PESTICIDE ACTION NETWORK *UK*

PESTICIDES ON A PLATE

a consumer guide to pesticide issues in the food chain
2013

Acknowledgements

Pesticides on a Plate:
a consumer guide to pesticide issues in the food chain

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Executive Summary

Are UK shoppers concerned about pesticides?

On average, 3 in 5 UK adults (59%) are concerned about pesticide residues in the food they buy, with Londoners topping the list at a massive 67%. Of all those concerned, an average of 3 in 5 would not be happy to consume an item of food in the knowledge that it may contain different pesticide residues.[1]

How much do they know – and want to know?

96% don't know what the maximum levels are, and only 4% know that producers can use over 300 kinds of pesticides. Yet an overwhelming 85% agree there should be more transparency when it comes to pesticides in food production.[2]

Introducing the PRiF survey…

The Expert Committee on Pesticide Residues (PRiF) tests fruit, vegetables and other products for pesticide residues each quarter.[3] This report analyses full year of results[4], with 40 food types tested for up to 372 different pesticides.

THE FINDINGS

Foods with the highest residues

The report shows that as much as 46% of the food we consume contains residues of one or more pesticides.[5] This figure has increased every year and has almost doubled since 2003 when it was just 25%.

The table below shows the foods with the highest residues. Note that as well as fruit and veg, bread and flour also rank highly. Moreover, several fruit categories had residues exceeding Government limits.

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1 Opinium research commissioned by the Organic. Naturally Different campaign. Survey of 2,003 UK adults aged 18+. July 2013

2 Opinium research commissioned by the Organic. Naturally Different campaign. Survey of 2,003 UK adults aged 18+. July 2013

3 http://www.pesticides.gov.uk/OneStopCMS/Core/TemplateHandler.aspx?NRMODE=Published&NRNODEGUID=%7b1445AB0C-08A7-49C5-AEDE-76644B15F0E3%7d&NRORIGINALURL=%2fguidance%2findustries%2fpesticides%2fadvisory-groups%2fPRiF%2fPRiF_Results_and_Reports%2f2011_Results_and_Reports&NRCACHEHINT=NoModifyGuest

4 Pesticide Residues in Food, Annual Report 2011, PriF. The report's introduction states that 54% of food sampled did NOT contain residues, and therefore the remaining 46% did

5 Pesticide Residues in Food, Annual Report 2011, PriF. The report's introduction states that 54% of food sampled did NOT contain residues, and therefore the remaining 46% did

- The food with the highest residues is soft citrus. 100% of samples contained residues and over 96% contained residues from more than one pesticide
- Soft citrus, oranges, pineapple and grapes all had pesticide residues exceeding the Government's MRL (Maximum Residue Levels)
- Flour is third on the list with over 96% containing pesticide residues, and 73% of bread samples tested contained residues
- 19% of samples contained more than one residue

Foodstuff 2011	Total samples	Non-organic samples	Non-organic samples containing residues		Non-organic samples with MRL exceedances		Nonorganic samples containing more than one residue		Presence in Quarterlies
Soft citrus	107	107	107	100.00 %	1	0.93%	103	96.26%	Q2, Q4
Oranges	99	99	97	97.98%	2	2.02%	94	94.95%	Q1, Q2, Q3, Q4
Flour	72	63	61	96.83%	0	0.00%	12	19.05%	Q1
Pears	118	115	111	96.52%	0	0.00%	108	93.91%	Q1, Q2, Q3, Q4
Pineapple	60	60	56	93.33%	3	5.00%	42	70.00%	Q1, Q3
Grapes	174	173	158	91.33%	5	2.89%	137	79.19%	Q1, Q2, Q3, Q4
Apples	96	96	87	90.63%	0	0.00%	73	76.04%	Q2, Q4
Dried Grapes	48	42	34	80.95%	0	0.00%	25	59.52%	Q4
Raspberries	63	51	39	76.47%	0	0.00%	23	45.10%	Q2, Q3
Bread	216	216	159	73.61%	0	0.00%	49	22.69%	Q3, Q4
Carrots, fresh	96	74	54	72.97%	0	0.00%	17	22.97%	Q2, Q3
Peppers	42	37	26	70.27%	0	0.00%	11	29.73%	Q4

WELL-KNOWN PESTICIDES

Chlorpyrifos – found on over 54% of oranges

It's been widely reported in the media that many pesticides have harmful effects on honey bees. One of the most toxic in the UK, chlorpyrifos, was found on over 54% of oranges and featured in all four quarterly reports in 2011. Chlorpyrifos was found on 10 different types of produce. These were apples, beans with pods, dried grapes, grapes, oranges, pears, pineapple, plantain, soft citrus and spinach.

The report investigated 10 pesticides which are more toxic in terms of health and environmental effects. The produce with the highest number of these harmful

pesticides was beans with pods. The beans with pods samples contained seven of the 10 pesticides which have very high toxicity.

Carbendazim – the most common pesticide

Carbendazim was recorded most often, appearing on 11.5% of oranges in 2011. It was also found on apples, beans with pods, cucumber, grapes, oranges, pineapple, pre-packed salads, raspberries, rice, soft citrus and spinach.

Evidence links carbendazim with developmental damage to mammals in the womb.[6] It can also interfere with the mammals' endocrine system, leading to the development of cancers, developmental problems and birth defects.

DDT – banned decades ago but still around

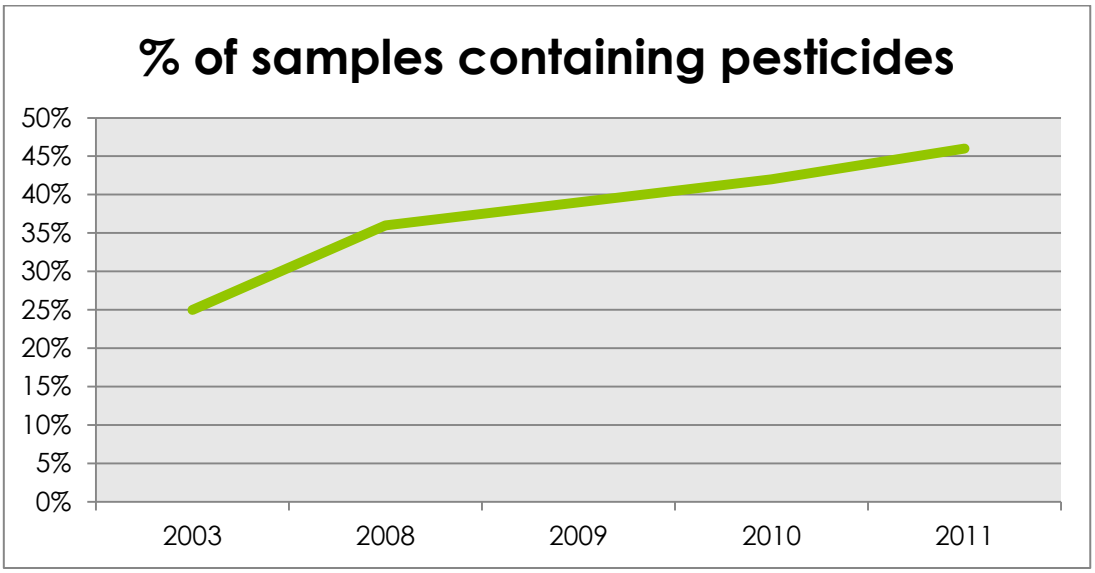
DDT was found in burgers, oily fish, liver and smoked fish where 25% of samples contained it. Banned in 38 countries since the 1970s, it's now no longer used for agricultural purposes but still shows up in food as residues.

[6] http://www.pan-uk.org/pestnews/Actives/Carbenda.htm

Hazardous pesticides & impact

Setting the context

Looking first at the overall picture, the Government's testing programme shows rising levels of percentages each year. In 2003 25% of foods sampled contained pesticide residues and now in 2011, almost half of the products tested contained residues.



Carbendazim

Carbendazim is on the Colborn List for endocrine disruptors. It is claimed to be reproductive system disrupting[7]. In 2011, Carbendazim was found on 11 different products: apples, beans with pods, cucumber, grapes, oranges, pineapple, pre-packed salads, raspberries, rice, soft citrus and spinach. The highest percentage was oranges which in Q3, and Q4 had 11.54% of their oranges with carbendazim residues on them.

Outlined below are the other effects of Carbendazim on the environment from various studies. On the Pesticide Action Network International 'Highly Hazardous Pesticides ' List, Carbendazim is listed as hazardous in the following criteria: a likely carcinogen according to the US Environmental Protection Agency (EPA carc), is known to be mutagenic to man according to the EU (EU muta 1,2), known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans according to the EU (EU GHS muta 1A, 1B), EU reproductive (1,2), known to impair fertility in humans according to the EU ((EU GHS repro (1A,

[7] http://www.ourstolenfuture.com/Basics/chemlist.htm

1B)), and is regarded as an endocrine disruptor or potential endocrine disruptor (EU EDC (1,2) or C2 &R2 GHS)

Fresh Produce	Pesticide	Total # of samples containing pesticide	Total # of samples	Quarter Presence	%
Apples	Carbendazim	1	30	Q3	3.33%
Beans with Pods	Carbendazim	5	93	Q1, Q3,Q4	4.16%
Cucumber	Carbendazim	4	91	Q2,Q4	4.40%
Grapes	Carbendazim	2	103	Q1,Q2	1.94%
Oranges	Carbendazim	6	52	Q3,Q4	11.54%
Pineapple	Carbendazim	3	62	Q2,Q3	4.84%
Pre Packed Salads	Carbendazim	1	24	Q2	4.17%
Raspberries	Carbendazim	1	29	Q2	3.45%
Rice	Carbendazim	1	29	Q2	3.45%
Soft Citrus	Carbendazim	4	108	Q2,Q4	3.70%
Spinach	Carbendazim	1	24	Q1	4.17%

HUMAN IMPACT:

There is evidence that Carbendazim can damage the development of mammals in the womb.[8] A study by Mantovani and others,[9] showed animals exposed to Carbendazim in the womb to have serious deformities such as lack of eyes and hydrocephalus (water on the brain, an abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles, or cavities, of the brain). The study also found that carbendazim can disrupt the development of sperm and damage testicular development in adult rats. For example one study of benomyl (which has Carbendazim as its main metabolite) found 'testicular atrophy and degeneration and foetotoxicity'.[10]
Carbendazim does affect the chromosomes. Recently researchers testing the effect of Carbendazim on cultured human lymphocytes concluded that it is obvious Carbendazim is a potent aneugen (affects the number of chromosomes) even at low exposures.[11]

ENVIRONMENTAL IMPACT:

In January of 2009 two-headed bass were found in the Noosa River in Queensland, Australia. Experts believe that the mutated fish, which survived only 48 hours after

[8] http://www.pan-uk.org/pestnews/Actives/Carbenda.htm
[9] Mantovani, A., Maranghi, F., Ricciardi, C., Macri, C., Stazi, A.V., Attias, L. and Zapponi, G.A., Developmental toxicity of carbendazim: Camparison of no-observed-adverse-effect level and benchmark dose approach, Food and Chemical Toxicology, 1998, 36: 37-45. Reference found at: http://www.pan-uk.org/pestnews/Actives/Carbenda.htm
[10] Ibid p.30
[11] Ibid p.33

hatching, are the victims of pesticide drift from neighbouring macadamia nut farms that routinely use endosulfan and carbendazim. The vice-president of the Australian College of Vetenarian Scientists' Aquatic Animal Health Chapter concluded that there were no other probable causes to explain the fish and larval mortality. His report also found that chickens, sheep and horses raised in close proximity to fish hatcheries are recording abnormally high levels of foetal deaths and birth defects. [12]

Highly toxic for aquatic organisms: However, it is probable that this high toxicity is unlikely to be seen in the field, because Carbendazim is strongly adsorbed to sediment .[13] Thus, sediment-living organisms would probably receive high exposure. [14]

Chlorpyrifos

Chlorpyrifos was found in 10 products in the 2011 pesticide survey: Apples, beans with pods, dried grapes, grapes, oranges, pears, pineapple, plantain, soft citrus and spinach. the highest ratio of samples to pesticide residue was oranges where 54.44% of samples obtained in all quarters had chlorpyrifos residues. The second highest was dried grapes where 35.42% of the samples in Q4 had chlorpyrifos residues.

Outlined below are the other effects of Chlorpyrifos on humans and the environment from various studies. On the Pesticide Action Network International 'Highly Hazardous Chemicals' List, chlorpyrifos is hazardous in the following criteria: highly toxic to bees.

Fresh Produce	Pesticide	Total # of samples containing pesticides	Total # of samples	Quarterly Presence	%
Apples	Chlorpyrifos	14	96	Q2, Q4	14.58%
Beans with Pods	Chlorpyrifos	5	120	Q1, Q2, Q3, Q4	4.17%
Dried Grapes	Chlorpyrifos	17	48	Q4	35.42%
Grapes	Chlorpyrifos	13	174	Q1,Q2,Q3,Q4	7.47%
Oranges	Chlorpyrifos	49	90	Q1,Q2,Q3,Q4	54.44%
Pears	Chlorpyrifos	17	86	Q1,Q3,Q4	19.76%
Pineapple	Chlorpyrifos	2	30	Q1	6.67%
Plantain	Chlorpyrifos	6	26	Q4	23.08%
Soft Citrus	Chlorpyrifos	32	108	Q2,Q4	29.63%
Spinach	Chlorpyrifos	1	24	Q1	4.16%

[12] http://www.beyondpesticides.org/dailynewsblog/?p=1113
[13] *IPCS International Programme on Chemical Safety, Carbendazim health and safety guide, number 82, WHO Geneva, 1993. Op. cit. 20. Found at:* http://www.pan-uk.org/pestnews/Actives/Carbenda.htm
[14] Ibid

HUMAN AND ENVIRONMENTAL IMPACT:

In boys, exposure to chlorpyrifos in the womb was associated with lower scores on short term memory tests, compared with girls exposed to similar amounts. [15] Chlorpyrifos was frequently used as an insecticide applied to bedding and clothing during the Gulf War. Since the Gulf War the use of Chlorpyrifos has been banned for household use in the US, but use and exposure remains high in agricultural communities and the UK and is approved for use in the EU. Gulf War syndrome is a chronic multi-symptom illness that has affected about a quarter of the deployed veterans of the 1991 Gulf War. Exposure to prolonged low-level organophosphate insecticides and other toxic chemicals is now thought to be responsible. [16]

Cypermethrin

Cypermethrin is a mixture of several similar chemicals. Cypermethrin is highly toxic to aquatic organisms, but seepage to water bodies from contaminated land is minimal as Cypermethrin binds strongly to soil particles. Ingestion of Cypermethrin can cause abdominal pain, vomiting and nausea.[17] It is present on the Colborn List for endocrine disruptors[18]

Cypermethrin was found on seven food products in 2011: Beans with Pods (where is was present in three quarters: 1, 2 and 3), Bread, Courgettes, Grapes, Okra, Soft Citrus and Spinach. The highest of these was Spinach where in Quarter 3 20.83% of the spinach sampled was contaminated with Cypermethrin. One sample of these

Vegetable	Pesticide	Total # of samples	Total # of samples	Quarterly Presence	%

was 0.8 mg/kg which is 0.1 over the MRL of 0.7 mg/kg. All of the samples were sourced in the UK.

[15] http://www.scientificamerican.com/article.cfm?id=common-insecticide-may-harm-boys-brains-more-than-girls
[16] http://precedings.nature.com/documents/6057/version/1/html
[17] http://apps.sepa.org.uk/spripa/Pages/SubstanceInformation.aspx?pid=135
[18] http://www.ourstolenfuture.com/Basics/chemlist.htm

		containing pesticides			
Beans with Pods	Cypermethrin	5	96	Q1,Q2,Q3	5.21%
Bread	Cypermethrin	1	108	Q3	0.93%
Courgettes	Cypermethrin	1	35	Q2	2.85%
Grapes	Cypermethrin	2	24	Q2	8.33%
Okra	Cypermethrin	9	54	Q3	16.68%
Soft Citrus	Cypermethrin	1	39	Q2	2.56%
Spinach	Cypermethrin	5	24	Q3	20.83%

On the Pesticide Action Network International 'Highly Hazardous Pesticides' List, Cypermethrin is considered highly hazardous according to WHO (WHO 1b), very toxic by inhalation according to the EU (R26) and is a probable/likely carcinogenic according to the US Environmental Protection Agency (EPA prop/likely carc). As well as this it is considered highly toxic to bees.

HUMAN IMPACT:

"Cypermethrin is classified by the World Health Organisation (WHO) as 'moderately hazardous' (Class II)[19]. It interacts with the sodium channels in nerve cells through which sodium enters the cell in order to transmit a nerve signal. These channels can remain open for up to a few seconds, compared to the normal period of a few milliseconds, after a signal has been transmitted. Cypermethrin also interferes with other receptors in the nervous system. The effect is that of long-lasting trains of repetitive impulses in sense organs." [20]

DDT:

Evidence has shown that the pesticide DDT[21] is hazardous to many fish[22] and is has proven to be embryotoxic in mice[23].Control actions to ban or severely restrict DDT have been taken in over 38 countries beginning as early as the 1970s[24]. In 2011, DDT was present in four products: burgers, liver, oily fish and smoked fish. The presence of the pesticide in the samples ranged from 2.08% to 25.92%.

In the case of smoked fish, the pesticide was reported to have been present in 28 of the 108 samples taken in Q2 and Q4 (25.92%). Since DDT has no set MRL, the amount ranged in Quarter 2 from 0.002mg/kg to 0.011mg/kg. Smoked salmon proved to have the highest amount of DDT with 0.011mg/kg and its country of origin was the UK.

[19] *WHO Recommended Classification of Pesticides by Hazard 1994-95, WHO, Geneva*
[20] http://www.pan-uk.org/pestnews/Actives/cypermet.htm
[21] http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC33482, http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC41900
[22] http://www.pic.int/Portals/5/DGDs/DGD_DDT_EN.pdf(2.2)
[23] http://www.pic.int/Portals/5/DGDs/DGD_DDT_EN.pdf(3.2.2)
[24] http://www.pic.int/Portals/5/DGDs/DGD_DDT_EN.pdf (2.1)

Food	Pesticide	Total # of samples containing DDT residues	Total # of samples	Quarterly Presence	%
Burgers	DDT	2	96		2.08%
Liver	DDT	10	108	Q2,Q4	9.26%
OilyFish	DDT	6	109	Q1,Q4	5.50%
SmokedFish	DDT	28	108	Q2,Q4	25.92%

Outlined below are the other effects of DDT on humans and the environment from various studies. On the Pesticide Action Network International 'Highly Hazardous Pesticides' List, DDT has been highlighted by the EPA (Environmental Protection Agency USA) and IARC (International Agency for Research on Cancer)as a probably/likely carcinogenic. It has also been highlighted by the EU as a substance which causes concern for humans owing to possible carcinogenic effects, as well as being a Suspected human carcinogen according to EU GHS Regulation (EU GHS (2)) and is recognised by the EU as a substance known to impair fertility in humans (EU GHS repro (1A, 1B)).[25]

HUMAN IMPACT:

DDT has been reported by the Food and Agriculture Organization of the United Nations to have the potential to cause or give rise to tumours (oncogenicity).[26] As well as this it is present on the Colborn List for endocrine disruptors.[27]

ENVIRONMENTAL IMPACT:

The characteristics of DDT to persist, especially in temperate climates, and to biomagnify the food chain led to significant reproductive effects in birds, such as the brown pelican, osprey and eagles, because of shell thinning.[28]

Dieldrin:

The pesticide Dieldrin has various health and environmental effects and is present on the PAN North America Bad Actor List. Dieldrin residues were present on 6 products surveyed in 2011: Burgers, Liver, Oily Fish, Smoked Fish, Courgettes and Cucumbers. The presence of the pesticide ranged from 0.002mg/kg to 0.020mg/kg. Smoked Fish was the worst offender with 20.37% of the samples tested containing residues of Dieldrin. Furthermore, 38% of the samples containing Dieldrin were produced in the UK.

[25] http://www.panna.org/sites/default/files/PAN_HHP-List_1101(1).pdf
[26] http://www.pic.int/Portals/5/DGDs/DGD_DDT_EN.pdf (2.2)
[27] http://www.ourstolenfuture.org/Basics/chemlist.htm
[28] http://www.pic.int/Portals/5/DGDs/DGD_DDT_EN.pdf (2.2)

Vegetable	Pesticide	Total # of Samples containing Dieldrin residues	Total # of samples	Quarterly Presence	%
Burgers	Dieldrin	1	96		1.04%
Courgettes	Dieldrin	2	90	Q2,Q4	2.22%
Cucumber	Dieldrin	1	30	Q1	3.33%
Liver	Dieldrin	2	108	Q2,Q4	1.85%
Oily Fish	Dieldrin	1	52	Q1	1.92%
SmokedFish	Dieldrin	22	108	Q2,Q4	20.37%

Outlined below are the other effects of Dieldrin on humans and the environment from various studies. On the Pesticide Action Network International 'Highly Hazardous Pesticides' List, Dieldrin is hazardous in its probability or likeliness to be a carcinogen according to the US Environmental Protection Agency (EPA probably likely carcinogenic). Furthermore it is highlighted by the EU to be a substance which cause concern for humans owing to possible carcinogenic effects, mutagenic to man (EU mutagenic to man (1,2)), an endocrine disruptor or potential endocrine disruptor (EU EDC (1,2) or C2 & R2 GHS). According to REACh criteria, Dieldrin is very bio accumulative and is highly toxic to bees.

HUMAN IMPACT:

The effects of Dieldrin have been assessed by the United Nationals Environment Program as Aldrin: Dieldrin appears after the absorption of Aldrin. The UNEP program found that Dieldrin has been found to reduce the activation or efficacy of the immune system (immunnosurpression) in mice. [29]
As well as this Dieldrin is on the Colborn List for endocrine disruptors and is noted to effect oestrogen levels.[30]

Glyphosate

Glyphosate is the most commonly used weed killer in the world[31] and evidence shows it is toxic to humans (see effects later in this section). Glyphosate residues occur in 5 products in 2011: Bread, lentils, pulses, rice and flour. The highest were Lentils where in Q3 and Q4 19 samples contained glyphosate residues (Q3 and Q4 sample sizes were 54 and 30: 22.62%). 15 of the 19 samples containing glyphosate residues in lentils were sourced in the UK.

[29] http://www.eeaa.gov.eg/cmuic/cmuic_pdfs/pic-doc/Decision%20guidance%20document/Decision%20Guidance%20Document%20pdf/aldrinEN.pdf (3.2.2)
[30] http://www.ourstolenfuture.org/Basics/chemlist.htm
[31] http://www.motherearthnews.com/organic-gardening/hazards-of-the-worlds-most-common-herbicide.aspx#axzz2WewonmfF

Fresh Produce	Pesticide	Total # of samples containing glyphosate residues	Total # of samples	Quarterly presence	%
Bread	Glyphosate	33	216	Q3, Q4	15.28%
Lentils	Glyphosate	19	84	Q3, Q4	22.62%
Pulses	Glyphosate	8	54	Q3, Q4	14.81%
Rice	Glyphosate	1	35	Q2	2.85%
Flour	Glyphosate	2	72	Q1	3.77%

HUMAN IMPACT:

A group of scientists from the University of Caen in France found that human placental cells are very sensitive to the herbicide at concentrations lower than the agricultural use, and that it disrupts human sex hormones. The scientists concluded that the herbicide could "induce reproduction problems" in humans.[32]
In another study, University of Pittsburgh biologist Rick Relyea looked at the effect of Roundup (the trade name of Glyphosate) on other life forms. Relyea found that the herbicide caused an 86-percent decline in the total population of tadpoles.[33]
Glyphosate and glyphosate-containing herbicides caused genetic damage in laboratory tests with human cells, as well as in tests with laboratory animals.[34]
Studies of farmers and other people exposed to glyphosate herbicides have shown that this exposure is linked with increased risks of the cancer non-Hodgkin's lymphoma, miscarriages, and attention deficit disorder. For each of the hazards identified in these studies there are also laboratory studies with results that are consistent with the studies of exposed people.[35]
There is also laboratory evidence that glyphosate herbicides can reduce production of sex hormones.[36]

ENVIRONMENTAL IMPACT:

Glyphosate herbicides caused genetic damage and damage to the immune system in fish. In frogs, glyphosate herbicides caused genetic damage and abnormal development.[37]
Studies of glyphosate contamination of water are limited, but new results indicate that it can commonly contaminate streams in both agricultural and urban areas.[38]
Problems with drift of glyphosate herbicides occur frequently. Only one other herbicide causes more drift incidents in the US.[39]

Lambda-Cyhalothrin

[32] http://pubs.acs.org/doi/abs/10.1021/tx800218n
[33] http://www.pitt.edu/~relyea/Site/Roundup.html
[34] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/glyphosate
[35] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/glyphosate
[36] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/glyphosate
[37] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/glyphosate
[38] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/glyphosate
[39] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/glyphosate

Lambda Cyhalothrin was present in 8 products in 2011: Beans with Pods, celery, dried grapes, grapes, okra, oranges, pre-packed salads, soft citrus and spinach. Lambda-Cyhalothrin can have corrosive effects on both eyes and the skin. However, tests on animals (rats and mice) have found that mammals are found to metabolize and excrete lambda cyhalothrin rapidly.[40] Nevertheless, it is highly toxic to bees[41] (when they eat or contact the chemical[42]) and very toxic to fish. Some studies have also found that the chemical may be bioaccumulative in fish, nevertheless in field studies with lambda-cyhalothrin products, researchers found no significant adverse effects to fish.[43]

On the Pesticide Action Network International 'Highly Hazardous Pesticides' List, Lambda-cyhalothrin is very toxic by inhalation according to the EU(R26), and is an endocrine disruptor or potential endocrine disruptor according to the EU (EU EDC (1,2) or C2 & R2 GHS). Furthermore it is highly toxic to bees.

Fresh Produce	Pesticide	Total # of samples containing lambda-cyhalothrin residues	Total # of samples	Quarterly Presence	%
Beans with Pods	lambda-cyhalothrin	6	54	Q1, Q4	11.11%
Celery	lambda-cyhalothrin	4	72	Q2,Q4	5.55%
Dried Grapes	lambda-cyhalothrin	15	48	Q4	31.25%
Grapes	lambda-cyhalothrin	1	62	Q2	1.61%
Okra	lambda-cyhalothrin	1	54	Q3	1.85%
Oranges	lambda-cyhalothrin	1	23	Q2	4.35%
Pre Packed Salads	lambda-cyhalothrin	3	24	Q3	12.50%
Soft Citrus	lambda-cyhalothrin	6	60	Q4	10%
Spinach	lambda-cyhalothrin	5	70	Q1,Q2,Q4	1.42%

[40] http://toxipedia.org/display/toxipedia/Lambda-Cyhalothrin#Lambda-Cyhalothrin-PANNA
[41] http://toxipedia.org/display/toxipedia/Lambda-Cyhalothrin#Lambda-Cyhalothrin-PANNA
[42] http://npic.orst.edu/factsheets/l_cyhalogen.pdf
[43] http://npic.orst.edu/factsheets/l_cyhalogen.pdf

Methamidophos

Acute exposure to methamidophos is highly toxic through all forms of exposure: dermal, oral and inhalation. As well as this, some organophosphates may cause delayed symptoms beginning 1-4 weeks after an acute exposure that may or may not have produced immediate symptoms. Improvement may occur over months or years, but some residual impairment will remain. [44] Since 1997 in Hong Kong, there have been numerous cases of acute poisoning following the consumption of green leafy vegetables imported from China. It is suspected that methamidophos has been used by some farmers and that the sprayed vegetables have been harvested too early before the residue levels have fallen to safe levels" [45]
Methamidophos was only found in one product in 2011: beans with pods. It was present in Quarter 1, 2 and 4 and although was low (1.42%) it is significant due to its high toxicity in humans.

Outlined below are the other effects of Methamidophos on man and the environment from various studies. On the Pesticide Action Network International 'Highly Hazardous Pesticides' List, Methamidophos is hazardous in the following criteria: Highly hazardous according to WHO (Who Ib), Very toxic by inhalation according to the EU(R26), is a possible carcinogen according to the EPA (EPA possible carcinogenic), and is highly toxic to bees.

Fresh Produce	Pesticide	Total # of samples containing methamidophos residues	Total # of samples	Quarterly Presence	%
Beans with Pods	Methamidophos	3	81	Q1,Q2,Q4	3.70%

HUMAN IMPACT:

[44] http://www.pic.int/Portals/5/DGDs/DGD_Methamidophos_EN.pdf
[45] http://www.pic.int/Portals/5/DGDs/DGD_Methamidophos_EN.pdf 3.1

Methamidophos affects the nervous system by inhibiting acetyl cholinesterase, an enzyme essential for normal nerve impulse transmission.[46]Furthermore, repeated exposure through inhalation, ingestion or through skin may gradually lead to signs and symptoms of inhibition of cholinesterase activity. Finally, excessive human exposure to methamidophos may cause delayed neuropathy. [47]

ENVIRONMENTAL IMPACT:

Methamidophos is toxic to bees

Methomyl

Methomyl is present on the PAN Bad Actor Chemical list. It also features on the Colborn List for endocrine disruptors as a thyroid disrupting chemical[48]. As well as this, it is highly toxic to honeybees,[49] birds, and is highly toxic through ingestion[50].
Methomyl was present in two of the products surveyed in 2011: beans with pods and celery. It featured in every quarter's sample of beans with pods.
Outlined below are the other effects of Methomyl on the environment from various studies. On the Pesticide Action Network International 'Highly Hazardous Pesticides' List, Methomyl is highly hazardous according to WHO (Who Ib) and is regarded as an endocrine disruptor according to the EU (EU EDC (1,2) or C2 &R2 GHS). It is also regarded as highly toxic to bees.

Fresh Produce	Pesticide	Total # of samples containing methomyl residues	Total # of samples	Presence in Quarterlies	%
Beans with Pods	methomyl	9	120	Q1,Q2,Q3,Q4	7.50%
Celery	methomyl	1	34	Q2	2.94%

ENVIRONMENTAL IMPACT:

According to the EPA (The United States Environment Protection Agency), methomyl significantly reduced fish larvae survival under flow through conditions.[51]As well as this, because of its high solubility in water (58,000 ug/ml) and its soil half-life (33 days), methomyl may have potential for groundwater contamination.[52]

[46] http://www.pic.int/Portals/5/DGDs/DGD_DDT_EN.pdf (2.1.1)
[47] Ibid 2.2.2
[48] http://www.ourstolenfuture.com/Basics/chemlist.htm
[49] http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35109
[50] http://pmep.cce.cornell.edu/profiles/extoxnet/haloxyfop-methylparathion/methomyl-ext.html
[51] http://www.epa.gov/oppsrrd1/REDs/factsheets/0028fact.pdf
[52] Original study: U. S. Department of Agriculture, Soil Conservation Service. 1990 (Nov.). SCS/ARS/CES Pesticide Properties Database: Version 2.0 (Summary). USDA - Soil Conservation Service, Syracuse, NY. Found at: http://pmep.cce.cornell.edu/profiles/extoxnet/haloxyfop-methylparathion/methomyl-ext.html

Omethoate

Omethoate is on the EU list of endocrine disruptors[53]. It was found in one product in 2011: Beans with pods. 11 samples contained residues in Quarter 1, 3 and 4 (11.82%)

On the Pesticide Action Network International 'Highly Hazardous Chemicals' List, Omethoate is highly hazardous according to WHO (Who Ib) and is regarded as an endocrine disruptor according to the EU (EU EDC (1,2) or C2 &R2 GHS). It is also highly toxic to bees.

Fresh Produce	Pesticide	Total # of samples containing methomyl residues	Total # of samples	Presence in Quarterlies	%
Beans with Pods	omethoate	11	93	Q1,Q3,Q4	11.82%

[53] http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC30

Conclusion

A COMMON-SENSE APPROACH

Over recent years levels of pesticide residues in our food have been steadily increasing, and as much as 40% of the food we eat contains them. Residues found in several fruit categories exceeded Government limits. A number of the most widely used are highly toxic and have been linked with developmental defects, cancers and other disorders.

Studies in the USA are starting to show that exposure to the chemicals in our environment, including pesticides, are having numerous effects on children and may cause problems such as Attention Deficit Hyperactivity Disorder (ADHD), autism and developmental delays. With 19% of samples containing more than one residue, research is showing that ingesting multiple pesticide residues even below the arbitrary 'safe' limit can have magnified effects.

Even where these chemicals have been found in the highest concentrations, they still make up a tiny amount in relation to the foodstuff itself. Nonetheless, it's worth remembering that all pesticides are by definition poisons. More research is needed to understand the cumulative effects of exposure to them over extended periods of time as well as the 'cocktail' effect of combinations of chemicals.
Given the evidence, it seems like simple common sense to reduce and avoid our exposure to them wherever possible.

What can the Government, retailers and farmers do?

The prevalent system of chemically intensive farming isn't the only way. The report aims to encourage everyone to support and promote the right of all of us as consumers to make an informed choice based on the best available research.

- The UK Government can support organic producers and also promote Integrated Pest Management (IPM). This focusses on non-chemical pest and weed control methods

- Retailers can support organic and IPM producers throughout their global supply chains. Farmers, with the support of government and retailers, could adopt organic and other non-chemical control methods wherever possible

- The public can insist that food sellers do more to support organic and IPM growers and state that they do not want pesticide residues in their food

- Key findings from the PRiF residue testing work should be advertised more clearly and accessibly to the public. PAN UK would also like to see the big retailers publishing their own residue testing data so everyone can see what is likely to be on the food in the shops they buy it from

- Further research into how multiple pesticide residues interact to affect human health is needed immediately. Specifically there should be government-funded research alongside independent research

How can consumers reduce their exposure to pesticide residues?

You can't see, smell or taste pesticides on your fruit and vegetables, yet these food groups are a crucial part of a balanced diet. The good news is it's possible to stick to your five-a-day and substantially reduce your exposure to pesticides by following these guidelines.

- Buy organic fruit and vegetables where possible. If you are unable to switch to a completely organic diet, start with buying organic produce for those foods which you eat most often or which are most likely to contain pesticide residues. Up to date assessment of pesticide residue data is available on the PAN UK food web pages - http://www.pan-uk.org/food/best-worst-food-for-pesticide-residues

- Don't eat the peel of non-organic citrus fruit – that is where the highest concentration of residues is. If you are using the peel, buy organic

- Buy ugly fruit and vegetables! They taste the same and are just as nutritious. Many pesticides are used solely for cosmetic reasons, so consumers need to show they want imperfect produce

- Organic food box schemes are increasingly available across the UK. These are a great way to ensure that your produce is pesticide free and supports local farming

- Ask your local supermarket what they're doing to reduce pesticide residues. Are they improving their labelling to give better information to consumers? Are they supporting growers who are reducing or phasing out pesticides?

- Grow your own organic fruit and vegetables and you'll know that nothing toxic has been used on them. Even a window box can grow salad; a patio can grow tomatoes

- Buy Fair Trade and Rainforest Alliance labelled produce. Both help to reduce or eliminate some of the most hazardous pesticides, supporting farmer and worker health and encouraging farmers to shift to safer pest management

- Support organisations such as PAN UK, Garden Organic, the Soil Association and Organic UK, who are campaigning to make real changes in the way food is produced

APPENDIX

12 Worst foods for pesticide residues / the "Dirty Dozen" 2007-2012

Foodstuff 2007-12	Total samples	Non-organic samples	Non-organic samples containing residues		Non-organic samples with MRL exceedances		Nonorganic samples containing more than one residue		Organic samples	Organic Samples Containing Residues	
Apples	696	671	597	88.97 %	6	0.89%	503	74.96%	25	0	0.00 %
Grapefruit	54	54	54	100.00 %	0	0.00%	54	100.00%	0	0	0.00 %
Soft citrus	168	168	164	97.62 %	3	1.79%	160	95.24%	0	0	0.00 %
Lemons	90	82	80	97.56 %	0	0.00%	72	87.80%	8	0	0.00 %
Flour	72	63	61	96.83 %	0	0.00%	12	19.05%	9	2	22.22%
Cherries	96	95	90	94.74 %	4	4.21%	62	65.26%	1	0	0.00 %
Pineapple	108	107	101	94%	3	2.80%	47	44%	1	0	0%
Pears	736	710	669	94.23 %	14	1.97%	492	69.30%	27	1	3.70 %
Nectarines	29	29	27	93.10 %	0	0.00%	18	62.07%	0	0	0.00 %
Bananas	150	139	129	92.81 %	0	0.00%	90	64.75%	15	0	0.00 %
Grapefruit, tinned	154	153	140	91.50 %	13	8.50%	119	77.78%	1	0	0.00 %
Oranges	265	261	238	91.19 %	3	1.15%	229	87.74%	4	0	0.00 %

Strawberries	143	135	123	91.11 %	0	0.00%	105	77.78%	8	0	0.00 %

12 Worst foods for pesticide residues of 2011

Foodstuff 2011	Total samples	Non-organic samples	Non-organic samples containing residues		Non-organic samples with MRL exceedances		Nonorganic samples containing more than one residue		Presence in Quarterlies
Soft citrus	107	107	107	100.00%	1	0.93%	103	96.26%	Q2, Q4
Oranges	99	99	97	97.98%	2	2.02%	94	94.95%	Q1, Q2, Q3, Q4
Flour	72	63	61	96.83%	0	0.00%	12	19.05%	Q1
Pears	118	115	111	96.52%	0	0.00%	108	93.91%	Q1, Q2, Q3, Q4
Pineapple	60	60	56	93.33%	3	5.00%	42	70.00%	Q1, Q3
Grapes	174	173	158	91.33%	5	2.89%	137	79.19%	Q1, Q2, Q3, Q4
Apples	96	96	87	90.63%	0	0.00%	73	76.04%	Q2, Q4
Dried Grapes	48	42	34	80.95%	0	0.00%	25	59.52%	Q4
Raspberries	63	51	39	76.47%	0	0.00%	23	45.10%	Q2, Q3
Bread	216	216	159	73.61%	0	0.00%	49	22.69%	Q3, Q4
Carrots, fresh	96	74	54	72.97%	0	0.00%	17	22.97%	Q2, Q3
Peppers	42	37	26	70.27%	0	0.00%	11	29.73%	Q4

Pesticide residues table 2011, organised by food product

Vegetable	Pesticide	Ratio of pesticide to product	%
Apples	Carbendazim	1 of 30 (Q3)	3.33%
Apples	Chlorpyrifos	4 of 43 (Q2), 10 of 53 (Q4)	14.58%
Beans with Pods	Carbendazim	1 of 24 (Q4), 1 of 39 (Q3) 3 of 30 (Q1)	4.16%

Beans with Pods	Chlorpyrifos	2 of 30 (Q1) 1 of 27 (Q2), 1 of 39 (Q3), 1 of 24 (Q4)	4.17%
Beans with Pods	Cypermethrin	2 of 39 (Q3), 1 of 27 (Q2), 2 of 30 (Q1)	5.21%
Beans with Pods	lambda-cyhalothrin	2 of 24 (Q4), 4 of 30 (Q1)	11.11%
Beans with Pods	Methamidophos	1 of 24 (Q4) 1 of 27 (Q2), 1 of 30 (Q1)	3.70%
Beans with Pods	methomyl	2 of 24 (Q4) 1 of 39 (Q3), 2 of 27 (Q2), 4 of 30 (Q1)	7.50%
Beans with Pods	omethoate	2 of 24 (Q4), 5 of 39 (Q3), 4 of 30 (Q1)	11.82%
Bread	Cypermethrin	1 of 108 (Q3)	0.93%
Bread	Glyphosate	18 of 108 (Q4) 15 of 108 (Q3)	15.28%
Burgers	DDT	2 of 96	2.08%
Burgers	Dieldrin	1 of 96	1.04%
Celery	lambda-cyhalothrin	2 of 38 (Q4), 2 of 34 (Q2)	5.55%
Celery	methomyl	1 of 34 (Q2)	2.94%
Courgettes	Cypermethrin	1 of 35 (Q2)	2.85%
Courgettes	Dieldrin	1 of 55 (Q4), 1 of 35 (Q2)	2.22%
Cucumber	Carbendazim	1 of 48 (Q4), 3 of 43 (Q2)	4.40%
Vegetable	**Pesticide**	**Ratio of pesticide to product**	**%**
Cucumber	Dieldrin	1 of 30 (Q1)	3.33%
Dried Grapes	Chlorpyrifos	17 of 48 (Q4)	35.42%
Dried Grapes	lambda-cyhalothrin	15 of 48 (Q4)	31.25%
Flour	Glyphosate	2 of 72 (Q1)	3.77%
Grapes	Carbendazim	1 of 62 (Q2) 1 of 41 (Q1)	1.94%
Grapes	Chlorpyrifos	1 of 41 (Q1), 3 of 62 (Q2), 6 of 37 (Q3), 3 of 34 (Q4)	7.47%
Grapes	Cypermethrin	2 of 24 (Q2)	8.33%
Grapes	lambda-cyhalothrin	1 of 62 (Q2)	1.61%
Lentils	Glyphosate	16 of 54 (Q4) 3 of 30 (Q3)	22.62%
Liver	DDT	4 of 54 (Q4), 6 of 54 (Q2)	9.26%
Liver	Dieldrin	1 of 54 (Q4), 1 of 54 (Q2)	1.85%
Oily Fish	DDT	3 of 57 (Q4), 3 of 52 (Q1)	5.50%
Oily Fish	Dieldrin	1 of 52 (Q1)	1.92%
Okra	Cypermethrin	9 of 54 (Q3)	16.68%
Okra	lambda-cyhalothrin	1 of 54 (Q3)	1.85%
Oranges	Carbendazim	3 of 17 (Q4) 3 of 35 (Q3)	11.54%
Oranges	Chlorpyrifos	20 of 25 (Q1), 16 of 23 (Q2), 6 of 25 (Q3), 7 of 17 (Q4)	54.44%
Oranges	lambda-cyhalothrin	1 of 23 (Q2)	4.35%
Pears	Chlorpyrifos	10 of 31 (Q1), 2 of 30 (Q3), 5 of 25 (Q4)	19.76%
Pineapple	Carbendazim	1 of 37 (Q3) 2 of 25 (Q2)	4.84%
Pineapple	Chlorpyrifos	2 of 30 (Q1)	6.67%
Plantain	Chlorpyrifos	6 of 26 (Q4)	23.08%
Pre Packed Salads	Carbendazim	1 of 24 (Q2)	4.17%
Pre Packed Salads	lambda-cyhalothrin	3 of 24 (Q3)	12.50%
Pulses	Glyphosate	7 of 30 (Q4) 1 of 24 (Q3)	14.81%
Raspberries	Carbendazim	1 of 29 (Q2)	3.45%
Rice	Carbendazim	1 of 29 (Q2)	3.45%
Rice	Glyphosate	1 of 35 (Q2)	2.85%
SmokedFish	DDT	15 of 60 (Q4), 13 of 48 (Q2)	25.92%
Smoked Fish	Dieldrin	11 of 60 (Q4) 11 of 48 (Q2)	20.37%
Soft Citrus	Carbendazim	2 of 69 (Q4) 2 of 39 (Q2)	3.70%
Soft Citrus	Chlorpyrifos	5 of 39 (Q2), 27 of 69 (Q4)	29.63%

Soft Citrus	Cypermethrin	1 of 39 (Q2)	2.56%
Soft Citrus	lambda-cyhalothrin	6 of 60 (Q4)	10%
Spinach	Carbendazim	1 of 24 (Q1)	4.17%
Spinach	Chlorpyrifos	1 of 24 (Q1)	4.16%
Spinach	Cypermethrin	5 of 24 (Q3)	20.83%
Spinach	lambda-cyhalothrin	2 of 18 (Q4), 2 of 28 (Q2), 1 of 24 (Q1)	1.42%

Pesticide residues table 2011, organised by pesticide

Vegetable	Pesticide	Ratio of pesticide to product	%
Apples	Carbendazim	1 of 30 (Q3)	3.33%
Beans with Pods	Carbendazim	1 of 24 (Q4), 1 of 39 (Q3) 3 of 30 (Q1)	4.16%
Cucumber	Carbendazim	1 of 48 (Q4), 3 of 43 (Q2)	4.40%
Grapes	Carbendazim	1 of 62 (Q2) 1 of 41 (Q1)	1.94%
Oranges	Carbendazim	3 of 17 (Q4) 3 of 35 (Q3)	11.54%
Pineapple	Carbendazim	1 of 37 (Q3) 2 of 25 (Q2)	4.84%
Pre Packed Salads	Carbendazim	1 of 24 (Q2)	4.17%
Raspberries	Carbendazim	1 of 29 (Q2)	3.45%
Rice	Carbendazim	1 of 29 (Q2)	3.45%
Soft Citrus	Carbendazim	2 of 69 (Q4) 2 of 39 (Q2)	3.70%
Spinach	Carbendazim	1 of 24 (Q1)	4.17%
Apples	Chlorpyrifos	4 of 43 (Q2), 10 of 53 (Q4)	14.58%
Beans with Pods	Chlorpyrifos	2 of 30 (Q1) 1 of 27 (Q2), 1 of 39 (Q3), 1 of 24 (Q4)	4.17%
Dried Grapes	Chlorpyrifos	17 of 48 (Q4)	35.42%
Grapes	Chlorpyrifos	1 of 41 (Q1), 3 of 62 (Q2), 6 of 37 (Q3), 3 of 34 (Q4)	7.47%
Oranges	Chlorpyrifos	20 of 25 (Q1), 16 of 23 (Q2), 6 of 25 (Q3), 7 of 17 (Q4)	54.44%
Pears	Chlorpyrifos	10 of 31 (Q1), 2 of 30 (Q3), 5 of 25 (Q4)	19.76%
Pineapple	Chlorpyrifos	2 of 30 (Q1)	6.67%
Plantain	Chlorpyrifos	6 of 26 (Q4)	23.08%
Soft Citrus	Chlorpyrifos	5 of 39 (Q2), 27 of 69 (Q4)	29.63%
Spinach	Chlorpyrifos	1 of 24 (Q1)	4.16%
Beans with Pods	Cypermethrin	2 of 39 (Q3), 1 of 27 (Q2), 2 of 30 (Q1)	5.21%
Bread	Cypermethrin	1 of 108 (Q3)	0.93%
Courgettes	Cypermethrin	1 of 35 (Q2)	2.85%
Grapes	Cypermethrin	2 of 24 (Q2)	8.33%
Okra	Cypermethrin	9 of 54 (Q3)	16.68%
Soft Citrus	Cypermethrin	1 of 39 (Q2)	2.56%
Spinach	Cypermethrin	5 of 24 (Q3)	20.83%
Burgers	DDT	2 of 96	2.08%
Liver	DDT	4 of 54 (Q4), 6 of 54 (Q2)	9.26%
Oily Fish	DDT	3 of 57 (Q4), 3 of 52 (Q1)	5.50%
Smoked Fish	DDT	15 of 60 (Q4), 13 of 48 (Q2)	25.92%
Burgers	Dieldrin	1 of 96	1.04%
Courgettes	Dieldrin	1 of 55 (Q4), 1 of 35 (Q2)	2.22%
Cucumber	Dieldrin	1 of 30 (Q1)	3.33%
Liver	Dieldrin	1 of 54 (Q4), 1 of 54 (Q2)	1.85%
Oily Fish	Dieldrin	1 of 52 (Q1)	1.92%
Smoked Fish	Dieldrin	11 of 60 (Q4) 11 of 48 (Q2)	20.37%
Bread	Glyphosate	18 of 108 (Q4) 15 of 108 (Q3)	15.28%
Lentils	Glyphosate	16 of 54 (Q4) 3 of 30 (Q3)	22.62%
Pulses	Glyphosate	7 of 30 (Q4) 1 of 24 (Q3)	14.81%
Rice	Glyphosate	1 of 35 (Q2)	2.85%
Flour	Glyphosate	2 of 72 (Q1)	3.77%
Beans with Pods	lambda-cyhalothrin	2 of 24 (Q4), 4 of 30 (Q1)	11.11%
Celery	lambda-cyhalothrin	2 of 38 (Q4), 2 of 34 (Q2)	5.55%

Vegetable	Pesticide	Ratio of pesticide to product	%
Dried Grapes	lambda-cyhalothrin	15 of 48 (Q4)	31.25%
Grapes	lambda-cyhalothrin	1 of 62 (Q2)	1.61%
Okra	lambda-cyhalothrin	1 of 54 (Q3)	1.85%
Oranges	lambda-cyhalothrin	1 of 23 (Q2)	4.35%
Pre Packed Salads	lambda-cyhalothrin	3 of 24 (Q3)	12.50%
Soft Citrus	lambda-cyhalothrin	6 of 60 (Q4)	10%
Spinach	lambda-cyhalothrin	2 of 18 (Q4), 2 of 28 (Q2), 1 of 24 (Q1)	1.42%
Beans with Pods	Methamidophos	1 of 24 (Q4) 1 of 27 (Q2), 1 of 30 (Q1)	3.70%
Beans with Pods	methomyl	2 of 24 (Q4) 1 of 39 (Q3), 2 of 27 (Q2), 4 of 30 (Q1)	7.50%
Celery	methomyl	1 of 34 (Q2)	2.94%
Beans with Pods	omethoate	2 of 24 (Q4), 5 of 39 (Q3), 4 of 30 (Q1)	11.82%

Hazardous Pesticides and their PAN International classifications:

Pesticide	Categories	Notes
DDT	EPA problikelcarc	Group 2: Long Term effects
	IARC probcarc	
	EU canc (3)	
	EU GHS (2)	
	EU GHS repro (1A, 1B)	
	PIC	Group 4: Conventions
	POP	
Dieldrin	EPA problikelcarc	Group 2: Long Term effects
	EU canc (3)	
	EU GHS (2)	
	EU GHS repro (1A, 1B)	
	VeryBioAcc	Group 3: EnvironmentalToxicity
	HighlytoxicBees	
	PIC	Group 4: Conventions
	POP	
Cypermethrin	Highly toxic Bees	Group 3: Environmental Toxicity
Lambda-cyhalothrin	R26	Group 1: AcuteToxicity
	EU EDC (1,2) or C2 &R2 GHS	Group 2: Long Term effects
	Highly toxic Bees	Group 3: Environmental Toxicity
Methomyl	WHO Ib	Group 1: Acute Toxicity
	EU EDC (1,2) or C2 &R2 GHS	Group 2: Long Term effects
	Highly toxic Bees	Group 3: Environmental Toxicity
Methamidophos	WHO Ib	Group 1: Acute Toxicity
	R26	
	Highly toxic Bees	Group 3: Environmental Toxicity
	PIC	Group 4: Conventions
Omethoate	WHO Ib	Group 1: Acute Toxicity
	EU EDC (1,2) or C2 &R2 GHS	Group 2: Long Term effects
	Highly toxic Bees	Group 3: Environmental Toxicity
Carbendazim	EU meta (1,2)	Group 2: Long Term effects
	Eu GHS muta (1A, 1B)	
	EU repro (1,2)	

	EU GHS repro (1A, 1B)	
	EU EDC (1,2) or C2 &R2 GHS	
Chlorpyrifos	Highly toxic Bees	Group 3: Environmental Toxicity

Key Terms Explained:

Colborn List:
The Colborn List is a list of endocrine disrupting chemicals that was published in the Scientific Literature in 1993 by Theo Colborn, followed by the popular book Our Stolen Future. The book highlighted the effects of endocrine disrupting chemicals on humans and the environment.54 The current list can be found here: http://www.ourstolenfuture.com/Basics/chemlist.htm

Highly Hazardous Pesticides List
In October 2007 the FAO and WHO Panel of Experts on Pesticide Management wrote a paper which "focuses on options for defining highly hazardous pesticides". PAN welcomed this decision but thought that the list of indicators agreed by the Panel of Experts omitted some prevalent indications of toxicity including endocrine disrupting properties, eco-toxicological properties, or inhalative toxicity. This lead PAN International to decide to independently develop a definition of Highly Hazardous Pesticides (HHPs) with a more comprehensive set of indicators. [55]

PAN Bad Actor List:
PAN and Californians for Pesticide Reform (CPR) created the term PAN Bad Actor pesticide in order to identify a "most toxic" set of pesticides. These pesticides are at least one of the following: known or probable carcinogens, reproductive or developmental toxicants, neurotoxic cholinesterase inhibitors, known groundwater contaminants or have a high acute toxicity. A more comprehensive explanation to the list can be found on PAN's website at: http://www.pesticideinfo.org/Docs/ref_toxicity7.html.

PAN International Highly Hazardous Acronyms explained:
WHO 1a: Extremely hazardous (Class 1a) according to World Health Organisation
WHO 1b: Highly hazardous (Class 1b) according to World Health Organisation
R26: Very toxic by inhalation according to EU
EPA carc: Human carcinogen according to EPA (US Environmental Protection Agency)
IARC carc: Human carcinogen according to IARC (International Agency For Research on Cancer)
EU carc (1,2): Known to be carcinogenic to humans (category 1) or sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer (category 2) according to EU

[54] http://www.womenlivingnaturally.com/articlepage.php?id=164
[55] http://www.panna.org/sites/default/files/PAN_HHP-List_1101(1).pdf Page 4.

EU GHS (1A, 1B): Known or presumed human carcinogens (1A or 1B) according to EU GHS Regulation
EPA prob/likelcarc: Probable/ Likely carcinogen according to EPA (US Environmental Protection Agency
IARC probcarc: Probable carcinogen according to IARC (International Agency For Research on Cancer)
EPA posscarc: Possible carcinogen according to EPA (US Environmental Protection Agency)
IARC posscarc: Possible carcinogen according to IARC (International Agency for Research on Cancer)
EU carc (3): Substances which cause concern for humans owing to possible carcinogenic effects (category 3) according to EU
EU GHS (2): Suspected human carcinogen (Cat. 2) according to EU GHS (Globally Harmonized System) Regulation 1272/2008/EC
EU muta (1,2): Substances known to be mutagenic to man (category 1) or substances which should be regarded as if they are mutagenic to man (category 2) according to EU
EU GHS muta (1A, 1B): Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans. Substances known to induce heritable mutations in the germ cells of humans' (Category 1A or 1B) according to EU
EU repro (1,2): Substances known to be mutagenic to man (category 1) or substances which should be regarded as if they are mutagenic to man (category 2) according to EU
EU GHS repro (1A, 1B): Substances known to impair fertility in humans (category 1) or substances which should be regarded as if they impair fertility in humans and/or substances which should be regarded as if they cause developmental toxicity to humans (category 2) according to EU
EU EDC (1,2) or C2 & R2 GHS: Endocrine disruptor or potential endocrine disruptor according to EU Category 1 or Category 2 or GHS Carcer 2 AND EU reproductive toxicity
Very bio acc: Very bioaccumulative according to REACh criteria
Very pers water: Very persistent/water according to REACh criteria
Very pers water sedi: Very persistent in water/sediment according to REACh criteria
Highly toxic bees: Hazard to ecosystem services – Highly toxic for bees according to U.S. EPA as listed by FOOTPRINT data

REACh Criteria:
REACh, the 'Registration, Evaluation, Authorisation and Restriction of Chemicals' is a European Union Regulation (EC/2006/1907 of 18 December 2006). It addresses the production and use of chemical substances, and their potential impacts on both human health and the environment. REACH applies to all chemicals imported or produced in the EU. According to REACh chemicals are "very bioaccumulative" if their Bio-Concentration Factor (BCF) is larger than 5,000 and "very persistent" if their

half-life in marine water or fresh water exceeds 60 days or their half-life in marine or freshwater sediment exceeds 180 days. [56]

[56] http://www.panna.org/sites/default/files/PAN_HHP-List_1101(1).pdf

Research Method: The information was gathered in the following manner: The 'Highly Hazardous' table that PAN International produced was used to (http://www.panna.org/sites/default/files/PAN_HHP-List_1101(1).pdf) highlight pesticides which were hazardous in three or more of the 4 'groups': Acute toxicity, long term effects, environmental toxicity and conventions. Some pesticides were also chosen due to their specific interest to PAN UK. We then looked at the quarterly reports from 2011 and gathered the data on which of these more 'harmful' pesticides were present. We came up with a list of 10 pesticides. Once this was completed, we began compiling this pesticide report which is a compilation of various sources of information, all credible and all referenced in the footnotes to each page.

According to Professor Jules Pretty, the cost for cleaning up pesticides in UK water alone is 143.2 million pounds a year.[57]

"Any pesticide that can persist for many years, build up in soil, and leach into waterways is likely to have effects far beyond the pest insects it intends to target. This is particularly so when the pesticide is highly toxic to non-target organisms"

Prof Dave Goulson of University of Sussex

The Telegraph (14 June)

[57]Farm costs and food miles: An assessment of the full cost of the UK weekly food basket (2005) JN Pretty