozide	10	9.2	0.013-0.064	Y	I
Myclobutanil	1	0.9	0.01	Y	F
Phosmet	3	2.8	0.012-0.139	Y	I; A
Pirimicarb	18	16.5	0.01-0.09	Y	I
Pyraclostrobin	12	11	0.012-0.053	Y	F
Pyrimethanil	2	1.8	0.023-0.118	Y	F

Spirodiclofen	6	5.5	0.013-0.036	Y	A
Tebuconazole	6	5.5	0.01-0.074	Y	F
Tebufenozide	3	2.8	0.015-0.046	Y	I
Thiacloprid	2	1.8	0.011-0.016	Y	I
Thiophanate-methyl	1	0.9	0.014	Y	F
THPI (Metabolite of Captan/Captafol)	76	69.7	0.01-0.369	Y	-
Trifloxystrobin	11	10.1	0.01-0.044	Y	F

Table 2: Ranges of concentrations of pesticides detected in apple samples and their current approval status within the EU. According to the Pesticide Properties Database, some of the detected pesticides may not be approved at the level of individual countries despite being approved for use at EU level (see: http://sitem.herts.ac.uk/aeru/ppdb/en/).
Key:
I = Insecticide; GR = Plant Growth Regulator; F = Fungicide; A = Acaricide

Table 3: Overview of the retail sources of purchased apple samples

Country	No. of samples conventional / organic	Retailers
Austria	9 / 1	4x Aldi/Hofer, 4x Rewe, 2x Spar
Belgium	3 / 1	1x Bioplanet, 1x Carrefour, 1x Colruyt, 1x Delhaize
Bulgaria	3 / 2	3x Billa, 1x Gimel, 1x Lidl
France	12 / 1	2x Auchan, 3x Carrefour, 2x Casino, 2x Intermarché, 2x Leclerc, 2x Super/Hyper U
Germany	33 / 6	6x Aldi, 1x Alnatura, 3xBasic, 9xEdeka, 8xMetro, 3xLidl, 9xRewe
Italy	9 / 1	3x Auchan, 3x Lidl, 3x Carrefour, 1x Naturasi
Netherlands	5 / 0	1x Albert Heijn, 2x Aldi, 2x Lidl
Poland	10 / 0	5x Auchan, 2x Intermarché, 3x Leclerc
Slovakia	8 / 0	3x Rewe/Billa, 2x Carrefour, 1x Gazdovsky, 2x Lidl
Spain	11 / 3	3x Auchan, 3x Carrefour, 2x Lidl, 2x Leclerc, 2x Mercadona, 2x Naturasi
Switzerland	6 / 2	1x Aldi, 3x Coop, 1x Lidl, 3x Migros

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Discussion

The most commonly detected substance in the analysed apples was the captan/captafol metabolite THPI, found in 76 of the 109 conventionally grown samples. 20 samples also contained residues of the parent compound captan. It is probable that, where THPI was present with or without residues of captan, it represents earlier-season use of captan since captafol is not approved for use in the EU.

Ethirimol was found in one sample from Poland. Ethirimol may be present as a breakdown product of Bupirimate rather than as a result of illegal use. Diphenylamine was also found in a single sample from Spain; this agent is not approved for use in Spain or in the wider EU. Diphenylamin is allowed as a post-harvest treatment in countries outside the EU. Accordingly the low level found may have arisen as a result of cross-contamination during storage or packaging of apples from both EU and non-EU sources.

Pyrimethanil is not approved for use in Bulgaria, but was found in one sample sourced there, together with residues of Flonicamid which also does not appear to be approved for use in this country.

Pirimicarb was found in one sample from Poland despite not being approved for use there.

In all other cases, residues found were of substances approved for use in the country in which the sample was purchased, though it must be kept in mind that the country of origin may have been different. None of the residues detected exceeded MRL values for apples.

Environmental Assessment

In a wildlife specific assessment, the effects of the 39 substances found were evaluated according to the German TLI pesticide meta-database[2]. This database comprises similar categories to the Greenpeace Blacklist[3] but with more species-specific data. According to the toxicological properties of the individual substance, up to 10 points may be assigned in 5 tiers (1; 3; 5; 8; 10) in one or more of 15 categories.

Toxicity to aquatic organisms

Of the pesticides detected in one or more of the conventional samples analysed in this study, several justify the maximum toxicity rating for aquatic organisms (fish & Daphnia spp.) under the TLI (Toxic Load Indicator) Pesticide Database. From the available information, it is not clear whether, or to what extent, multiple residues may interact with each other when present as part of a mixture. On the basis of the TLI ranking, it is clear that the application and subsequent mobilisation of these high ranked pesticides has the potential to impact severely on aquatic systems into which such pesticides may enter.

2 www.pestizidexperte.de/tli.php ; TLI = Toxic Load Indicator
3 Die Schwarze Liste der Pestizide II, Greenpeace Germany 2010 www.greenpeace.de/sites/www.greenpeace.de/files/Schwarze_Liste_der_Pestizide_II_2010_0.pdf

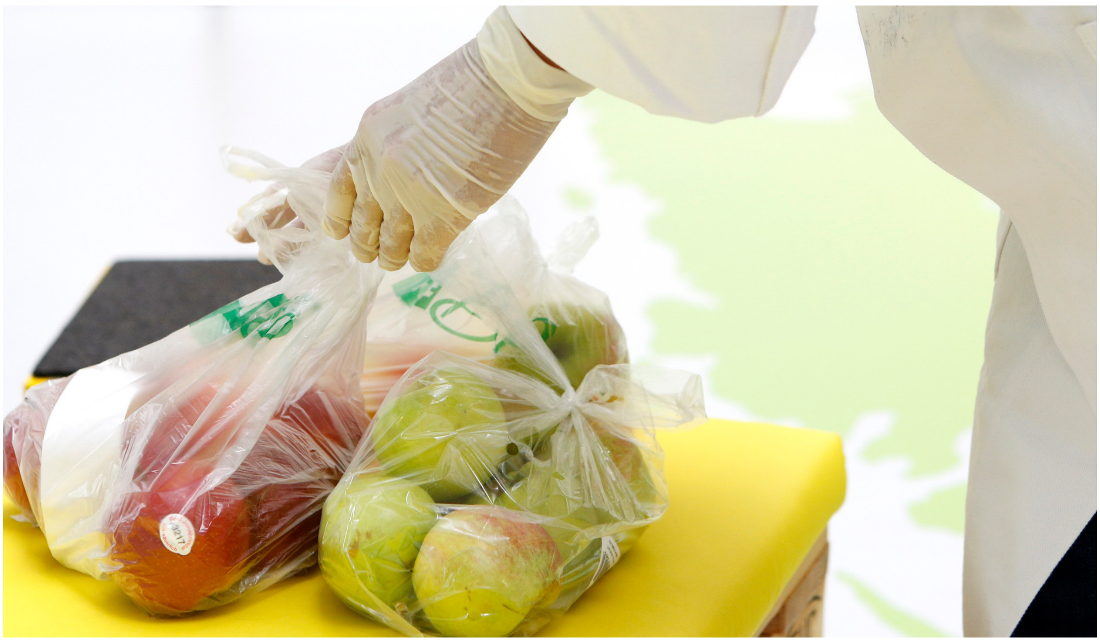
Table 4: Highest aquatic toxicity values of the pesticides found in the apples

Pesticide	Algae toxicity	Fish & *Daphnia spp.* toxicity	No. of samples in which found
Chlorantraniliprole	5	10	7
Chlorothalonil	5	10	1
Chlorpyrifos	5	10	15
Chlorpyrifos-methyl	5	10	3
Cypermethrin	5	10	1
Diflubenzuron	1	10	1
Dithianon	5	10	4
Fenpyroximate	1	10	1
Lambda-Cyhalothrin	5	10	1
Phosmet	5	10	3
Pirimicarb	1	10	18
Pyraclostrobin	5	10	12
Spirodiclofen	5	10	6
Trifloxystrobin	10	10	11

Table 4: Highest aquatic toxicity values of the pesticides found in the apples (from TLI pesticide database). Toxicity is scored out of 10 points on a 5-tiered scale.

Toxicity to soil-dwelling organisms

Despite the clear hazardous potential to aquatic systems represented by some of the pesticides detected, none of those detected are ranked highly for earthworm toxicity. No data are available on the potential impact on soil organisms of multiple residues.



Toxicity to bees and other pollinators

As indicated in Table 5 based on the TLI database, 15 of the pesticides detected are ranked as posing a high risk to beneficial insects. 8 of these are also ranked as being of extremely high concern specifically to bees.

Table 5: Highest bee and beneficial toxic values of the pesticides found in the apples

Pesticide	Bee toxicity	Toxicity to beneficial insects	No. of samples in which found
Acetamiprid	5	10	2
Captan	0	10	20
Chlorothalonil	0	10	1
Chlorpyrifos-ethyl	10	10	15
Chlorpyrifos-methyl	10	10	3
Cypermethrin	10	10	1
Diflubenzuron	0	10	1
Ethirimol	10	1	1
Fenpyroximate	0	10	1
Flonicamid	0	10	7
Imidacloprid	10	10	1
Indoxacarb	10	10	2
Lambda-Cyhalothrin	10	10	1
Phosmet	10	10	3
Trifloxystrobin	0	10	11

Table 5: Highest bee and beneficial toxic values of the pesticides found in the apples (from TLI pesticide database). Toxicity is scored out of 10 points on a 5-tiered scale.

Pesticides with endocrine disrupting potential

None of the pesticides detected in the analysis of apple samples are known to have endocrine disrupting properties, although as apparent from Table 8 detailing possible human health issues, there are significant data gaps and unresolved details around endocrine disrupting properties.

Persistence in the environment

Table 6 below shows that 13 of the pesticides isolated from the apple samples attract the highest possible rating of 10 under the TLI database. This indicates that, once introduced into the environment, they can persist for a considerable time. Coupled with the fact that some have a high bioaccumulative potential (see Table 7), this suggests that these substances have the potential for significant environmental effects either alone or in combination.

Table 6: Pesticides with very high persistence

Pesticide	Very high persistence	No. of samples in which found
Boscalid	10	19
Chlorantraniliprole	10	7
Cyprodinil	10	5
Difenoconazole	10	1
Fludioxonil	10	8
Fluopyram	10	3
Imazalil	10	1
Imidacloprid	10	1
Methoxyfenozide	10	10
Myclobutanil	10	1
Pirimicarb	10	18
Tebuconazole	10	6
Tebufenozide	10	3

Table 6: Pesticides with very high persistence (10 out of 10 points from the TLI pesticide database) found in the apple samples

Potential for bioaccumulation

Table 7 shows that seven of the detected pesticides in the apple samples attract the highest possible classification of 10 under the TLI classification

Table 7: Pesticides found in apples with very high bioaccumulative potential

Pesticide	Very high bioaccumulating potential	No. of samples in which found
Chlorpyrifos-ethyl	10	15
Chlorpyrifos-methyl	10	3
Cypermethrin	10	1
Fenpyroximate	10	1
Indoxacarb	10	2
Lambda-Cyhalothrin	10	1
Pyraclostrobin	10	12

Table 7: Pesticides found in apples with very high bioaccumulative potential (10 out of 10 points from the TLI pesticide database)

Human health issues

The Table 8 below shows potential issues related to human health associated with exposures to the pesticides identified in one or more apple samples in this study. These toxicity data generally relate to occupational exposures or are inferred from animal models.

As is apparent from the table a significant number of data and assessment gaps remain to be resolved. In addition, it must be stressed that this information from the PPDB reflects the intrinsic properties and hazards of each of the active ingredients, and does not imply that such health effects are likely to result in individuals as a direct consequence of consuming apples containing pesticide residues at the concentrations detected. Rather, it is included as an illustration of the hazardous nature of many of the pesticides in common use in conventional apple growing. The table also illustrates the significant data gaps which exist in relation to the hazardous properties of many of these pesticides.

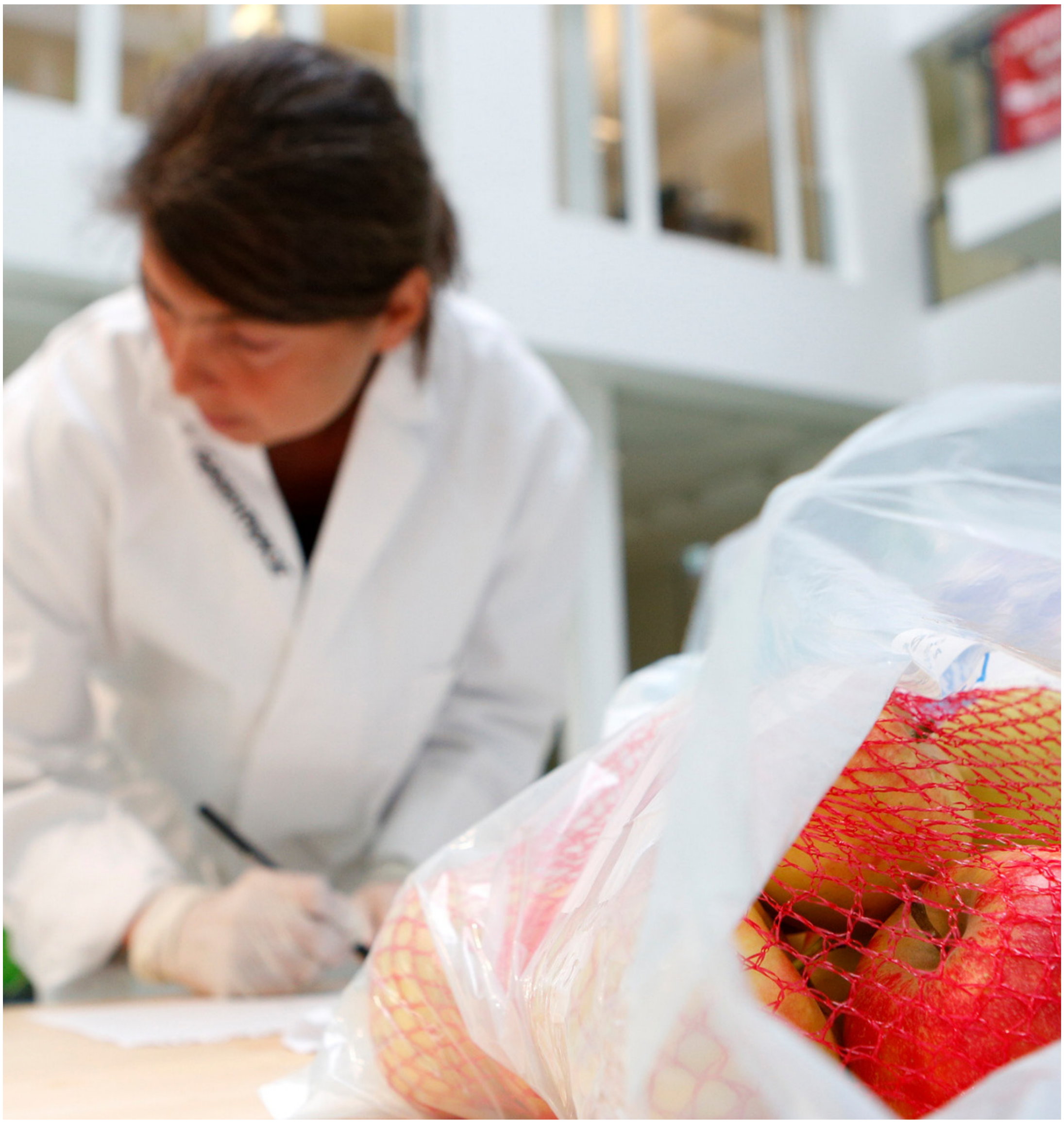


Table 8: Human health issues associated with pesticides detected in analysed apples

pesticide name	Pesticide Type	Carcinogen	Mutagen	EDC	Reproduction/ development effects	Cholinesterase inhibitor	Neurotoxicant	Respiratory tract irritant
Acetamiprid	I	N	-	-	-	N	N	N
Boscalid	F	?	-	N	?	N	N	N
Bupirimat	F	N	-	N	?	N	N	-
Captan	F	Y	N	N	-	N	N	-
Chlorantraniliprole	I	N		N	N	?	N	-
Chlorpyrifos(-ethyl)	I	N	N	?	Y	Y	Y	N
Chlorpyrifos(-methyl)	I, A	N	-	N	-	Y	Y	N
Chlorthalonil	F	Y	N	N	Y	N	N	Y
Cyhalothrin, lambda-	I	N	N	N	?	N	?	Y
Cypermethrin	I	?	N	?	?	N	N	Y
Cyprodinil	F	N	N	-	?	N	N	Y
Difenoconazol	F	?	-	N	?	N	N	N
Diflubenzuron	I	N	N	N	N	N	N	Y
Diphenylamin	GR;F;I	N	N	-	Y	N	?	Y
Dithianon	F	?	-	-	?	N	N	-
Ethirimol	F	N	-	-	-	N	N	-
Fenoxycarb	I	?	N	Y	?	?	?	Y
Fenpyroximat	A	N	-	-	Y	N	N	-
Flonicamid	I	?	-	-	?	N	N	N
Fludioxonil	F	?	-	-	?	N	N	N
Fluopyram	F	?	-	-	Y	-	N	-
Folpet	F	Y	?	-	-	N	N	?
Imazalil	F	?	N	N	Y	N	N	Y
Imidacloprid	I	N	?	-	Y	N	?	N
Indoxacarb	I	N	-	?	?	N	Y	N
Iprodion	F	Y	-	?	-	N	N	Y
Methoxyfenozid	I	N	N	?	N	N	N	-
Myclobutanil	F	N	-	-	?	N	N	N
Phosmet	I;A	?	N	-	Y	Y	Y	-
Pirimicarb	I	?	-	-	N	Y	Y	N
Pyraclostrobin	F	N	-	-	?	N	N	N
Pyrimethanil	F	N	-	?	N	N	N	-
Spirodiclofen	A	?	-	-	?	N	?	-
Tebuconazol	F	?	-	-	Y	N	N	N
Tebufenozid	I	N	-	-	N	N	-	-
Thiacloprid	I	?	-	-	-	N	-	N
Thiophanat-methyl	F	?	Y	-	Y	N	-	Y
THPI (Metabolite Captan/Captafol)	-	-	-	-	-	-	-	-
Trifloxystrobin	F	N	-	-	Y	N	N	-

Key:
Y = Yes, known to cause a problem, N = No, known not to cause a problem, ? = possible issue status not identified, - = No data
Reproduced from: http://sitem.herts.ac.uk/aeru/ppdb/en/index.htm

Skin irritant	Eye irritant	Other
Y	Y	
N	?	
N	Y	skin sensitiser, poss. liver, thyroid toxicant
Y	Y	may cause contact dermatitis
N	?	Possible liver toxicant
?	?	skin sensitiser, cardiovascular and blood toxicant
Y	N	as above
Y	Y	skin sensitiser, poss. contact dermatitis
?	Y	skin sensitiser; immune, thyroid toxicant if susceptible
Y	Y	Highly toxic
Y	Y	Skin sensitiser
Y	Y	Liver, heart,thyroid, kidney toxicant
N	?	Reported to cause methaemoglobiaemia
Y	Y	Gastrointestinal cardiovascular, kidney, liver toxicant, may cause methaemoglobiaemia and splenic congestion
N	Y	Skin sensitiser, toxic, poss liver,kidney toxicant
N	Y	
Y	Y	Poss. liver, kidney, thyroid toxicant
Y	Y	Poss. sensitiser
N	N	Poss. liver, kidney toxicant
Y	Y	
N	N	Poss. liver, thyroid, blood toxicant
Y	Y	Poss. skin sensitiser
N	Y	Poss. Liver, kidney toxicant. Moderate skin sensitiser
?	?	Potential liver, kidney, thyroid, heart, spleen toxicant. Moderately toxic
Y	Y	Poss. kidney, liver, spleen, CNS toxicant. Prob. skin sensitiser. Moderately toxic
Y	Y	May cause pulmonary problems
?	?	Potential endocrine effects on thyroid and adrenal glands at high doses
N	N	Liver toxicant
N	Y	Highly toxic by all routes
?	Y	Highly toxic, may be fatal by inhalation, ingestion, skin absorbtion
Y	?	
N	?	Poss. liver, kidney, adrenals, bladder and thyroid toxicant
N	N	Possi. adrenal gland toxicant, skin sensitiser
N	Y	Targets liver/blood system
N	N	Blood, liver, kidney toxicant
N	N	Poss.liver, thyroid toxicant
?	?	Skin sensitiser, Mutagenic potential
-	-	
Y	N	Skin sensitiser

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Annex

Details of the lab results:

sample number	name of super-market	organic yes/no	name of pesticide	residue in mg/kg
Italy - 1	Auchan		THPI (Metabolit Captan/Captafol)	0,123 mg/kg
			Captan	0,013 mg/kg
Italy - 2	Auchan		THPI (Metabolit Captan/Captafol)	0,044 mg/kg
			Boscalid	0,084 mg/kg
Italy - 3	Auchan		THPI (Metabolit Captan/Captafol)	0,012 mg/kg
Italy - 4	Lidl		THPI (Metabolit Captan/Captafol)	0,056 mg/kg
Italy - 5	Lidl		THPI (Metabolit Captan/Captafol)	0,028 mg/kg
			Boscalid	0,047 mg/kg
			Bupirimat	0,011 mg/kg
Italy - 6	Lidl			n.d.
Italy - 7	Carrefour		THPI (Metabolit Captan/Captafol)	0,115 mg/kg
Italy - 8	Carrefour		Boscalid	0,019 mg/kg
Italy - 9	Carrefour		THPI (Metabolit Captan/Captafol)	0,043 mg/kg
Italy - 10	Naturasi	yes		n.d.
Slovakia - 1	Carrefour		THPI (Metabolit Captan/Captafol)	0,012 mg/kg
Slovakia - 2	Carrefour		THPI (Metabolit Captan/Captafol)	0,01 mg/kg
			Methoxyfenozid	0,018 mg/kg
Slovakia - 3	Billa		Chlorpyrifos (-ethyl)	0,046 mg/kg
			THPI (Metabolit Captan/Captafol)	0,136 mg/kg
			Fludioxonil	0,111 mg/kg

			Trifloxystrobin	0,022 mg/kg
			Spirodiclofen	0,022 mg/kg
Slovakia - 4	Billa		THPI (Metabolit Captan/Captafol)	0,033 mg/kg
Slovakia - 5	Billa		THPI (Metabolit Captan/Captafol)	0,019 mg/kg
			Boscalid	0,021 mg/kg
Slovakia - 6	Lidl		Boscalid	0,016 mg/kg
Slovakia - 7	Lidl		Chlorpyrifos (-ethyl)	0,044 mg/kg
			THPI (Metabolit Captan/Captafol)	0,072 mg/kg
			Fludioxonil	0,079 mg/kg
			Trifloxystrobin	0,027 mg/kg
			Spirodiclofen	0,036 mg/kg
Slovakia - 8	Gazdovsky		THPI (Metabolit Captan/Captafol)	0,026 mg/kg
			Chlorantraniliprole	0,026 mg/kg
			Methoxyfenozid	0,046 mg/kg
Switzerland - 1	Coop	yes		n.d.
Switzerland - 2	Coop		THPI (Metabolit Captan/Captafol)	0,025 mg/kg
Switzerland - 3	Coop			n.d.
Switzerland - 4	Migros	yes		n.d.
Switzerland - 5	Migros		Folpet	0,938 mg/kg
			Fluopyram	0,044 mg/kg
			Pirimicarb	0,018 mg/kg
			Diflubenzuron	0,03 mg/kg
			Tebufenozid	0,046 mg/kg
Switzerland - 6	Migros		Tebufenozid	0,015 mg/kg
Switzerland - 7	Aldi		THPI (Metabolit Captan/Captafol)	0,026 mg/kg
			Chlorpyrifos (-ethyl)	0,017 mg/kg
			Pirimicarb	0,016 mg/kg

Switzerland - 8	Lidl		THPI (Metabolit Captan/Captafol)	0,056 mg/kg
France - 1	Super U			n.d.
Austria - 1	Spar		THPI (Metabolit Captan/Captafol)	0,045 mg/kg
			Captan	0,03 mg/kg
			Chlorpyrifos (-ethyl)	0,05 mg/kg
			Fenoxycarb	0,031 mg/kg
Austria - 2	Spar		THPI (Metabolit Captan/Captafol)	0,017 mg/kg
			Captan	0,012 mg/kg
			Dithianon	0,015 mg/kg
Austria - 3	Rewe		THPI (Metabolit Captan/Captafol)	0,013 mg/kg
			Chlorpyrifos (-ethyl)	0,02 mg/kg
			Dithianon	0,013 mg/kg
Austria - 4	Rewe		Captan	0,011 mg/kg
			Flonicamid	0,011 mg/kg
			THPI (Metabolit Captan/Captafol)	0,09 mg/kg
			Chlorantraniliprole	0,019 mg/kg
Austria - 5	Rewe		THPI (Metabolit Captan/Captafol)	0,188 mg/kg
			Captan	0,037 mg/kg
			Chlorantraniliprole	0,018 mg/kg
Austria - 6	Hofer	yes		n.d.
Austria - 7	Hofer			n.d.
Austria - 8	Hofer		THPI (Metabolit Captan/Captafol)	0,125 mg/kg
			Captan	0,014 mg/kg
			Chlorpyrifos (-ethyl)	0,018 mg/kg
			Dithianon	0,02 mg/kg
			Chlorantraniliprole	0,042 mg/kg
Austria - 9	Hofer		Dithianon	0,057 mg/kg
Austria - 10	Penny		Cyprodinil	0,011 mg/kg
			Boscalid	0,037 mg/kg

France - 2	Carrefour			n.d.
France - 3	Auchan		Pirimicarb	0,044 mg/kg
			Boscalid	0,039 mg/kg
			Pyraclostrobin	0,03 mg/kg
			THPI (Metabolit Captan/Captafol)	0,022 mg/kg
France - 4	Leclerc		Thiacloprid	0,016 mg/kg
France - 5	Carrefour		Thiacloprid	0,011 mg/kg
France - 6	Carrefour	yes		n.d.
France - 7	Casino		Boscalid	0,055 mg/kg
			Fludioxonil	0,085 mg/kg
			Pyraclostrobin	0,031 mg/kg
			THPI (Metabolit Captan/Captafol)	0,017 mg/kg
France - 8	Intermarché		Boscalid	0,081 mg/kg
			Fludioxonil	0,101 mg/kg
			Pyraclostrobin	0,052 mg/kg
			THPI (Metabolit Captan/Captafol)	0,053 mg/kg
Bulgaria - 1	Gimel	yes		n.d.
Bulgaria - 2	Lidl		THPI (Metabolit Captan/Captafol)	0,016 mg/kg
			Chlorpyrifos (-methyl)	0,016 mg/kg
Bulgaria - 3	Billa		Thiophanat-methyl	0,014 mg/kg
			THPI (Metabolit Captan/Captafol)	0,025 mg/kg
Bulgaria - 4	Billa		Cyprodinil	0,025 mg/kg
			Chlorantraniliprole	0,026 mg/kg
			Pyrimethanil	0,023 mg/kg
			Fludioxonil	0,017 mg/kg
			Difenoconazol	0,065 mg/kg
			THPI (Metabolit Captan/Captafol)	0,032 mg/kg
			Captan	0,011 mg/kg
			Flonicamid	0,01 mg/kg

Bulgaria - 5	Billa	yes		n.d.
Spain - 1	Auchan		Captan	0,01 mg/kg
			THPI (Metabolit Captan/Captafol)	0,015 mg/kg
			Folpet	0,768 mg/kg
			Iprodion	0,023 mg/kg
			Diphenylamin	0,017 mg/kg
			Imazalil	0,777 mg/kg
Spain - 2	Auchan		Tebuconazol	0,036 mg/kg
			THPI (Metabolit Captan/Captafol)	0,011 mg/kg
			Chlorpyrifos (-ethyl)	0,02 mg/kg
			Cypermethrin	0,023 mg/kg
Spain - 3	Auchan	yes		n.d.
Spain - 4	Carrefour		THPI (Metabolit Captan/Captafol)	0,025 mg/kg
			Chlorpyrifos (-ethyl)	0,05 mg/kg
			Methoxyfenozid	0,044 mg/kg
Spain - 5	Carrefour		THPI (Metabolit Captan/Captafol)	0,083 mg/kg
			Chlorpyrifos (-ethyl)	0,209 mg/kg
			Tebuconazol	0,018 mg/kg
Spain - 6	Carrefour		THPI (Metabolit Captan/Captafol)	0,046 mg/kg
			Chlorpyrifos (-methyl)	0,024 mg/kg
			Chlorpyrifos (-ethyl)	0,052 mg/kg
			Phosmet	0,012 mg/kg
			Tebuconazol	0,01 mg/kg
			Methoxyfenozid	0,02 mg/kg
			Tebufenozid	0,034 mg/kg
Spain - 7	Lidl		Chlorpyrifos (-ethyl)	0,015 mg/kg
			Boscalid	0,026 mg/kg
			Pyraclostrobin	0,028 mg/kg
Spain - 8	Lidl		Acetamiprid	0,022 mg/kg
Spain - 9	Mercadona		Pirimicarb	0,035 mg/kg
			Boscalid	0,118 mg/kg

			Methoxyfenozid	0,026 mg/kg
			Pyraclostrobin	0,053 mg/kg
Spain - 10	Mercadona		THPI (Metabolit Captan/Captafol)	0,013 mg/kg
			Chlorpyrifos (-ethyl)	0,056 mg/kg
			Myclobutanil	0,01 mg/kg
			Phosmet	0,052 mg/kg
			Tebuconazol	0,016 mg/kg
			Fludioxonil	0,021 mg/kg
			Methoxyfenozid	0,014 mg/kg
Spain - 11	Leclerc		THPI (Metabolit Captan/Captafol)	0,019 mg/kg
			Chlorthalonil	0,013 mg/kg
			Chlorpyrifos (-ethyl)	0,028 mg/kg
			Cyhalothrin, lambda-	0,019 mg/kg
			Tebuconazol	0,074 mg/kg
Spain - 12	Leclerc		THPI (Metabolit Captan/Captafol)	0,165 mg/kg
			Chlorpyrifos (-methyl)	0,179 mg/kg
			Captan	0,01 mg/kg
			Phosmet	0,139 mg/kg
Spain - 13	Naturasi	yes		n.d.
Spain - 14	Naturasi	yes		n.d.
Poland - 1	Aucan		Flonicamid	0,059 mg/kg
			THPI (Metabolit Captan/Captafol)	0,073 mg/kg
			Captan	0,033 mg/kg
			Methoxyfenozid	0,064 mg/kg
			Spirodiclofen	0,013 mg/kg
Poland - 2	Auchan		Captan	0,027 mg/kg
			THPI (Metabolit Captan/Captafol)	0,09 mg/kg
			Pirimicarb	0,014 mg/kg
Poland - 3	Auchan		Flonicamid	0,012 mg/kg
			THPI (Metabolit Captan/Captafol)	0,01 mg/kg

Poland - 4	Auchan		Flonicamid	0,015 mg/kg
			THPI (Metabolit Captan/Captafol)	0,017 mg/kg
			Pirimicarb	0,027 mg/kg
			Fenpyroximat	0,01 mg/kg
Poland - 5	Auchan		THPI (Metabolit Captan/Captafol)	0,034 mg/kg
Poland - 6	Leclerc		THPI (Metabolit Captan/Captafol)	0,05 mg/kg
Poland - 7	Leclerc		Captan	0,016 mg/kg
			THPI (Metabolit Captan/Captafol)	0,13 mg/kg
			Methoxyfenozid	0,018 mg/kg
Poland - 8	Leclerc		THPI (Metabolit Captan/Captafol)	0,032 mg/kg
Poland - 9	Intermarché		Captan	0,016 mg/kg
			THPI (Metabolit Captan/Captafol)	0,143 mg/kg
			Chlorpyrifos (-ethyl)	0,02 mg/kg
			Imidacloprid	0,045 mg/kg
			Indoxacarb	0,012 mg/kg
Poland - 10	Intermarché		THPI (Metabolit Captan/Captafol)	0,081 mg/kg
			Ethirimol	0,036 mg/kg
France - 9	Hyper U		Boscalid	0,012 mg/kg
France - 10	Intermarché			n.d.
France - 11	Casino			n.d.
France - 12	Leclerc			n.d.
France - 13	Auchan			n.d.
Netherlands - 1	Aldi		THPI (Metabolit Captan/Captafol)	0,07 mg/kg
			Boscalid	0,018 mg/kg
			Pyraclostrobin	0,012 mg/kg
Netherlands - 2	Aldi		THPI (Metabolit Captan/Captafol)	0,153 mg/kg
			Methoxyfenozid	0,013 mg/kg

Netherlands - 3	Lidl		Captan	0,013 mg/kg
			THPI (Metabolit Captan/Captafol)	0,103 mg/kg
			Boscalid	0,03 mg/kg
			Pyraclostrobin	0,025 mg/kg
Netherlands - 4	Lidl		THPI (Metabolit Captan/Captafol)	0,106 mg/kg
			Boscalid	0,037 mg/kg
			Pyraclostrobin	0,031 mg/kg
Netherlands - 5	Albert Heijn		Captan	0,016 mg/kg
			THPI (Metabolit Captan/Captafol)	0,369 mg/kg
			Pirimicarb	0,013 mg/kg
			Boscalid	0,062 mg/kg
			Pyraclostrobin	0,016 mg/kg
Belgium - 1	Carrefour		Captan	0,015 mg/kg
			THPI (Metabolit Captan/Captafol)	0,208 mg/kg
			Boscalid	0,043 mg/kg
			Pyraclostrobin	0,038 mg/kg
Belgium - 2	Delhaize		THPI (Metabolit Captan/Captafol)	0,048 mg/kg
			Pirimicarb	0,09 mg/kg
Belgium - 3	Colruyt		THPI (Metabolit Captan/Captafol)	0,075 mg/kg
			Cyprodinil	0,024 mg/kg
			Boscalid	0,046 mg/kg
			Pyraclostrobin	0,029 mg/kg
Belgium - 4	Bioplanet	yes		n.d.
Germany - 1	Aldi		THPI (Metabolit Captan/Captafol)	0,125 mg/kg
			Captan	0,106 mg/kg
Germany - 2	Netto		THPI (Metabolit Captan/Captafol)	0,01 mg/kg
			Acetamiprid	0,056 mg/kg
			Pyrimethanil	0,118 mg/kg
			Spirodiclofen	0,013 mg/kg
Germany - 3	Aldi		THPI (Metabolit Captan/Captafol)	0,011 mg/kg

			Pirimicarb	0,044 mg/kg
			Trifloxystrobin	0,014 mg/kg
Germany - 4	Edeka		THPI (Metabolit Captan/Captafol)	0,016 mg/kg
			Pirimicarb	0,028 mg/kg
Germany - 5	Edeka		Pirimicarb	0,012 mg/kg
Germany - 6	Real		THPI (Metabolit Captan/Captafol)	0,015 mg/kg
Germany - 7	Netto			n.d.
Germany - 8	Rewe		THPI (Metabolit Captan/Captafol)	0,084 mg/kg
			Flonicamid	0,018 mg/kg
			Chlorantraniliprole	0,02 mg/kg
			Trifloxystrobin	0,024 mg/kg
Germany - 9	Alnatura	yes		n.d.
Germany - 10	Edeka		THPI (Metabolit Captan/Captafol)	0,126 mg/kg
			Captan	0,06 mg/kg
Germany - 11	Edeka		THPI (Metabolit Captan/Captafol)	0,01 mg/kg
Germany - 12	Lidl		Pirimicarb	0,012 mg/kg
Germany - 13	Real			n.d.
Germany - 14	Rewe		THPI (Metabolit Captan/Captafol)	0,034 mg/kg
Germany - 15	Rewe	yes		n.d.
Germany - 16	Real		THPI (Metabolit Captan/Captafol)	0,099 mg/kg
			Chlorpyrifos (-ethyl)	0,055 mg/kg
Germany - 17	Real		THPI (Metabolit Captan/Captafol)	0,028 mg/kg
			Pirimicarb	0,018 mg/kg
Germany - 18	Rewe		Fluopyram	0,078 mg/kg

			Tebuconazol	0,038 mg/kg
Germany - 19	Aldi		THPI (Metabolit Captan/Captafol)	0,034 mg/kg
Germany - 20	Aldi			n.d.
Germany - 21	Aldi		Fludioxonil	0,035 mg/kg
Germany - 22	Edeka			n.d.
Germany - 23	Rewe		Trifloxystrobin	0,023 mg/kg
Germany - 24	Rewe		Pirimicarb	0,01 mg/kg
Germany - 25	Real		THPI (Metabolit Captan/Captafol)	0,048 mg/kg
			Captan	0,017 mg/kg
			Trifloxystrobin	0,019 mg/kg
Germany - 26	Rewe		THPI (Metabolit Captan/Captafol)	0,102 mg/kg
			Boscalid	0,163 mg/kg
			Pyraclostrobin	0,05 mg/kg
Germany - 27	Penny		THPI (Metabolit Captan/Captafol)	0,045 mg/kg
			Trifloxystrobin	0,012 mg/kg
Germany - 28	Penny		THPI (Metabolit Captan/Captafol)	0,169 mg/kg
			Captan	0,029 mg/kg
			Cyprodinil	0,06 mg/kg
			Fludioxonil	0,038 mg/kg
Germany - 29	Aldi		THPI (Metabolit Captan/Captafol)	0,044 mg/kg
			Flonicamid	0,02 mg/kg
			Trifloxystrobin	0,011 mg/kg
Germany - 30	Basic	yes		n.d.
Germany - 31	Basic	yes		n.d.
Germany - 32	Basic	yes		n.d.

Germany - 33	Kaufhof		Pirimicarb	0,029 mg/kg
Germany - 34	Kaufhof		THPI (Metabolit Captan/Captafol)	0,016 mg/kg
			Fluopyram	0,012 mg/kg
			Cyprodinil	0,013 mg/kg
			Pirimicarb	0,015 mg/kg
			Methoxyfenozid	0,032 mg/kg
			Trifloxystrobin	0,018 mg/kg
			Spirodiclofen	0,016 mg/kg
Germany - 35	Netto		THPI (Metabolit Captan/Captafol)	0,011 mg/kg
Germany - 36	Real		Trifloxystrobin	0,01 mg/kg
Germany - 37	Lidl		THPI (Metabolit Captan/Captafol)	0,01 mg/kg
			Pirimicarb	0,013 mg/kg
			Indoxacarb	0,023 mg/kg
Germany - 38	Edeka	yes		n.d.
Germany - 39	Lidl		THPI (Metabolit Captan/Captafol)	0,024 mg/kg
			Pirimicarb	0,029 mg/kg
			Chlorantraniliprole	0,012 mg/kg
			Trifloxystrobin	0,044 mg/kg
			Spirodiclofen	0,02 mg/kg

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

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