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## **The ‘Dirty Dozen’: UK Government testing reveals alarming levels of pesticide cocktails in fruit and vegetables**

New official figures published last week show which UK fruit and vegetables are most likely to contain cocktails of potentially hazardous pesticides.(1) Known as ‘The Dirty Dozen’, the list of the twelve worst offenders was topped by strawberries with almost 90 percent of those tested by the UK Government containing residues of more than one pesticide. Lemons and prepacked salad leaves came a close second and third, with pesticide cocktails found in more than 80 percent of tests. Individual samples were found to contain the residues of anywhere up to 14 different pesticides.

Nick Mole from PAN UK said, “The Dirty Dozen reveals that pesticide cocktails remain extremely common in UK food and should be of deep concern to consumers. There’s increasing evidence that chemicals can be more harmful when combined, particularly to pregnant women and young children, but we continue to set safety limits for just one pesticide at a time.(2) Concern about the so called ‘cocktail effect’ has been growing for decades. It’s high time we took action to protect human health.”

### **The Dirty Dozen**

<b>Product</b>	<b>Percentage of samples with multiple pesticide residues present</b>	<b>Highest number of pesticides found on one sample (1 kg)</b>
<b>Strawberries</b>	<b>89.92</b>	<b>11</b>
<b>Lemons</b>	<b>83.72</b>	<b>10</b>
<b>Pre packed salad</b>	<b>81.61</b>	<b>10</b>
<b>Grapes</b>	<b>77.69</b>	<b>14</b>
<b>Peaches &amp; Nectarines</b>	<b>67.01</b>	<b>5</b>
<b>Apples</b>	<b>66.67</b>	<b>13</b>
<b>Spinach</b>	<b>61.80</b>	<b>8</b>
<b>Chilli Peppers</b>	<b>57.14</b>	<b>10</b>
<b>Tomatoes</b>	<b>48.91</b>	<b>9</b>
<b>Lettuce</b>	<b>46.27</b>	<b>8</b>
<b>Peppers</b>	<b>41.38</b>	<b>6</b>
<b>Beans with Pods</b>	<b>30.48</b>	<b>11</b>

The Dirty Dozen was found to contain the residues of 127 different pesticides, many of which have been linked to serious health problems including cancer, birth defects and reproductive issues such as infertility.(3) More than a quarter (28%) of these pesticides are currently banned for use in the EU due to concerns over their negative impact on human health or the environment.(4) The list includes

iprodione which has been linked to cancer, and chlopyrifos which has the potential to harm the brain development of foetuses and young children.

PAN UK's analysis shows that just under a third (32%) of all food tested by the Government in 2019 (which included meat fish, grains and dairy) contained multiple pesticides. When looking just at fruit and vegetables that figure rose to just under half (48%), while for fruit alone it was over two-thirds (67%). The data also reveals worrying levels of pesticide cocktails in grains, with 94% of oats and 27% of bread containing multiple residues.

Today's data shows a significant rise in the prevalence of pesticide cocktails when compared to the previous year. In 2018, 23.5% of the food tested contained pesticide cocktails, compared to 32% in 2019. For fruit and vegetables, the percentage containing pesticide cocktails rose from 36% in 2018 to 48% a year later.(5)

"Pesticide residues aren't listed anywhere on food labels so the Dirty Dozen is the only way for British consumers to get a sense of which pesticides appear in their food", added Mole. "Most of us can't access a fully organic diet so we hope this information will help people work out which produce to prioritise".

Despite limited attempts by regulators, it has proved impossible to create a system sufficiently sophisticated to be able to assess the full spectrum of health impacts resulting from long-term exposure to hundreds of different pesticides. Pesticides appear in millions of different combinations in varying concentrations in our food. The only way to minimise the risk is to hugely decrease our overall pesticide use, thereby reducing our exposure to pesticide cocktails.

PAN UK is calling for the UK Government to reduce pesticide cocktails in food by supporting UK farmers to end their reliance on pesticides. In particular, the organisation is calling for the Government's long-awaited National Action Plan on the Sustainable Use of Pesticide, which is expected to be published soon, to introduce a pesticide reduction target and increase financial and other support to British farmers to adopt non-chemical alternatives.

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#### **NOTES TO EDITOR:**

- (1) UK Government's Expert Committee on Pesticide Residues in Food (PRiF) Annual Report 2019, published on 4<sup>th</sup> November 2020: <https://www.gov.uk/government/publications/expert-committee-on-pesticide-residues-in-food-prif-annual-report> PAN UK's analysis based on PRiF's 2019 quarterly reports: <https://www.gov.uk/government/publications/pesticide-residues-in-food-quarterly-monitoring-results-for-2019>
- (2) Evidence detailed in The Cocktail Effect report published by PAN UK and the Soil Association in October 2019: <https://www.pan-uk.org/the-cocktail-effect/>
- (3) See Table 1 below for more detail including references
- (4) See Table 2 below for more detail including references
- (5) PAN UK and the Soil Association, The Cocktail Effect, 2019, page 14: <https://www.pan-uk.org/the-cocktail-effect/>

## Background information

**Table 1 - Which fruit and vegetables on the Dirty Dozen list contain the most harmful pesticides?**

The following table shows how many active substances which are hazardous to human health were found on the Dirty Dozen products. Note: an 'active substance' is the chemically active part of a manufactured pesticide product. For example, glyphosate is the active substance in a number of different weedkiller products, including Roundup). For a guide to the human health risks outlined in the table see the explainer below the table.

Product	Total number of samples tested (sample = 1 kg) <sup>1</sup>	Number of different active substances found across all samples <sup>1</sup>	Number of active substances classified as carcinogens (known, probable, possible) <sup>2</sup>	Number of active substances classified as Suspected Endocrine Disruptors (EDCs) <sup>2</sup>	Number of active substances classified as developmental or reproductive toxins <sup>2</sup>	Number of active substances classified as cholinesterase inhibitors <sup>2</sup>
Strawberries	120	48	17	6	2	0
Lemons	96	30	12	10	7	2
Pre packed salad	88	30	7	4	1	0
Grapes	121	55	13	9	1	2
Peaches & Nectarines	97	35	13	9	1	1
Apples	96	34	16	5	3	1
Spinach	96	32	4	3	1	0
Chilli Peppers	49	43	18	10	2	4
Tomatoes	96	40	9	3	2	2
Lettuce	72	18	4	2	0	0
Peppers	122	27	9	3	2	0
Beans with Pods	106	26	9	11	4	4

### Table 1 sources

<sup>1</sup> UK Government's Expert Committee on Pesticide Residues in Food (PRiF) quarterly monitoring report for 2019: <https://www.gov.uk/government/publications/pesticide-residues-in-food-quarterly-monitoring-results-for-2019>

<sup>2</sup> University of Hertfordshire Pesticide Properties DataBase: <http://sitem.herts.ac.uk/aeru/ppdb/> & Pesticide Action Network North America, PesticideInfo Database: [http://www.pesticideinfo.org/Search\\_Chemicals.jsp](http://www.pesticideinfo.org/Search_Chemicals.jsp)

### Health issues related to pesticides – an explainer:

- Carcinogens are capable of causing different types of cancer, including Leukaemia and Non-Hodgkin's Lymphoma.
- Endocrine disruptors (EDCs) interfere with hormone systems and can cause birth defects, developmental disorders and reproductive problems such as infertility.
- Developmental or reproductive toxins have adverse effects on sexual function and fertility in both adults and children, and can reduce the number and functionality of sperm and cause miscarriages
- Cholinesterase Inhibitors reduce the ability of nerve cells to pass information to each other and can impair the respiratory system and cause confusion, headaches and weakness.

**Table 2 - Which pesticides found on the Dirty Dozen are banned by the EU for health or environmental reasons?**

Of the 127 active substances found, 36 (28%) are currently banned for use in the EU due to concerns over their negative impact on health and/or environment. The table bellows shows the 36 active substance and indicates the key reason why each is not permitted for use by the EU.

Active substances found on Dirty Dozen <sup>1</sup>	Not permitted for use by EU due to human health concerns <sup>2</sup>	Not permitted for use by EU due to environmental concerns <sup>2</sup>	Active substances found on Dirty Dozen <sup>1</sup>	Not permitted for use by EU due to human health concerns <sup>2</sup>	Not permitted for use by EU due to environmental concerns <sup>2</sup>
Acephate	X		Fipronil	X	
Bifenthrin	X		Haloxyfop	Approval not renewed	
Carbendazim		X	Hexaconazole	X	
Chlorates		x	Iprodione	X	
Chloridazon		X	Methamidophos	X	
Chlorpropham	X		Omethoate	X	
Chlorpyrifos	X		Procymidone	X	
Clothianidin		X	Profenofos	X	
Cyfluthrin	X		Propiconazole	X	
Dimethoate	X		Pymetrozine	X	
Dinetofuran		X	Quinoxifen		X
Ethion	X		Quizalofop	Approval not renewed	
Ethirimol	X		Spirodiclofen	X	
Fenamidone		X	Sulfloxaflor	X	
Fenbutatin Oxide	X		Teflubenzuron		X
Fenpropathrin		X	Thiacloprid	X	
Fenpropimorph	Withdrawn from approval renewal by applicant		Thiamethoxam		X
Fenvalerate	X		Triadimenol		X

**Table 2 sources**

<sup>1</sup> UK Government’s Expert Committee on Pesticide Residues in Food (PRiF) quarterly monitoring report for 2019: <https://www.gov.uk/government/publications/pesticide-residues-in-food-quarterly-monitoring-results-for-2019>

<sup>2</sup> EU Pesticide Approvals Database: <https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=homepage&language=EN> & University of Hertfordshire Pesticide Properties DataBase: <http://sitem.herts.ac.uk/aeru/ppdb/> & Pesticide Action Network North America, PesticideInfo Database: [http://www.pesticideinfo.org/Search\\_Chemicals.jsp](http://www.pesticideinfo.org/Search_Chemicals.jsp)

**Three additional key findings**

**1. Many of the most concerning pesticides found on the Dirty Dozen are fungicides**

The residues found on the latest Dirty Dozen that pose the greatest threat to human health are, for the most part, fungicides. This reflects the increased use of fungicides in agriculture which, according to UK Government figures, has seen the area of UK land treated with fungicides rise by 69% from

21.5 million hectares in 2016 to 36 million hectares in 2016. (Government data available at: <https://secure.fera.defra.gov.uk/pusstats/myindex.cfm>)

Much of fungicide use is aimed at facilitating transport and storage of produce. Therefore, a reduction in the length of supply chains and a move toward greater seasonality would help to reduce the unnecessary use of a wide range of fungicides which are harmful to human health. Fungicides found on the Dirty Dozen include:

- **Fludioxnil** – a fungicide most commonly used post-harvest. It is thought to be an endocrine disrupting chemical (EDC) and was found on all of the Dirty Dozen produce with the exception of chilli peppers.
- **Myclobutanil** – is a fungicide used to combat powdery mildew, apple scab and rusts. It is a suspected EDC and developmental toxin and was found on strawberries, grapes, peaches & nectarines and peppers.
- **Pyrimethanil** – is a fungicide used to treat a range of problems on fruit and vegetables. It is a possible carcinogen, suspected EDC and developmental toxin. It was found on strawberries, lemons, pre-packed salad, grapes, peaches & nectarines, apples, chilli peppers and beans with pods.
- **Tebuconazole** – is a fungicide used on fruit, vegetables and cereals. It is a possible carcinogen and a suspected EDC and a known developmental toxin. It was found on grapes, peaches & nectarines, apples, chilli peppers and beans with pods.

## 2. Pesticide cocktails are not only a problem in fruit and vegetables. They are also a significant issue in grains and bread

The UK Government also tests a handful of grains and grain-based products such as bread for pesticide cocktails. Testing in 2019, revealed that large percentages of the grains tested contained residues of multiple pesticides. This is likely to be the result of an increase in pesticide use on UK cereal crops. For example, according to data purchased from FERA (which monitors pesticide usage on behalf of the UK Government), in 1974 wheat received an average of 1.7 pesticide treatments per season. By 2014, that figure has risen to 20.7 times (12 times the average in 1974). (Source: <https://www.pan-uk.org/pesticides-agriculture-uk/>)

Product	Percentage of samples with multiple residues in 2019
Oats	94.59
Barley	65.08
Bread	27.09

### 3. High percentages of grains and cereals consumed in the UK contain residues of glyphosate

Glyphosate is the world's most ubiquitous herbicide and is used widely on UK arable crops. It has been classified as a 'probable human carcinogen' by the World Health Organisation and has been linked with the development of the cancer Non-Hodgkin's Lymphoma, most recently in a number of high profile court cases in the US. According to UK Government figures, the total area of cereals treated with glyphosate in the UK has increased by more than ten times from 161,000 hectares in 1990 to 1.75 million hectares in 2016. (Government data available at:

<https://secure.fera.defra.gov.uk/pusstats/myindex.cfm>)

Product	Percentage of samples with glyphosate residues in 2019
Barley	68.25
Oats	62.5
Bread	26.67

#### Methodology for compiling the Dirty Dozen list

The data underpinning the Dirty Dozen list, and PAN UK's associated analysis, are taken from the UK Government's Expert Committee on Pesticide Residues in Food (PRiF) monitoring results for 2019. The analysis was undertaken by PAN using the 2019 quarterly reports which are published at: <https://www.gov.uk/government/publications/pesticide-residues-in-food-quarterly-monitoring-results-for-2019>. PRiF's Annual report 2019 was published on 4th November 2020 and is available at: <https://www.gov.uk/government/publications/expert-committee-on-pesticide-residues-in-food-prif-annual-report>

PAN UK has taken the results across all four quarters of 2019 for the fresh fruit and vegetables tested, and collated the results to arrive at the overall percentages detailed in the Dirty Dozen list. We then cross-checked the quarterly reports with the annual report. We focussed on multiple residues as these pose the greatest risk to human health. We also looked at each report to identify which individual samples of produce contain the highest numbers of different pesticide residues.

PAN UK also interrogated the data to establish which pesticide active substances had been found on the various produce tested. We then cross-referenced this with both the University of Hertfordshire Pesticide Properties DataBase (<http://sitem.herts.ac.uk/aeru/ppdb/>) and Pesticide Action Network North America, PesticideInfo Database: [http://www.pesticideinfo.org/Search\\_Chemicals.jsp](http://www.pesticideinfo.org/Search_Chemicals.jsp) in order to determine which active substances give cause for concern in terms of human health impacts.

It should be noted that if a fruit or vegetable is not included on the Dirty Dozen list then it does not mean that it does not contain pesticide residues. Similarly, if a fruit or vegetable was included in a previous years' Dirty Dozen but is not included in the 2019 list then it does not mean that it has improved. The testing conducted by PRiF offers merely a glimpse into the pesticide residues present in UK food because it only provides information for those products that they choose to test. While this is useful to an extent, it only provides a snapshot in time as testing remains inconsistent and piecemeal – for example, in 2018, soft citrus (e.g. tangerines etc.) was found to contain the highest levels of pesticide cocktails (96%), but soft citrus was not reselected for testing in 2019.