

Department for Environment, Food and Rural Affairs

The Expert Committee on Pesticide Residues in Food (PRiF)

Report on the pesticide residues monitoring programme: Quarter 1 2018

September 2018





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This publication is available at www.gov.uk/government/groups/expert-committee-on-pesticide-residues-in-food-prif

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Introduction and summary results

Introduction to the work of the Expert Committee on Pesticide Residues in Food (PRiF)

The PRiF's role is to give Ministers, the Director of the Health and Safety Executive (HSE) and the Chief Executive of the Food Standards Agency (FSA) independent advice on the UK government's national rolling programme of surveys, in particular:

- the planning of surveillance programmes for pesticide residues in the UK food supply and the evaluation of the results;
- Procedures for sampling, sample processing, new methods of analysis, the assessment of variability of pesticide residues in food and related issues.

[More information about PRiF](#)

HSE working under Defra's authority has official responsibility to organise a monitoring programme of UK food for pesticide residues. The programme is made up of a risk-based national rolling programme of surveys and also includes participation in EU-wide monitoring. HSE is also responsible for considering the safety to people who eat the food (in co-operation with the Food Standards Agency if necessary) and following up adverse or unexpected results. They are also responsible for determining whether food is compliant with the law, specifically, whether any pesticide residue found is within the Maximum Residue Level. Maximum Residue Levels (MRLs) reflect levels of pesticides that could occur in produce, which has been treated in accordance with good agricultural practice. Where pesticides do not give rise to readily detectable residues, or are not approved for use on particular commodities, MRLs are set at the lowest level which can be identified in routine laboratory analysis. This provides a mechanism for statutory controls on pesticides in produce which is put into circulation and for monitoring the correct use of these chemicals.

Chair's summary of results

This is our first quarterly report for 2018. During this year's surveillance programme we are looking for a range of up to 371 pesticides in the fruit and vegetable surveys. This quarter's programme surveyed 573 samples of 21 different foods (see contents page for a full list).

44 of the samples contained residues above the legal Maximum Residue Level (the maximum permitted levels by law). These results are in the surveys of beans with pods, beef, frozen vegetables, grapefruit, melon and okra. [A summary table of all the results is below.](#)

However we do not think the findings of chlorate residues in frozen vegetables and melon should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex. You can read updated information about work currently being done on chlorate residues in [Section 4.](#)

HSE undertakes a screening risk assessment for every residue found, to determine whether the residues could lead to intakes above the relevant reference (safety) doses. HSE also produces [detailed risk assessments](#) for every case where the actual residue level found could lead to an intake above the safety levels. We have looked carefully at all of these findings including the risk assessments. In most cases the presence of the residues found would be unlikely to have had any effect on the health of the people who ate the food. In the case of grapefruit, we found residues in some samples where short-lived effects were possible if people ate all of the peel as well as the flesh, but not when the fruit was peeled before eating.

Full details of suppliers and retailers of the food sampled, and full analytical results, are available on data.gov.uk as ODF (Open Document Format) spreadsheet files. There is no change to the level of detail or data structure previously included in our reports, but we hope the new data format is useful for people wanting to look at the individual results in more detail.

We asked suppliers and the authorities of the exporting countries for an explanation of our findings. Any responses we have received are available in section 2.

Dr Paul Brantom

Chairman of the Expert Committee on Pesticide Residues in Food

Summary table of all results

Food	Analysed	With residues at or below the MRL	With residues above the MRL	With residues of non- approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Apples	24	9	0	2	8	12	0
Aubergine	36	23	0	0	10	0	0
Banana	18	10	0	0	8	10	2
Beans with pods	18	5	8	0	8	1	1
Beef	24	2	1	0	0	2	0
Broccoli	24	5	0	0	3	8	0
Eggs	29	0	0	0	0	4	0
Fish (white)	30	5	1	0	1	0	0
Frozen vegetables	24	0	24	0	0	1	1

Food	Analysed	With residues at or below the MRL	With residues above the MRL	With residues of non- approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Game	17	2	0	0	0	0	0
Grapefruit	24	23	1	0	23	0	0
Grapes	23	21	0	0	15	0	0
Lettuce	27	14	0	1	10	2	0
Melon	30	25	2	0	17	0	0
Milk	78	0	0	0	0	23	0
Mushrooms	18	3	0	0	1	11	0
Okra	20	7	8	0	10	0	0
Pears	30	26	0	0	24	4	0
Peppers	19	17	0	0	16	1	0

Food	Analysed	With residues at or below the MRL	With residues above the MRL	With residues of non- approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Pineapple	29	19	0	0	8	0	0
Potatoes	31	15	0	0	3	1	0

Summary of samples with residues over the MRL

PRiF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
Beans with pods						
0040/2018	Speciality Beans	Bangladesh	carbendazim (sum)	1.3	0.2	Yes
			fenpropathrin	0.08	0.01*	Yes
0075/2018	Speciality Beans	India	dimethoate (sum)	0.02	0.01*	No
0080/2018	Speciality Beans	Mexico	folpet (sum)	0.06	0.03*	No
0122/2018	Speciality Beans	Bangladesh	dimethoate (sum)	0.07	0.01*	Yes
			fenpropathrin	0.03	0.01*	Yes
			quinalphos	0.02	0.01*	No
0274/2018	Speciality Beans	Bangladesh	abamectin (sum)	0.04	0.03	No
			dimethoate (sum)	0.06	0.01*	Yes

PRiF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
			fenvalerate (sum)	0.2	0.1	Yes
0622/2018	Speciality Beans	Kenya	profenofos	0.1	0.01*	Yes
0625/2018	Speciality Beans	Kenya	lambda-cyhalothrin	0.4	0.2	No
			profenofos	0.3	0.01*	Yes
4175/2018	Speciality Beans	Egypt	propargite	0.08	0.01*	Yes
Beef						
3000/2018	Aberdeen Angus Steak Mince	UK	BAC (sum)	0.7	0.1	Yes
Fish (white)						
2858/2018	Skinless & boneless cod fillets	North East Atlantic	DDAC (sum)	0.2	0.1	No
Frozen vegetables						

PRiF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
1648/2018	Frozen Mixed Vegetables	UK	chlorate	0.07	0.01*	No
1675/2018	Frozen Steam Pack Mixed Vegetable	UK	chlorate	0.02	0.01*	No
1709/2018	Frozen Mixed Vegetables	Belgium	chlorate	0.05	0.01*	No
2777/2018	Frozen Mixed Vegetables	UK	chlorate	0.07	0.01*	No
2840/2018	Frozen Carrots, Cauliflower, Broccoli	Spain	chlorate	0.08	0.01*	No
2881/2018	Frozen Steam Fresh Vegetables	UK	chlorate	0.03	0.01*	No
2909/2018	Frozen Minced Vegetables	UK	chlorate	0.03	0.01*	No
2941/2018	Frozen Chunky Vegetables	UK	chlorate	0.07	0.01*	No
2981/2018	Frozen Vegetable Medley	UK	chlorate	0.07	0.01*	No
4012/2018	Frozen Mixed Vegetables	Belgium	chlorate	0.2	0.01*	No

PRiF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
4029/2018	Frozen Mixed Vegetables	UK	chlorate	0.03	0.01*	No
4067/2018	Frozen Casserole Mix	UK	chlorate	0.1	0.01*	No
4090/2018	Frozen Mixed Vegetables	UK	chlorate	0.03	0.01*	No
4106/2018	Frozen Stir Fry Vegetables	Spain	chlorate	0.1	0.01*	No
4124/2018	Frozen Steamfresh Vegetables	UK	chlorate	0.03	0.01*	No
4136/2018	Frozen Mixed Vegetables	UK	chlorate	0.05	0.01*	No
4168/2018	Frozen Chunky Mixed Vegetables	UK	chlorate	0.06	0.01*	No
4176/2018	Frozen Organic Vegetable Mix	UK	chlorate	0.02	0.01*	No
4780/2018	Frozen Special Vegetables	UK	chlorate	0.07	0.01*	No
4790/2018	Frozen Stir Fry Mix	Spain	chlorate	0.1	0.01*	No

PRiF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
4828/2018	Frozen Mixed Vegetables	UK	chlorate	0.03	0.01*	No
4846/2018	Frozen Stir Fry Vegetables	UK	chlorate	0.08	0.01*	No
4872/2018	Frozen Mixed Vegetables	UK	chlorate	0.04	0.01*	No
4894/2018	Frozen Mixed Veg With Red Peppers	UK	chlorate	0.06	0.01*	No
Grapefruit						
1639/2018	White Grapefruit Loose	Israel	Imazalil	6.2	5	No
Melon						
1571/2018	Watermelon	UK	chlorate	0.04	0.01*	No
1585/2018	Watermelon	Guatemala	chlorate	0.02	0.01*	No
Okra						

PRiF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
0026/2018	Fresh	Honduras	Chlorfenapyr	0.03	0.01*	Yes
			Oxamyl	0.07	0.01*	Yes
0131/2018	Fresh	Honduras	chlorothalonil	0.3	0.01*	Yes
			Thiacloprid	0.04	0.01*	Yes
0264/2018	Fresh	India	Emamectin	0.06	0.02	Yes
0623/2018	Fresh	India	diafenthiuron	0.02	0.01*	Yes
0626/2018	Fresh	India	flonicamid (sum)	0.2	0.03*	Yes
0628/2018	Fresh	India	flonicamid (sum)	0.05	0.03*	No
4004/2018	Fresh	Honduras	chlorothalonil	0.4	0.01*	Yes
1665/2018	Frozen	Vietnam	chlorfenapyr	0.04	0.01*	Yes

* Maximum Residue Levels set at the LOD (LOD MRL): These MRLs are set at a default level, i.e. at the limit of determination (LOD) where analytical methods can reasonably detect the presence of the pesticide. Either insufficient trials data are available on which to set a maximum residue level or there may be no use of the pesticide on that crop in the EU. However they may be permitted elsewhere.

Section 1: findings by food

Apples

Summary of results

In a survey of 24 samples of apples collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The apple samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

24 samples were tested for up to 367 pesticide residues

Eating

- 6 samples came from the UK
- 7 samples were imported from outside the EU
- 11 samples came from the EU

Pesticide residues detected from those sought

- 15 samples contained no residues from those sought
- 9 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 12 samples were labelled as organic. None contained residues from those sought

Multiple residues

8 samples contained residues of more than one pesticide

- 1 sample contained 2 residues
- 1 sample contained 3 residues
- 2 samples contained 4 residues
- 1 sample contained 5 residues
- 2 samples contained 6 residues
- 1 sample contained 8 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Further investigation: Suspected illegal use

We have passed details of 2 samples from the UK that contained a residue of myclobutanil which is no longer approved for use on apples in the UK to HSE Enforcement. HSE Enforcement is investigating; brand name details will not be published until the investigations are complete.

Aubergine

Summary of results

In a survey of 36 samples of aubergines collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The aubergine samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Pesticide residues detected from those sought

- 13 samples contained no residues from those sought
- 23 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

10 samples contained residues of more than one pesticide

- 3 samples contained 2 residues
- 1 sample contained 3 residues
- 3 samples contained 4 residues
- 1 sample contained 5 residues
- 2 samples contained 7 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Bananas

Summary of results

In a survey of 18 samples of bananas collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The banana samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

18 samples were tested for up to 366 pesticide residues

18 samples were imported from outside the EU

Pesticide residues detected from those sought

- 8 samples contained no residues from those sought
- 10 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 10 samples were labelled as organic. 2 contained residues from those sought

Multiple residues

8 samples contained residues of more than one pesticide

- 4 samples contained 2 residues
- 3 samples contained 3 residues
- 1 sample contained 5 residues

Risk assessments

Imazalil

1 sample of banana contained a residue of imazalil at levels where the effect on health needed to be considered in more detail. The highest level detected was 1.5 mg/kg, if all the peel was consumed we consider that an effect on health is unlikely. However, if the peel is not consumed then an effect on health is not expected. Full risk assessment is available at page 70.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Organic sample with a residue of spinosad

The Secretariat has written to the suppliers of a sample of bananas from the Dominican Republic with a residue of spinosad which is permitted by some Organic Certification Bodies in organic food production. Defra's Organic Farming branch and the organic certification organisation were also informed.

Organic sample with a residue of boscalid and fenpropidin

The Secretariat has written to the suppliers of a sample of bananas from Mexico with residues of boscalid and fenpropidin which are not permitted in organic food production. Defra's Organic Farming branch and the organic certification organisation were also informed.

Beans with pods

Summary of results

In a survey of 18 samples of beans with pods collected between January and March 2018, 8 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The beans with pods samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

18 samples were tested for up to 366 pesticide residues

Speciality Beans

- 18 samples were imported from outside the EU

Pesticide residues detected from those sought

- 5 samples contained no residues from those sought
- 13 samples contained residues above the reporting level
- 8 samples contained residues above the MRL
- 1 sample was labelled as organic. 1 contained residues from those sought

Multiple residues

8 samples contained residues of more than one pesticide

- 3 samples contained 2 residues
- 2 samples contained 3 residues

- 1 sample contained 5 residues
- 1 sample contained 7 residues
- 1 sample contained 13 residues

Residues measured above the MRL

The laboratory detected 13 residues above the MRL in beans with pods

- 1 sample of hyacinth beans from Bangladesh contained residues of
 - dimethoate (sum) at 0.07 mg/kg. The MRL is 0.02* mg/kg
 - fenpropathin at 0.03 mg/kg. The MRL is 0.01* mg/kg
- 1 sample of uri beans from Bangladesh contained residues of
 - abamectin (sum) at 0.04mg/kg. The MRL is 0.03 mg/kg
 - dimethoate (sum) at 0.06 mg/kg. The MRL is 0.01* mg/kg
 - fenvalerate (sum) at 0.02. The MRL is 0.01* mg/kg
- 1 sample of uri beans from Bangladesh contained residues of
 - carbendazim (sum) at 1.3 mg/kg. The MRL is 0.2 mg/kg
 - fenpropathin at 0.08 mg/kg. The MRL is 0.01* mg/kg
- 1 sample of organic green beans from Egypt contained a residue of propargite at 0.08 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample of valor beans from Kenya contained a residue of profenofos at 0.1mg/kg. The MRL is 0.01* mg/kg.
- 1 sample of valor beans from Kenya contained residues of
 - lambda-cyhalothrin at 0.4 mg/kg. The MRL is 0.2 mg/kg
 - profenofos at 0.1mg/kg. The MRL is 0.01* mg/kg.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

- 1 sample of yard long beans from Malaysia contained a residue of dimethoate (sum) at 0.06 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample of yard long beans from Mexico contained a residue of folpet (sum)¹ at 0.06 mg/kg. The MRL is 0.03* mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with similar effects but no risk issue

Some sample(s) contained residues of more than one pesticide. Some of these residues are from pesticides which belong to similar chemical groups, and may have similar toxicological effects. So the risk assessors needed to consider their possible impacts on human health, both on their own and in combination.

HSE carried out a combined risk assessment of the relevant samples. We would not expect any of these combinations to have an effect on health.

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Organic sample with a residue of propargite

The Secretariat has written to the suppliers of a sample of green beans from Egypt with a residue of propargite which is not permitted in organic food production. Defra's Organic Farming branch and the organic certification organisation were also informed.

¹ . The full residue definition is "sum of folpet and phthalimide, expressed as folpet" and this sample we detected only phthalimide. See [section 4](#) for more information

Beef

Summary of results

In a survey of 24 samples of beef collected between January and March 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The beef samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

24 samples were tested for up to 104 pesticide residues

- 21 samples came from the UK
- 3 samples came from the EU

The country of origin on the packaging does not necessarily indicate where the cattle were raised. It may be where the meat was processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 21 samples contained no residues from those sought
- 3 samples contained residues above the reporting level
- 1 sample contained residues above the MRL
- 2 samples were labelled as organic. None contained residues from those sought

Multiple residues

No samples contained residues of more than one pesticide

Residues measured above the MRL

The laboratory detected 1 residue above the MRL

- 1 sample of steak mince from the UK contained a residue of BAC (sum) at 0.7 mg/kg. The MRL is 0.1 mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Broccoli

Summary of results

In a survey of 24 samples of broccoli collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The broccoli samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

24 samples were tested for up to 361 pesticide residues

Fresh

- 2 samples came from the UK
- 22 samples came from the EU

Pesticide residues detected from those sought

- 19 samples contained no residues from those sought
- 5 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 8 samples were labelled as organic. None contained residues from those sought

Multiple residues

3 samples contained residues of more than one pesticide

- 3 samples contained 2 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Eggs

Summary of results

In a survey of 29 samples of eggs collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

No residues were detected at or above the reporting limit.

Survey design

The eggs samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

29 samples were tested for up to 104 pesticide residues

Hens

- 28 samples came from the UK

Quail

- 1 sample came from the UK

Pesticide residues detected from those sought

- 29 samples contained no residues from those sought
- None of the samples contained residues above the reporting level
- 4 samples were labelled as organic. None contained residues from those sought

Fish (white)

Summary of results

In a survey of 30 samples of fish collected between January and March 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

DDT

Two samples of sea bass contained a residue of DDT. The use of DDT is banned or heavily restricted in many countries because the residues take a long time to breakdown in the environment and can accumulate in fatty tissue.

More detailed information about DDT residues is in [section 4](#) of this report.

Survey design

The fish samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

30 samples were tested for up to 38 pesticide residues

Cod

- 1 sample came from the UK
- 13 samples were imported from outside the EU

Haddock

- 4 samples were imported from outside the EU

Hake

- 1 sample came from the UK
- 3 samples were imported from outside the EU

Pollock

- 2 samples were imported from outside the EU

Sea bass

- 2 samples were imported from outside the EU

Sea bream

- 1 sample came from the UK
- 2 samples were imported from outside the EU

Sole

- 1 sample was imported from outside the EU

The country of origin on the packaging does not necessarily indicate where the fish was caught or landed. It may be where the fish was processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 25 samples contained no residues from those sought
- 4 samples contained residues above the reporting level
- 1 sample contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

One sample contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Frozen Vegetables

Summary of results

In a survey of 24 samples of frozen vegetables collected between January and March 2018, all of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

We found chlorate over the default MRL in all of the samples. However, we do not think that these findings should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex.

We expected to find residues of chlorate above the MRL in frozen vegetables. We are testing a limited number of foods for chlorate in 2018, as we did in 2017, to provide evidence on consumer safety and confirm that it is necessary to review the existing default MRL in order to take account of non-pesticide sources. In particular, chlorine-based treatments of drinking and irrigation water as well as chlorine-based surface disinfectants which are widely used to ensure microbiological safety. We agree with HSE and the FSA that the current MRL does not take account of these often unavoidable sources.

Following the HSE's risk assessment, we do not expect any of the residues we found to have an effect on health. We do not think any change in production practice by the brand-owners or manufacturers is needed in response to these findings.

This adds to a growing body of evidence, from both official monitoring across the EU and from the food and farming industries, about the incidence of chlorate residues in food.

More information on work being done on chlorate in the diet is available in [section 4](#)

Survey design

The frozen vegetable samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

24 samples were tested for up to 3 pesticide residues

- 19 samples came from the UK
- 5 samples came from the EU

The country of origin on the packaging does not necessarily indicate where the vegetable were grown. It may be where the vegetables were frozen, or where they were packed for consumer purchase.

Pesticide residues detected from those sought

- All samples contained residues
- 24 samples contained residues measured above the MRL.
- 1 sample was labelled as organic. 1 contained residues from those sought

Multiple residues

No samples contained residues of more than one pesticide

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Game

Summary of results

In a survey of 17 samples of game collected between February and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

No residues were detected at or above the reporting limit.

Survey design

The game samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

17 samples were tested for up to 38 pesticide residues

Duck

- 11 samples came from the UK

Guinea fowl

- 1 sample came from the UK
- 2 samples came from the EU

Rabbit

- 1 sample came from the UK

Venison

- 2 samples came from the UK

Pesticide residues detected from those sought

- 15 samples contained no residues from those sought
- 2 samples contained residues above the reporting level
- None of the samples contained residues above the MRL

- None of the samples were labelled as organic.

Grapefruit

Summary of results

In a survey of 24 samples grapefruit collected between January and March 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

Several samples contained residues that required a detailed risk assessment. We have presented the risk assessments in full. One of the samples contained imazalil at 6.2 mg/kg. Some people eating large portions of grapefruit (including all of the peel) containing this level may experience nausea. We consider the likelihood of an effect to be low and the effects to be minor, short lived and reversible

Survey design

The grapefruit samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

24 samples were tested for up to 365 pesticide residues

21 samples were imported from outside the EU

3 samples came from the EU

Pesticide residues detected from those sought

- All samples contained residues
- 1 sample contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

23 samples contained residues of more than one pesticide

- 5 samples contained 2 residues
- 8 samples contained 3 residues
- 4 samples contained 4 residues

- 5 samples contained 5 residues
- 1 sample contained 6 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in grapefruit

- 1 sample from Israel contained a residue of imazalil at 6.2 mg/kg. The MRL is 5 mg/kg.

Risk assessments

Chlorpyrifos

1 sample of grapefruit contained a residue of chlorpyrifos at a level where the effect on health needed to be considered in more detail. The level detected was 0.2 mg/kg. Based on HSE's risk assessment of the residues detected an effect on health is not expected. Full risk assessment is available at page 71

Imazalil

12 samples of grapefruit contained a residue of imazalil at levels where the effect on health needed to be considered in more detail. The highest level detected was 6.2 mg/kg. If all the peel was consumed then some people might experience nausea after eating large portions (97.5th percentile) of grapefruit containing the highest level found in this report, such effects would be minor, short lived and reversible. If the peel is not consumed then an effect on health is not expected. Full risk assessment is available at page 74.

Combined risk assessments

Multiple residues with no similar effects

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Grapes

Summary of results

In a survey of 23 samples of grapes collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The grape samples were collected by the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesale markets, retail depots, ports and import points).

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

23 samples were tested for up to 371 pesticide residues

- 23 samples were imported from outside the EU

Pesticide residues detected from those sought

- 2 samples contained no residues from those sought
- 21 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

15 samples contained residues of more than one pesticide

- 6 samples contained 2 residues
- 3 samples contained 3 residues
- 3 samples contained 4 residues

- 1 sample contained 5 residues
- 2 samples contained 7 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Lettuce

Summary of results

In a survey of 27 samples of lettuces collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The lettuce samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

27 samples were tested for up to 367 pesticide residues

Cos

- 1 sample came from the EU

Iceberg

- 14 samples came from the EU

Little Gem

- 1 sample came from the UK
- 7 samples came from the EU

Romaine

- 2 samples came from the EU

Round

- 2 samples came from the UK

Pesticide residues detected from those sought

- 13 samples contained no residues from those sought
- 14 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 2 samples were labelled as organic. None contained residues from those sought

Multiple residues

10 samples contained residues of more than one pesticide

- 6 samples contained 2 residues
- 1 sample contained 4 residues
- 2 samples contained 8 residues
- 1 sample contained 11 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination

Follow up actions

Letters sent

We have passed one sample to HSE enforcement for consideration, a UK sample containing inorganic bromide at 35 mg/kg. The MRL for inorganic bromide is 50 mg/kg but we are checking the residue does not result from the pesticide methyl bromide which is no longer authorised for use on soil in the UK.

Melon

Summary of results

In a survey of 30 samples of melons collected between January and March 2018, 2 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Chlorate

We found chlorate over the default MRL in both samples of frozen melon samples. However, we do not think that these findings should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex.

We expected to find residues of chlorate above the MRL in frozen foods in particular. We are testing a limited number of foods for chlorate in 2018, as we did in 2017, to provide evidence on consumer safety and confirm that it is necessary to review the existing default MRL in order to take account of non-pesticide sources. In particular, chlorine-based treatments of drinking and irrigation water as well as chlorine-based surface disinfectants which are widely used to ensure microbiological safety. We agree with HSE and the FSA that the current MRL does not take account of these often unavoidable sources. We knew that these disinfectants are essential to maintaining the microbiological safety of frozen foods, and wanted to provide evidence that the current MRLs are insufficient.

Following the HSE's risk assessment, we do not expect any of the residues we found to have an effect on health. We do not think any change in production practice by the brand-owners or manufacturers is needed in response to these findings.

This adds to a growing body of evidence, from both official monitoring across the EU and from the food and farming industries, about the incidence of chlorate residues in food.

More information on work being done on chlorate in the diet is available in [section 4](#)

Survey design

The melon samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

30 samples were tested for up to 365 pesticide residues

Cantaloupe

- 1 sample was imported from outside the EU

Frozen Watermelon

- 1 sample came from the UK
- 1 sample was imported from outside the EU

Galia

- 7 samples were imported from outside the EU

Honeydew

- 6 samples were imported from outside the EU

Melons

- 1 sample was imported from outside the EU

Piel De Sapo

- 2 samples were imported from outside the EU

Watermelon

- 9 samples were imported from outside the EU
- 2 samples came from the EU

The country of origin on the packaging does not necessarily indicate where the melon was grown. It may be where the melons were processed and packed for consumer purchase.

Pesticide residues detected from those sought

- 3 samples contained no residues from those sought
- 27 samples contained residues above the reporting level
- 2 samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

17 samples contained residues of more than one pesticide

- 10 samples contained 2 residues
- 6 samples contained 3 residues
- 1 sample contained 6 residues

Residues measured above the MRL

The laboratory detected 2 residues above the MRL in watermelon

- 1 sample of frozen watermelon balls from Guatemala contained a residue of chlorate at 0.02 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample of frozen watermelon chunks from the UK contained a residue of chlorate at 0.04 mg/kg. The MRL is 0.01* mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

Some sample contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Milk

Summary of results

In a survey of 78 samples of milk collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

No residues were detected at or above the reporting limit.

Survey design

The milk samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

78 samples were tested for up to 104 pesticide residues

Cows milk

- 74 samples came from the UK

Goats milk

- 4 samples came from the UK

Pesticide residues detected from those sought

- 78 samples contained no residues from those sought
- None of the samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 23 samples were labelled as organic. None contained residues from those sought.

Mushrooms

Summary of results

In a survey of 18 samples of mushroom collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The mushroom samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

18 samples were tested for up to 368 pesticide residues

Button

- 7 samples came from the UK
- 1 sample came from the EU

Chestnut

- 9 samples came from the UK
- 1 sample came from the EU

Pesticide residues detected from those sought

- 15 samples contained no residues from those sought
- 3 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 11 samples were labelled as organic. None contained residues from those sought

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

One sample contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

1 sample from the UK contained a residue of mepiquat (below the MRL) which is not approved for use on mushrooms in the UK. Mepiquat is known to occur in mushrooms grown on straw and mepiquat is widely used on cereal crops. So HSE did not treat this residue as arising from unauthorised use of a pesticide.

Okra

Summary of results

In a survey of 20 samples of okra collected between January and March 2018, 8 of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The okra samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

20 samples were tested for up to 366 pesticide residues

Fresh

- 19 samples were imported from outside the EU

Frozen

- 1 sample was imported from outside the EU

Pesticide residues detected from those sought

- 5 samples contained no residues from those sought
- 15 samples contained residues above the reporting level
- 8 samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

10 samples contained residues of more than one pesticide

- 8 samples contained 2 residues
- 1 sample contained 3 residues
- 1 sample contained 4 residues

Residues measured above the MRL

The laboratory detected 10 residues above the MRL in okra

- 1 sample from Honduras contained
 - a residue of chlorfenapyr at 0.03 mg/kg. The MRL is 0.01^{2*} mg/kg.
 - a residue of oxamyl at 0.07 mg/kg. The MRL is The MRL is 0.01* mg/kg.
- 1 sample from Honduras contained
 - a residue of chlorothalonil at 0.3 mg/kg. The MRL is 0.01* mg/kg.
 - A residue of thiacloprid at 0.04 mg/kg. The MRL is The MRL is 0.01* mg/kg.
- 1 sample from Honduras contained a residue of chlorothalonil at 0.4 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample from India contained a residue of diafenthiuron at 0.02 mg/kg. The MRL is 0.01* mg/kg.
- 2 samples from India contained a residue of flonicamid (sum) at 0.2 mg/kg and 0.05 mg/kg. The MRL is 0.03* mg/kg.
- 1 sample from India contained a residue of emamectin at 0.06 mg/kg. The MRL is 0.02 mg/kg
- 1 sample from Vietnam contained a residue of chlorfenapyr at 0.04 mg/kg. The MRL is 0.01* mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Follow up actions

The secretariat has written to the suppliers of the samples with residues above the MRL. Any response received is in Section 2.

² Maximum Residues Levels set at the LOD (LOD) MRL: These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005

Pears

Summary of results

In a survey of 30 samples of pears collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The pear samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

30 samples were tested for up to 369 pesticide residues

- 10 samples came from the UK
- 1 sample was imported from outside the EU
- 19 samples came from the EU

Pesticide residues detected from those sought

- 4 samples contained no residues from those sought
- 26 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 4 samples were labelled as organic. None contained residues from those sought

Multiple residues

24 samples contained residues of more than one pesticide

- 3 samples contained 2 residues
- 10 samples contained 3 residues

- 6 samples contained 4 residues
- 3 samples contained 5 residues
- 1 sample contained 6 residues
- 1 sample contained 11 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Peppers

Summary of results

In a survey of 19 samples of peppers collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The pepper samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

19 samples were tested for up to 368 pesticide residues

Fresh

- 2 samples were imported from outside the EU
- 17 samples came from the EU

Pesticide residues detected from those sought

- 2 samples contained no residues from those sought
- 17 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 1 sample was labelled as organic. None contained residues from those sought

Multiple residues

16 samples contained residues of more than one pesticide

- 9 samples contained 2 residues

- 3 samples contained 3 residues
- 1 sample contained 4 residues
- 1 sample contained 5 residues
- 2 samples contained 6 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with no similar effects

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Pineapple

Summary of results

In a survey of 29 samples of pineapples collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health

Survey design

The pineapple samples were bought by a market research company from retail outlets across the UK

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

29 samples were tested for up to 365 pesticide residues

Canned

- 2 samples came from the UK
- 9 samples were imported from outside the EU

Fresh

- 2 samples came from the UK
- 16 samples were imported from outside the EU

Pesticide residues detected from those sought

- 10 samples contained no residues from those sought
- 19 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

8 samples contained residues of more than one pesticide

- 7 samples contained 2 residues
- 1 samples contained 3 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with similar effects but no risk issue

One sample contained residues of more than one pesticide. Some of these residues are from pesticides which belong to similar chemical groups, and may have similar toxicological effects. So the risk assessors needed to consider their possible impacts on human health, both on their own and in combination.

HSE carried out a combined risk assessment of the relevant samples. We would not expect any of these combinations to have an effect on health.

Potatoes

Summary of results

In a survey of 31 samples of potatoes collected between January and March 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

We note that HSE have undertaken a revised risk assessment for residues of chlorpropham based on a recent consideration of chlorpropham by EFSA in 2017. This HSE assessment of residues (that are well below the MRL) indicates that although there is an exceedance of the acute reference dose an effect on health is unlikely. We have asked to be kept updated on whether there will be changes to the permitted uses of chlorpropham to take into account this updated assessment.

Survey design

The Animal and Plant Health Agency's Plant Health and Seed Inspectors collected the potato samples from a range of points across the supply chain (wholesalers, potato processors, ports and import points).

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at <https://data.gov.uk/dataset/pesticide-residues-in-food>

Samples tested

31 samples were tested for up to 366 pesticide residues

Maincrop

- 20 samples came from the UK
- 3 samples were imported from outside the EU

New

- 3 samples came from the UK
- 5 samples were imported from outside the EU

Pesticide residues detected from those sought

- 16 samples contained no residues from those sought
- 15 samples contained residues above the reporting level

- None of the samples contained residues above the MRL
- 1 sample was labelled as organic. None contained residues from those sought

Multiple residues

3 samples contained residues of more than one pesticide

- 2 samples contained 2 residues
- 1 sample contained 3 residues

Risk assessments

Two samples of potato contained residue of chlorpropham at levels where the effect on health needed to be considered in more detail. The levels detected were 3.7 mg/kg and 4.3 mg/kg. These levels are well below the MRL of 10 mg/kg. Based on HSE's risk assessment using a revised approach following on from a 2017 EFSA consideration of chlorpropham an effect on health is unlikely. Full risk assessment is available at page 77.

Combined risk assessments

Multiple residues with no similar effects

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Section 2: Sample details and supplier responses

Sample details

The sample details are published on data.gov.uk as a dataset in ODS format.

About sample information

The following information is available on each sample collected this quarter:

- Date and place of collection
- Description (e.g. 'runner bean', organic milk);
- Country of origin or manufacture;
- Brand name and packer/manufacturer; and
- Residues detected (results shown in green indicate residues above the MRL).
- Where the brand name of a sample is given the produce involved may have been on sale in other retail premises at the same time.

The description and country of origin are taken from labelling on the food or at the point of sale. The country of origin of processed food may not be the country where the unprocessed produce was produced. This is true even of food that has undergone minimal processing, such as meat that has been butchered or frozen vegetables.

Samples with residues above the MRL are in bold, green text.

UK samples with residues of pesticides not approved for use on that food in the UK in bold, blue text

Organic samples with residues of pesticides not permitted for use in organic food production are in bold text

Some brand name details have been withheld – these will be published once enquiries are complete.

The Government's 'brand naming' policy

The Government has decided that brand name information should be published as part of the Government food chemical surveillance programme. Brand names have been published for most pesticide residue surveys since 1998. Certain samples are excluded

from the release of brand name information. These include samples taken as part of any pesticide residues enforcement programme and those taken as part of surveys to study individual people/farms. This policy was reviewed in 2000/1, when Ministers agreed to its continuation.

Where we find residues above an MRL or the presence of non-approved pesticides brand owners/retailers/ growers are notified of the result in advance of publication of reports and given four weeks to comment.

Interpreting brand name information

There is no ready definition of what constitutes a brand in all cases. For clearly branded produce like breakfast cereals or biscuits the “brand owner” is shown. In the case of “own brand” goods this may be one of the multiple retailers. For fruit and vegetables the retailer is generally shown. For meat, milk and most other animal products the retailer is also generally shown. Finally, for all commodities the country of origin is shown where this was displayed either on the produce or in the store.

Our programme takes samples of produce in approximate proportion to the market share of the main retailers. This has been done to ensure we obtain an accurate representation of a sector (e.g. fruit and vegetables).

Individual programmes are not capable of generating statistically valid information on residues in particular crops from particular retailers. This would require the collection of a much larger number of samples: either substantially increasing costs or greatly reducing the range of different foods sampled in any one year. Therefore, results from an individual survey cannot be taken as a fair representation of the residues status of any particular brand.

However, we do collect samples from a variety of outlets in a range of locations, over a period of years. Successive programmes should therefore help generate information on the typical residues profile of particular types of produce and on major trends in the incidence and levels of pesticides. It should be noted that this quarterly report is not intended to give a comprehensive comparison with previous surveys of the same commodities.

A particular issue arises in relation to the country of origin of fruit and vegetables. The origins included in the reports are those recorded either on the produce or in the store. However, it is not uncommon for mixing to occur on shop shelves. We have responded by increasing the proportion of pre-packed goods sampled. However, pre-packed samples are not available for some produce in some stores and it could also introduce bias to surveys if loose produce were not sampled. Loose produce is therefore sampled but the origin of the sample should be interpreted with a degree of caution.

Supplier responses

Action taken by HSE

HSE wrote to:

- The suppliers of all samples containing residues above the MRL
- The authorities of the exporting countries of all samples containing residues above the MRL
- The suppliers of UK samples that contained residues that were not approved for that crop.
- The Organics branch of Defra about samples that were labelled as organic and contained residues of pesticides not approved for organic production
- The suppliers and certification organisation of all organic samples containing residues of pesticides not approved for organic production.

Recipients of the letters are given 4 weeks to provide a statement for inclusion in the report. The Expert Committee on Pesticide Residues in Food reviews any replies received.

Section 3: HSE assessment of risk

The surveillance programme is designed to enable the regulatory authorities to check that:

- specified pesticide MRLs are being respected;
- users of pesticides are complying with conditions of use specified in the authorisation;
- Dietary intakes of residues are within acceptable limits.

This section details how risks from dietary intakes are assessed.

When assessments are carried out

A screening assessment is done for each residue and commodity combination to identify residue levels that would lead to intakes above the relevant reference doses. Further information on this screening approach is available on request from HSE. Detailed assessments are then produced for every case where the actual residue level found could lead to an intake by any group above the reference dose.

Assessing Dietary intakes

Assessing the acceptability of dietary intakes is complicated. Consumer risk assessments are carried out for both short-term (peak) and long-term intakes. These assessments use information on food consumption collected in UK dietary surveys in conjunction with the residue levels we find. Occasionally, additional pesticide specific information on the losses of residues that occur during preparation and/or cooking of food is also used.

How the assessment is carried out

Short-term intakes (also called NESTIs) are calculated using consumption data for high-level consumers, based on single-day consumption values and the highest residue found in a food commodity. The residue found is multiplied by a variability factor to take account of the fact that residues may vary between individual items that make up the sample analysed. The estimated intake is compared to the Acute Reference Dose (ARfD). This is done for ten consumer groups; adults, infants, toddlers, 4-6 year olds, 7-10 year olds, 11-14 year olds, 15-18 year olds, vegetarians, elderly living in residential homes and elderly living in their own homes.

Long-term intakes (NEDI) are also calculated for high-level consumers, but in this case the consumption data are high-level long-term values rather than peak single-day events, and similarly the residue values used reflect long-term average levels rather than occasional high values. Again these estimates are made for the ten consumer groups. In this case the estimated intake is compared to the Acceptable Daily Intake (ADI). More information on intake assessments is available on HSE's website:

www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-

[registration/data-requirements-handbook/consumer-intake-assessments-new-intake-calculation-models](http://ec.europa.eu/sanco_registration/data-requirements-handbook/consumer-intake-assessments-new-intake-calculation-models).

The reference doses (ADI, ARfD) are set by the Advisory Committee on Pesticides (ACP), or agreed within the EC (an increasing proportion of UK pesticide authorisations are now carried out in accordance with harmonised EU processes). However, where neither the UK nor the EC has set a reference dose, levels set by regulatory authorities in other countries may be used. For a small number of pesticides the reference doses used have been determined by HSE. These have not been independently peer-reviewed and should therefore be regarded as provisional. Reference dose values are available on the EU website:

http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.selection.

Although MRLs are not safety levels, an MRL would not be established if the residue concentrations measured in the supervised trials used to support the MRL would give rise to health concerns. In most cases residues present at the MRL result in intakes below the ARfD and the ADI. So even if the MRL is exceeded this does not always lead to an intake above the ARfD or ADI.

In addition, an estimated intake that exceeds the ADI or ARfD does not automatically result in concerns for consumer health, because a protective approach is used in setting the ADI and ARfD. In the unusual circumstance of an intake exceeding the ADI or ARfD, an evaluation of the toxicological data is made, and details of this assessment would be presented.

Most consumer intake assessments are for short-term exposure rather than chronic exposure. This is because in most cases the monitoring data show the majority of samples to contain residues below the reporting limit and so chronic exposure would not present a concern. Long-term risk assessments have been carried out on a case-by-case basis, but are not routinely reported. Long-term exposure assessments are done using median residue levels, rather than using the highest residues found. Therefore, long-term risk assessments would only need to be carried out where data indicated a high proportion of samples contained residues above the MRL (this would result in a higher median residue level than that previously assessed when setting the MRL), or where there is no MRL and acute toxicology is not considered relevant for the particular pesticide concerned.

Where intakes exceed a reference dose, it is necessary for the underlying toxicological studies (animal studies) to be considered to enable the significance of such an exceedance to be understood. Toxicological studies are conducted using different doses to determine the nature of any ill health effects as well as the levels at which such effects can be expected to occur.

Toxicological studies are conducted using test animals to identify the highest experimental dose that causes no detectable adverse effects (the NOAEL). Where there is more than one relevant toxicological study, the lowest appropriate NOAEL for the most sensitive adverse effect is typically used. There is some uncertainty in extrapolating between animals and people and it is therefore important to use a 'safety factor' to account for sources of

variation. This safety factor is incorporated (by dividing the NOAEL by the safety factor) in deriving a reference dose, either an ADI or an ARfD, to which consumer intakes are compared. A safety factor therefore extrapolates from the animal testing to the general population. Factors in the order of x100 are commonly used, x 10 for animal to man, and x10 for within human population differences in sensitivity. However, toxicologists may propose different values (e.g. from 5 to 1000) based on scientific reasoning in accordance with study designs and the quality of the data that has been generated from the studies.

In order to ensure exposures to pesticides do not pose unacceptable risk to humans a wide range of investigations are performed. Most of these are performed on experimental animals because the only end-points that can be examined in human volunteers are those involving observation or blood and urine sampling. Human volunteer studies involving pesticides are not generated in current regulatory work. There is debate at the international level as to whether human studies that have been generated should be used for risk assessment purposes. In the EU, the policy is not to use these data in assessments; the JMPR chose to apply judgement in the appropriate use of these data if available. The HSE risk assessments will usually refer to test animal species, such as dog, rat, and rabbit. All toxicological work is undertaken based on principles of minimising animal distress. Where scientifically valid human data are available the risk assessments will refer to these as they reduce the uncertainty in the assessment. Therefore, human data is only referred to in more limited circumstances.

Acute (short term) toxicology is not a concern for all pesticides, as some are not acutely toxic. In terms of the pesticides that have been found in fruit and vegetables through the surveillance programme an acute risk assessment would not be necessary on the following: tecnazene, maleic hydrazide, diphenylamine, furalaxyl, iprodione, kresoxim-methyl, pendimethalin, propargite, propyzamide, quintozene and tolclofos-methyl.

As the surveillance programme monitors residues in all types of food, from raw commodities (e.g. potatoes) to processed (e.g. wine), dried (e.g. dried fruit) and composite foods (e.g. fruit bread), consumer risk assessments are specifically tailored to address processed and mixed food products. MRLs are generally set for raw commodities, although when MRLs are established the assessment of dietary intakes takes into account the potential for residues to remain in processed foods produced from the raw agricultural commodities. MRLs have been set for processed infant foods, and in future may be extended to other processed food products.

Residues are usually reduced during food processing and occasionally may concentrate. The alteration of residues can be considered in consumer risk assessments, for example, in oil seed rape a fat-soluble pesticide may result in higher residues in the oil compared to residues in the raw seed. Consumption data are available for many major processed food items such as boiled potatoes, crisps, fruit juice, sugar, bread, and wine. Where such consumption data are not available, the intake estimates are based on the total consumption of the raw commodity, which would represent the worst-case (for example, breakfast cereals consumption would be based on total cereal products consumption). In

the case of composite products a suitable worst-case alternative would be used, for example total bread consumption for fruit bread consumption.

Dithiocarbamate residues

Dithiocarbamate residues are determined as carbon disulphide which is a common product from different dithiocarbamate pesticides; for the risk assessment a precautionary approach is taken: the worst case dithiocarbamate residue is calculated by assuming the residue is derived from ziram ((a molecular weight conversion is applied to estimate the level of residue based on ziram) and this is compared to the ARfD for ziram. Where it can be confirmed that a specific dithiocarbamate was applied the equivalent residue of the specific active substance is estimated and the intake compared to the appropriate reference dose. We only present a detailed risk assessment when either the worst case assessment of intake (based on ziram) leads to an exceedance of the ziram ARfD and it has not been possible to further identify the dithiocarbamate source of the residues, or, when further refined assessments based on a specific knowledge of the dithiocarbamate pesticide applied in practice still lead to an exceedance of the ARfD for the known dithiocarbamate pesticide.

Probabilistic Modelling

The standard calculations of consumer exposure use realistic consumption data and residue levels. However, they tend to overestimate intakes in most circumstances. This is due to the assumptions used; fruit and vegetables would contain high levels of residue in an individual unit and that these would be consumed by high-level consumers. They do not take into account the possible range of residue levels and consumption distributions that may occur in reality. These possible combinations of residues and consumption levels can be taken into account using modelling/simulation techniques to produce probability distributions of residue intake levels to indicate the range of consumer intakes, presented as a probabilistic assessment of consumer exposure. These techniques are not yet routinely used to estimate dietary intakes of pesticide residues in the EC.

Multiple residues

The risk assessment process is not standing still. We are aware that some consumers are concerned by the 'cocktail effect'- the possible implications of residues of more than one chemical occurring in, say, a single portion of fruit or vegetables or the interaction between mixtures of pesticides and veterinary medicines at residue levels.

Where more than one pesticide residue is found in a sample, we produce a separate table which identifies each sample and what was found (see Appendix D). If more than one organophosphate/carbamate is found we will undertake an additional risk assessment. If the combination of pesticides found is either unusual or gives cause for concern then this will be detailed in the report.

The Food Standards Agency (FSA) asked the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment to assess these concerns. Their report "Risk Assessment of Mixtures of Pesticides and Veterinary Medicines" was published in 2002. The Committee concluded that the probability of any health hazard from exposures to

mixtures is likely to be small. Nonetheless, it identified areas of uncertainty in the risk assessment process and made recommendations for further work. These fell under the broad headings of regulatory, surveillance, research and public information issues. An action plan to take forward the recommendations has been published on the FSA website at: <http://www.food.gov.uk/safereating/chemsafe/pesticides/pestmixbranch/>. A number of research projects have been commissioned by the FSA to help progress the action plan; details can be found at: <http://www.food.gov.uk/multimedia/pdfs/ressurprjlistsep07> and <http://www.food.gov.uk/science/research/researchinfo/researchportfolio/>

Scientific methodologies have yet to be developed to deal with mixtures from groups of pesticides identified by the Committee. However, the Advisory Committee on Pesticides (ACP) has developed an approach for the anticholinesterase compounds. They have also recommended an approach for assessing compounds that might have combined toxicity. This includes a consideration of the proportion of the respective reference doses taken up by the predicted exposures to each active substance. If this is only a small proportion (e.g. <50% if there are two components; <33% for 3 etc.) then assuming simple additivity the risks would still be acceptable. However if exposures to each active substance represent a high proportion of the respective reference doses and the total exceeds 100% a more detailed consideration is needed

(www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/data-requirements-handbook/toxicity-assessment-of-combinations-of-2-or-more-compounds-in-a-formulation)

We are keen to ensure our reports reflect consumer concerns. We therefore now regularly assess findings showing multiple residues of organophosphate and carbamate pesticides. Combined assessment is a new development in risk assessment, which is being taken forward at the international level, e.g. the European Food Safety Authority (EFSA) held a colloquium in 2006 and has set-up two working groups to help develop the methodology (<http://www.efsa.europa.eu/en/events/event/colloque061128.htm>; <http://www.efsa.europa.eu/en/supporting/pub/117e.htm>; <http://www.efsa.europa.eu/en/efsajournal/pub/705.htm>; <http://www.efsa.europa.eu/en/efsajournal/pub/1167.htm>). Further advances in risk assessment methodology will be taken into account in developing the approach to multiple risk assessments in the future.

Assessment of Risk to Human Health: Short-term intake estimates

Screening assessments have been done for all acutely toxic and potentially acutely toxic pesticides to check that predicted intakes are within the ARfD (or ADI, as appropriate, where an ARfD is not available). An acute exposure assessment is not done for pesticides which are not acutely toxic where it has been established that an ARfD is not required. Toxicological endpoints can be found in the DG Sanco EU Pesticides database which is available at http://ec.europa.eu/food/plant/protection/evaluation/database_act_subs_en.htm

The screening assessment uses the internationally agreed approach to short-term (acute) consumer exposure assessment with UK food consumption data as detailed within the UK NESTI model which is available on the PSD website at <http://www.pesticides.gov.uk/approvals.asp?id=1687>.

For the Q1 (2018) assessments, the following approaches have been taken to refine the NESTI according to case-by-case issues and to ensure that appropriate consumption values are used for less frequently consumed commodities where available food consumption data may be limited:

- Data on fish were used for all forms of white fish.
- Data on meat were used for all forms of beef and game.
- Data on poultry were used for all forms of game birds.
- Specific consumption data available for milk were used.
- Data on beans with pods were used for okra and all forms of speciality green beans.

- Data on melon were used for all forms of melon and watermelon (including pre-prepared and frozen).
- Consumption values were provided by the Food Standards Agency for grapefruit to identify the various contributions of grapefruit in the diet. The consumption values used here (and as in Q2 2016 and Q4, 2016) cover consumption for fresh grapefruit excluding juice, canned grapefruit and grapefruit consumed in other recipe forms. For the current assessments, the consumer groups covered represent infants (4 to 18 months old), toddlers (1.5 to 3 years), 4-6 year olds, 7-10 year olds, 11-14 year olds, 15-18 year olds, and elderly. These are slightly different to the groups used previously. For the new survey data vegetarians, elderly residential and elderly in their own home are not reported separately. For some of the consumer subgroups, the number of grapefruit consumers in the surveys (from years 2008 to 2012) are very low e.g. infants which is not unexpected. The highest number of young consumers out of all the young consumer groups was three persons for infants (3 out of 2863 infant consumers). These data are used as they represent the best up to date data. Adults and elderly consume fresh grapefruit at a higher frequency (a higher number of consumers) than the other consumer groups, and of these adults is the most critical consumer group.
- For potato/chlorpropham the default variability factor of 7 was used, from the EFSA Conclusion (EFSA, 2017). This represents an altered approach to the variability factor which was previously at a lower specific level of 3. The default factor of 7 is applied pending further data that could support a lower variability factor. As an additional change, EFSA have concluded not to further refine risk assessments for chlorpropham according to losses over cooking, since a metabolite might form over cooking that would counterbalance this (EFSA, 2017). The risk assessment below also uses this altered approach whereas in previous PRiF assessments some losses due to cooking of potatoes were previously assumed.
- For all forms of frozen vegetables, data on cauliflower without the use of a variability factor were used for screening purposes (this indicated the worst case amounts of short term dietary intake when levels of different vegetables consumed were compared). As vegetable pieces are small, a whole vegetable consideration which takes account of unit to unit variability is not considered relevant; the consumption values for cauliflower are considered protective compared to a number of different vegetables consumed in this way. (For chronic exposure assessment, a similar form of assessment approach was performed, using carrot as representative of worst case amounts of long term dietary intake when levels of different vegetables consumed were compared).

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Banana	Imazalil	1.5	0.018	0.13 (infant)	General population 0.1 Pregnant and nursing females 0.05	EFSA, 2007 ³

Comment on risk assessment

Banana flesh, after peeling

The EU MRL risk assessment assumes that bananas are peeled before consumption. After peeling only 11% of the residue remains (EFSA, 2017), the highest intake is below 0.1 mg/kg bw/day and there are no exceedances of the ARfD.

Whole banana, including all the peel

Pregnant and nursing females

There is no exceedance of the acute reference dose of 0.05 mg/kg bw/day (for pregnant and nursing females) and hence no

³ Opinion of the Scientific Panel on Plant protection products and their Residues on a request from the Commission on the Acute Reference Dose (ARfD) for imazalil. (Question N° EFSA-Q-2006-202) adopted on 7 March 2007 EFSA Journal (2007) 460, 1 - 15

health effects are expected.

General population

If infants ate or drank large portions of banana containing imazalil at 1.5 mg/kg, their intake of imazalil could be 125% of the Acute Reference Dose of 0.1 mg/kg bw/d for the general population. This intake is 77 times lower than a dose which caused no observed adverse effect in a rabbit developmental study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible differences in susceptibility between people. Also it is noted that an ARfD based on maternal toxicity in a developmental study with repeated dosing (13 days) might be over-protective for the general population. Based on this assessment we consider the reduced factor of 77 still enough to make an effect on health unlikely.

This estimate assumes that peel of the fruit is consumed. However if the peel is not consumed then the risk assessment that is the basis for the MRL applies (see the first paragraph of this assessment) and intakes in all groups are within the ARfD and an effect on health is not expected.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Grapefruit	Chlorpyrifos	0.2	0.0029	0.011 (infant)	0.005	EU, 2015

Comment on risk assessment

The risk assessments detailed below refer to the EU acute Reference Dose 2015 value but also consider the risks based on the existing JMPR value which was based on data which examined impacts upon humans. CRD accept that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment do not expect an effect on health.

Assessment A using the ARfD set in the EU

Grapefruit flesh after peeling

EU MRL risk assessment usually assumes that grapefruits are peeled before consumption. After peeling only 2% of the residue remains (EFSA, 2017), the highest intake is below 0.005 mg/kg bw/day, and there are no exceedances of the ARfD.

However, assuming that consumers eat all the peel, intakes for infants exceed the acute reference dose of 0.005 mg/kg bw/day.

Whole grapefruit, including all the peel

The intakes for infants exceeded the EU ARfD. If infants ate large portions of grapefruit containing chlorpyrifos at 0.2 mg/kg, their intake of chlorpyrifos could be 218% of the EU Acute Reference Dose. This intake is 45 times lower than a dose which caused no observed adverse effects in a single dose rat study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the likelihood of an effect on health to be low, given the remaining factor of 45. This is because an adverse effect on health would rely on

- 1) a susceptible individual eating a large quantity of the product which in turn had the highest levels of residue (i.e. 7 times the maximum value found in monitoring) ; and
- 2) the actual difference in susceptibility between that individual and rats being higher than the factor we are left with in this

situation; and

3) the critical NOAEL being close to the actual doses needed to produce an adverse effect in the animals studied.

Furthermore, HSE consider that the EU ARfD was derived using a particularly sensitive approach since red blood cell cholinesterase inhibition was used as the end-point. This is a sensitive way to assess adverse effects due to cholinesterase inhibition.

In conclusion we consider that some people might experience salivation, intestinal disturbances or sweating after eating large portions (97.5th percentile consumption) of grapefruit containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor, short-lived, and reversible.

Assessment B with reference to the ARfD set by the JMPR

The intakes for infants exceeded the EU ARfD. If infants ate large portions of grapefruit, including all of the peel, containing chlorpyrifos at 0.2 mg/kg, their intake of chlorpyrifos could be 218% of the Acute Reference Dose. However, the EU ARfD was set without taking into account scientifically valid human data. The JMPR (Joint FAO/WHO meetings on pesticides) has recommended a higher Acute Reference Dose (ARfD) of 0.1 mg/kg bow/day using that human data. It allows an appropriate factor (10) to account for possible differences in susceptibility between people. Intakes in all groups are within the JMPR ARfD. Based on this assessment we do not expect an effect on health.

Conclusion

HSE accept that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment do not expect an effect on health.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Grapefruit	Imazalil	6.2	0.090	0.34 (infants) 0.11 (7-10 year olds) 0.090 (adults) 0.067 (elderly) 0.066 (11-14 year olds)	General population 0.1 Pregnant and nursing females 0.05	EFSA, 2007 ⁴
<p>Comment on risk assessment</p> <p><u>Grapefruit flesh after peeling</u></p> <p>The EU MRL risk assessment assumes that grapefruits are peeled before consumption. After peeling only 7% of the residue remains (EFSA, 2017), the highest intake is below 0.05 mg/kg bw/d, and there are no exceedances of either ARfD.</p>						

Opinion of the Scientific Panel on Plant protection products and their Residues on a request from the Commission on the Acute Reference Dose (ARfD) for imazalil. (Question N° EFSA-Q-2006-202) adopted on 7 March 2007

Whole grapefruit, including all the peel

However, assuming that consumers eat all the peel, intakes for infants and 7-10 year old children exceed the acute reference dose of 0.1 mg/kg bw/day (for the general population excluding pregnant and nursing women). It is noted that in consumer groups aged over 11 years intakes for adults and 11-14 year old children exceed the acute reference dose of 0.05 mg/kg bw/day (for pregnant and nursing women).

Pregnant and nursing women

The intakes for adults and 11-14 year old children exceeded the ARfD of 0.05 mg/kg bw/d for pregnant and nursing females. The highest intake was for adults.

If adults ate large portions of grapefruit containing imazalil at 6.2 mg/kg their intake could be 180% of the Acute Reference Dose of 0.05 mg/kg bw/day. This intake is 55 times lower than a dose which caused no observed adverse effects in a 13 day repeat dose rabbit developmental study (the ARfD is based on a NOAEL of 5 mg/kg bw/day for fetal toxicity (increased resorptions)). The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the reduced factor of 55 still enough to make an effect on health unlikely.

General population

The intakes for infants and 7-10 year old children exceed the ARfD of 0.1 mg/kg bw/d for the general population. The highest intake was for infants.

If infants ate large portions of grapefruit containing imazalil at 6.2 mg/kg their intake could be 340% of the Acute Reference Dose of 0.1 mg/kg bw/day. This intake is 29 times lower than a dose which caused no observed adverse effects in a rabbit developmental study, used as the basis of the ARfD (the ARfD is based on a NOAEL of 10 mg/kg bw/day for reduced bodyweight gain and food consumption in dams). The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the likelihood of an effect on health to be low, given the remaining factor of 29. This is because an adverse effect on health would rely on

- 1) a susceptible individual eating a large quantity of the product, with the peel, which in turn had the highest levels of residue (i.e. 7 times the maximum value found in monitoring) ; and
- 2) the actual difference in susceptibility between that individual and rabbits used to derive the critical NOAEL, being higher than the factor we are left with in this situation; and
- 3) the critical NOAEL being close to the actual doses needed to produce an adverse effect in the animals studied.

Also it is noted that an ARfD based on maternal toxicity in a developmental study with repeated dosing (13 days) might be over-protective for the general population.

Conclusion

In conclusion, we consider that some people might experience nausea after eating large portions (97.5th percentile consumption) of grapefruit containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor, short-lived, and reversible.

This estimate assumes that peel of the fruit is consumed. However if the peel is not consumed then the risk assessment that is the basis for the MRL applies (see the first paragraph of this assessment) and intakes in all groups are within both ARfDs and an effect on health is not expected.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Potato	Chlorpropham	4.3	0.10	0.66 (infants)	0.5	EU, 2004
<p>Comment on risk assessment</p> <p>The intakes for infants exceeded the EU ARfD. If infants ate large portions of potatoes containing chlorpropham at 4.3mg/kg, their intake of chlorpropham could be 132% of the EU Acute Reference Dose. This intake is 76 times lower than the single dose given to dogs without any adverse effects. The European Food Safety Authority used this study as the basis of the ARfD.</p> <p>Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the reduced factor of 76 still enough to make an effect on health unlikely. This estimate assumes that potatoes are eaten unpeeled (for example as jacket potato); much of the residue is expected to be associated with the peel.</p>						

†Highest intake of all ten consumer groups, or intakes for all consumer groups that exceed the ARfD

Acute risk assessments for samples containing more than one triazole fungicide, organophosphorus/carbamate, carbendazim/thiophanate-methyl, clothianidin/thiamethoxam or captan/folpet following screening assessment.

None

Section 4: issues arising in this report and updates on previous reports

Issues arising in this report

Chlorate

Since 2016 we have been testing a limited number of foods for chlorate. The pesticide sodium chlorate is a residual broad action weed killer, which is not authorised for use in the EU. However, we are confident that the residues we are detecting come from use of chlorine-based disinfectants used to maintain microbiological safety (control microorganisms that cause food poisoning). Because these residues are unavoidable, and important for the maintaining of microbiological control vital for food safety, we are not treating these results as breaches of the MRL. We are not advising that food companies change their existing practices as a result of our findings but they should be aware about the ongoing discussion in this area. .

We are only part of the work going on across government and beyond to consider what to do about chlorate residues in food and water.

The Food Standards Agency is working with the food industry to develop and promote best practice in the use of sanitisers. This is important because the presence of low level residues of chlorate in food results from measures taken by the food and water industries to protect food safety by reducing microbiological contamination of food and drink (including drinking water, which is a significant source of chlorate in food). Chlorate itself is not used as a disinfectant, but chlorine-based sanitisers can contain small amounts of chlorate.

The Health and Safety Executive is leading UK work in the EU to establish more meaningful statutory levels for chlorate in food to provide reassurance to consumers and allow the continued use of disinfectants that are themselves important for safeguarding human health. Chlorate was historically used as a pesticide and residues of chlorate in food fall under EU legislation on plant protection products. Since it is no longer authorised for use as a pesticide, chlorate is subject to a Maximum Residue Limit (MRL) of 0.01 mg/kg. This level was, in line with normal practice for pesticides that are not currently used, set at the default limit of detection rather than on the basis of an assessment of health risks. Our findings are adding to the evidence that that current legal limits are not sufficient to allow for the essential use of disinfectants to protect food and water hygiene

Defra is also working on the EU recast of its Drinking Water Directive. Discussions are underway about the possible future monitoring of chlorate and the level to be achieved. In national legislation throughout the UK it is already a requirement to keep disinfection by-

products as low as possible. This is usually achieved through management of disinfectant dosing and storage.

Departments have an approach to enforcement, which reflects an agreement within the EU that, while the default MRL for chlorate remains in place, enforcement should be left to the discretion of Member States. The UK approach, in line with that normally taken for environmental or process contaminants, is to require that levels in food are as low as reasonably achievable to ensure the protection of human health.

Beginning in 2018 the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) will be considering chlorate as part of its on-going work looking at the chemicals in the diet of infants and young children (up to 5 years). The European Food Safety Authority's 2015 opinion on chlorate⁵ establishes appropriate health-based guidance values for chlorate exposure to protect against acute and chronic risks to health.

Residues below the MRL that exceed the ARfD

When MRLs are agreed at the EU level they are set at levels that are compatible with consumer safety. Occasionally, assessment of PRiF monitoring samples containing residues below or at the MRL will show consumer intakes could potentially be above the ARfD. This situation typically arises because of one of three reasons:

- the ARfD may have been lowered because of new information but there is a delay before MRLs have been reassessed or new MRLs are put in place;
- during the MRLs process the risk assessments are currently based on the highest residue level observed in residues trials used to support the MRL which will often be less than the actual MRL (it is expected that most residues found will be below the MRL, and if for this reason there are later samples which give intakes above the ARfD the numbers are expected to be low);
- the agreed EU approach might assume the commodity is peeled and data are used to reduce the intake in the risk assessment at the time of setting MRLs, whereas in the PRiF work risk assessments for the whole commodity are presented as routine and, if information showing the effects of processing on residues level is available to PRiF, a refined assessment is presented.

The first two of these reasons are common to EU assessments and the third represents a difference between the approach used by HSE for the risk assessment and that used at

⁵ [EFSA Journal 2015;13\(6\):4135 \[103 pp.\]](http://ec.europa.eu/food/plant/standing_committees/sc_phytopharmaceuticals/index_en.htm)

http://ec.europa.eu/food/plant/standing_committees/sc_phytopharmaceuticals/index_en.htm

the time the MRL is set. We will highlight how our assessments differ from that done at the EU level so that readers are aware of the basis of the evaluation.

DDT

The use of DDT is banned or heavily restricted in many countries. It isn't allowed for use on food crops any more but it is still used in some countries outside the EU as a public health insecticide. Residues of DDT take a long time to break down in the environment and can accumulate in fatty tissue which is a major reason that it has been banned in the EU and many other countries.

Due to the bans and restrictions on use, the levels in food have decreased substantially since the 1960s and 1970s. Even so, because it takes a long time to breakdown we do expect, and do see, occasional DDT residues in our monitoring results. Overall, the incidence and the size of residues have fallen steadily over time, which is what we would expect. In recent years none of our findings were unusual, unexpected or of concern. We can tell from the chemical form that we detect whether the residues we have found are from historic use (which is what we usually find). We explain this every time we publish DDT results to try to make it as clear as we can that the results show food producers are not using DDT today. However, there are occasional media stories about DDT and various links and associations, which do not make this distinction.

The residues we find nowadays are at levels that would not be expected to have any effect on health, either in the short term or in the long term, when checked against today's understanding of the effect of DDT on health. As a committee, we take care to ensure we look thoroughly at this, and the Food Standards Agency is also actively involved in our considerations.

Folpet and Phthalimide

The full residue definition for folpet is "sum of folpet and phthalimide, expressed as folpet. You can read more about multi-component residue definitions in [Section 5](#)

Folpet is a widely used fungicide. Phthalimide is included in the residue definition for folpet based on evidence phthalamide can form as a metabolite after folpet is used.⁶ However chemical analysis cannot distinguish between any phthalimide we found formed in this way or from other non-pesticide sources of phthalimide. Phthalimide is present in many chemical products including medicines, dyes and the sweetener saccharine and also occurs naturally. Where we do not find folpet in the same sample, we think it's at least possible that the residue is from a source other than folpet use.

⁶ Reasoned opinion on the review of the existing maximum residue levels (MRLs) for folpet according to Article 12 of Regulation (EC) No 396/200
EFSA Journal 2014;12(5):3700

Follow-up from Previous Reports

Quarter 2 2017

Cucumber

Fluopyram: Sample number 4627/2017

We passed details of a sample of cucumber from the UK that contained fluopyram to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Raspberries

Carbendazim: Sample number 4448/2017

We passed details of a sample of raspberries from the UK that contained carbendazim to HSE. HSE's investigation concluded that the likely cause of the residue was spray drift from an area of non-cropping land nearby where carbendazim was sprayed for worm case control which is an authorised use. The grower has informed HSE of steps they have put in place to prevent a reoccurrence of this. HSE actions are complete, so we have included brand name details in this report.

Quarter 3 2017

Kale

Linuron: Sample numbers 2101/2017, 2108/2017, 5310/2017, 2471/2017 and 3653/2017

We passed details of five samples of kale from the UK that contained residues of linuron to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Raspberries

Chlorpyrifos: Sample number 1855/2017

We passed details of a sample of raspberries from the UK that contained a residue of chlorpyrifos to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Quarter 4 2017

Cauliflower

Triallate: Sample number 3698/2017

We passed details of a cauliflower from the UK that contained triallate to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Cucumber

Propamocarb (sum): Sample number 3334/2017

We passed details of a cucumber from the UK that contained propamocarb to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Brand name details of samples where follow-up action is now complete

Sample ID	Date of Sampling	Description	Country of Origin	Retail Outlet	Address	Brand Name	Packer / Manufacturer	Pesticide residues found in mg/kg (MRL)
2325/2017	31/07/2017	Bramley Apples Loose	UK	Morrisons	215 King St, Aberdeen AB24 5DA	Newmafruit International Ltd	Worldwide Fruit Ltd Apple Way, Pinchbeck, Spalding PE11 3BB	boscalid 0.03 (MRL = 2)
								captan (sum) 0.09 (MRL = 10)
								dithiocarbamates 0.05 (MRL = 5)
								ethirimol 0.01 (MRL = 0.1)
								myclobutanil 0.02 (MRL = 0.6)
								paclobutrazol 0.01 (MRL = 0.5)
								pyraclostrobin 0.02 (MRL = 0.5)
2248/2017	31/07/2017	Bramley Apples	UK	Sainsburys	Flaxlands Bretton Centre, Bretton, Peterborough PE3 8DA	Sainsburys	Sainsburys Supermarkets Ltd 33 Holborn, London EC1N 2HT	boscalid 0.09 (MRL = 2)
								captan (sum) 0.06 (MRL = 10)
								chlorantraniliprole 0.01 (MRL = 0.5)
								paclobutrazol 0.01 (MRL = 0.5)
								pyraclostrobin 0.02 (MRL = 0.5)

Sample ID	Date of Sampling	Description	Country of Origin	Retail Outlet	Address	Brand Name	Packer / Manufacturer	Pesticide residues found in mg/kg (MRL)
3647/2017	03/09/2017	Cucumber	UK	Waitrose	Morningside Road, Edinburgh EH10 4AX			cyprodinil 0.02 (MRL = 0.5)
								fluopyram 0.02 (MRL = 0.5)
								metalaxyl (sum) 0.04 (MRL = 0.5)
								propamocarb (sum) 0.02 (MRL = 5)
4591/2017	31/07/2017	Karina British Cherries	UK	Asda	Chandler Way, Carlisle CA3 0JG	Asda	Asda Stores Ltd Asda House, Great Wilson Street, Leeds LS11 5AD	cyantraniliprole 0.2 (MRL = 6)
								fenhexamid 0.4 (MRL = 7)
								spinosad (sum) 0.06 (MRL = 0.2)
								thiacloprid 0.06 (MRL = 0.5)
2466/2017	04/09/2017	Sweetheart Cherries	Scotland (UK)	Marks and Spencer	56 George Street, Altrincham WA14 1RH	M&S	Marks and Spencer Plc PO Box 3339, Chester CH99 9QS	boscalid 0.07 (MRL = 4)
								fludioxonil 0.02 (MRL = 5)
								fenhexamid 0.2 (MRL = 7)
								iprodione 0.1 (MRL = 10)

Sample ID	Date of Sampling	Description	Country of Origin	Retail Outlet	Address	Brand Name	Packer / Manufacturer	Pesticide residues found in mg/kg (MRL)
3739/2017	04/09/2017	Sweetheart Cherries	Scotland (UK)	Waitrose	Sovereign Way, Tunbridge TN9 1RG	Waitrose	Waitrose Limited Bracknell, Berkshire RG12 8YA	boscalid 0.09 (MRL = 4)
								fenbuconazole 0.01 (MRL = 1)
								fludioxonil 0.02 (MRL = 5)
								fenhexamid 0.2 (MRL = 7)
								iprodione 0.1 (MRL = 10)
								pirimicarb (sum) 0.01 (MRL = 5)

In our next report:

In Quarter 2 of 2018 we will look at results for:

Animal fats

Apples

Aubergine

Bananas

Beans with pods

Beef

Berries/small fruit

Broccoli

Cheese (soft)

Chinese cabbage

Cream

Curry leaves

Eggs

Fish (white)

Game

Grapefruit

Grapes

Lettuce

Melon

Milk

Mushroom

Mushroom (speciality)

Okra

Pears

Peas

Peppers

Pineapple

Potatoes

Soft citrus

Speciality vegetables

Section 5: background and reference

Reasons for pesticide residue testing

Food safety is important. Modern food production processes have given us plentiful supplies of a wide range of good quality affordable produce.

In the food industry of today the production environment can be managed from the preparation of seeds used for crops, through to growth, harvesting and storage of the produce.

One of the ways the food industry controls the environment in which foodstuffs are produced is by applying pesticides. They help farmers and growers maximise the production of food stuffs by, for example, preventing weeds inhibiting the growth of the crop, or insects destroying or infesting them. Pesticides can also be used to help protect seeds, or prolong the life of crops after they have been harvested. Biological and physical (cultural) controls are also used to protect crops or as part of an integrated system.

As pesticides are used to control unwanted pests, weeds and diseases, they can potentially also harm people, wildlife and the environment. This is why the UK, in common with most other countries, imposes legally enforceable conditions as to how and when pesticides can be used. No pesticide can be supplied or used on a food or ornamental crops in the UK without Government authorisation. To obtain this authorisation the manufacturer of the pesticide must show that it does not present a concern for people's health or the environment. Naturally derived and synthetic pesticides are subject to the same regulation.

Once the authorisation has been granted Government authorities carry out follow up checks to ensure that the authorisation is providing the necessary degree of protection to users, consumers and the environment and that those who use pesticides are complying with conditions specified within it.

The Government authority responsible for checking pesticide residues in foodstuffs is the Health and Safety Executive. Defra's Expert Committee on Pesticide Residues in Food (PRiF) oversees and provides an independent check on this work. We know that the use of pesticides on crops may lead to traces (residues) of these chemicals in food and we expect to find these in our monitoring programme.

Defra's Expert Committee on Pesticide Residues in Food (PRiF)

The Expert Committee on Pesticide Residues in Food was established in 2011. Our members have a broad range of expertise relating to the food supply industry. The main function of the Committee is to oversee Government's £2 million pesticide residues surveillance programme. Previously this work was carried out by the Pesticide Residues Committee.

Our Chairman, Dr Paul Brantom is an independent consultant in toxicological risk assessment. The Committee also includes members with expertise in toxicology, food production and supply as well as two public interest experts.

Information on the membership of the PRiF is also available on the PRiF's website:

<https://www.gov.uk/government/groups/expert-committee-on-pesticide-residues-in-food-prif>

Our role is to advise Ministers, the Director of the Health and Safety Executive (HSE) and the Chief Executive of the Food Standards Agency (FSA) on:

- the planning of surveillance programmes for pesticide residues in the UK food supply and the evaluation of the results;
- Procedures for sampling, sample processing, new methods of analysis, the assessment of variability of pesticide residues in food and related issues.

Detail of reporting practice

Results by food commodity

- We include information about the survey (for instance where samples came from) for each commodity
- Detailed tabulated results are at the back of this report - these tables are also available for download from our website
- We summarise our findings and any follow-up action taken.

Risk assessments – single residues

- All results are screened by HSE to check for intakes above the Acute Reference Dose (ARfD). HSE assumes a relatively high level of intake and also assumes that most produce is eaten whole including peel/skin even when these are rarely consumed
- Where intakes above the ARfD are identified, we consider a detailed risk assessment prepared by HSE (at Section II of this report).
- Our observations and the follow-up action taken are summarised in the section for that food.

Risk assessments – multiple combined residues

- Residues of more than one pesticide from the same category/class of particular categories of pesticides, which have a similar toxicological mode of action, are screened by HSE to check for intakes above the combined Acute Reference Dose (ARfD).
- Where combined intakes above the combined ARfD are identified, we consider a detailed combined risk assessment prepared by HSE (at Section II of this report).
- Our observations and any follow-up action taken are summarised in the section for that food commodity.

Risk assessment - conclusions

Where, in the light of current knowledge and considering the usual level of scientific uncertainty (or precaution) the intake will not cause ill health the conclusion will say no effect on health is expected.

Where, in the light of current knowledge and considering a slightly higher level of scientific uncertainty (or less precaution) the intake is not likely to cause ill health, the conclusion will be less definite and state that an effect on health is unlikely.

Where scientific uncertainty is greater more information is provided.

Residues in UK produce of pesticides which are not approved for use on that crop in the UK.

- All residues found in UK-produced foods are checked by HSE to make sure the pesticide is approved for use.
- Where no UK approval is identified, details of the sample are referred to HSE's Enforcement Section for follow up.
- Our observations and any follow-up action taken to date are summarised in the section for that food commodity. We may have to withhold details of samples while investigations are underway, in which case the details will be published in a later report.

Residues above the MRL, after taking into account measurement uncertainty

- Samples containing residues above the MRL are listed at Appendix B, and those which are clearly above the MRL after taking into account measurement uncertainty of plus or minus 50% are highlighted.
- Our observations and any follow-up action taken are summarised in the section for that food commodity.

The results in our reports are rounded for publication but not adjusted for measurement uncertainty.

We apply measurement uncertainty only to decide whether to highlight a result as over the MRL in the brand name annex. To do this we use the actual value reported by the laboratory before rounding. If after taking measurement uncertainty into account that value is found to be over the MRL the result will be highlighted in the brand name annex.

For example:

- The lab reports the results of duplicate analysis of a residue above an MRL at 0.023 mg/kg and 0.025 mg/kg giving an average value of 0.024mg/kg. For reporting purpose this value would be 0.02 mg/kg.
- If measurement uncertainty is then applied to the reported value of 0.02 mg/kg it could take the value to between 0.01 - 0.03 mg/kg. If the MRL is 0.01 mg/kg the lower value would be at the MRL and there is no exceedance.
- However if measurement uncertainty is applied to the measured result, e.g. 0.024 mg/kg the value could then be in the range of 0.012 – 0.036 mg/kg. In this case the lower value is above the MRL and so will be treated as an exceedance.

Residues in organic food

- We monitor pesticide residues in all the UK food supply, including organic food.
- We are not responsible for checking compliance with the rules associated with organic production. However, when we do detect residues in an organic food we explain whether or not those residues indicate a breach of the rules and inform Defra's Organic Farming Branch.

Brand Name Annex

- Full brand name details for samples included in this report are published in a brand name annex. Within this annex, samples with results of interest are highlighted.
- Brand name details are only published when enough follow-up work is completed for us to be reasonably sure whether a breach of the law or good practice has occurred. Therefore sometimes brand name details are withheld pending completion of this work but are published in a later report.

Pesticides analysed as multi-component analytes and their reporting limits

Why some results cover more than one substance

Both the legal controls and our analytical tests are aimed at checking food for the presence of residues of specific pesticides. Residues are the chemical traces left behind after pesticides are used. In most cases the residue of a pesticide is measured by first identifying the pesticide and then measuring the quantity of that pesticide in the food itself. But for some pesticides the residue remaining in the food is known to be chemically different from the original pesticide and so the laboratory needs to look for more than one component. There are various reasons why this happens, for example:

- the animal or plant can change the pesticide into related chemicals
- the pesticide can change in the environment into related chemicals
- some pesticides are mixtures of chemicals, so the relevant components of the mixture need to be checked for
- in the laboratory sample preparation and/or analysis may change pesticides into related chemicals
- related chemicals may be pesticides in their own right

The MRL setting process takes account of all these issues. The EU may set a complex residue definition to ensure that the identity and quantity of the residue found is representative of the pesticide present. A complex residue definition may be set where it is necessary for safety reasons or to be able to accurately identify the pesticide residue present in the food. This definition usually includes the actual pesticide, plus other related chemicals. These residues are usually reported together as a “sum”. Sometimes different foods need different definitions because different pesticide residues are known to occur in that food. For instances, plants and animals may metabolise a pesticide differently, which forms different residues.

The full definitions of pesticides that we have found in our surveys are described in the table below. If you would like more detail about a particular residue definition, please get in touch. You can email us at prif@hse.gov.uk and other contact details are on the back cover.

Where the detailed individual analysis results tell us something useful, we mention that in our conclusions.

How we calculate sums

Unless the definition says otherwise, the summed result is a simple addition. For individual components that are not detected that result is treated as a zero.

Where a residue definition says “expressed as”, that means that the individual component results are adjusted by molecular weight before being added together. The residue definition is set this way so that the final calculated result for the whole definition is an expression of the level

of the most toxic component, and so that value can be used directly in consumer risk assessment without further adjustment.

The EU Reference Laboratories for pesticide residues have an e-learning package aimed at analytical chemists on this very technical subject at <http://www.eupt.es/e-learning/>.

Complex residue definitions used in our reports

There are a large number of pesticides used and types of food in the world. So other complex residue definitions may apply to food/pesticide combinations not yet considered by PRiF. You can look up all the EU MRL definitions for pesticide residues at the European Commission's pesticide database at http://ec.europa.eu/food/plant/pesticides/pesticides_database/index_en.htm

Short name we use in our reports	Legal residue definition – These definitions apply to all foods unless otherwise stated
2,4-D (sum)	2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)
abamectin (sum)	Abamectin (sum of Avermectin B1a, AvermectinB1b and delta-8,9 isomer of Avermectin B1a)
aldicarb (sum)	Aldicarb (sum of Aldicarb, its sulfoxide and its sulfone, expressed as Aldicarb)
aldrin and dieldrin	Aldrin and Dieldrin (Aldrin and dieldrin combined expressed as dieldrin), aka dieldrin (sum)
Amitraz	Amitraz (amitraz including the metabolites containing the 2,4 - dimethylaniline moiety expressed as amitraz)
BAC (sum)	Benzalkonium chloride (mixture of alkylbenzyltrimethylammonium chlorides with alkyl chain lengths of C ₈ , C ₁₀ , C ₁₂ , C ₁₄ , C ₁₆ and C ₁₈)
benthiavalicarb (sum)	Benthiavalicarb (Benthiavalicarb-isopropyl (KIF-230 R-L) and its enantiomer (KIF-230 S-D) and diastereomers (KIF-230 R-L and KIF-230 S-D))
bixan (animal products)	Sum of bixafen and desmethyl bixafen expressed as bixafen This definition applies to animal products only
captan (sum)	Captan (Sum of captan and THPI, expressed as captan)
carbendazim (animal products)	Carbendazim and thiophanate-methyl, expressed as carbendazim
Carbendazim (sum)	Carbendazim and benomyl (sum of benomyl and carbendazim expressed as carbendazim)
carbofuran (sum)	Carbofuran (sum of carbofuran and 3-hydroxy-carbofuran)

	expressed as carbofuran)
chlordan (animal products)	Chlordane (sum of cis- and trans-isomers and oxychlordan expressed as chlordan) This definition applies to animal products only
chlordan (sum)	Chlordane (sum of cis- and trans- isomers) This definition applies to all foods except animal products
chlorpropham (potatoes)	Chlorpropham only This definition applies only to potatoes
chlorpropham (sum for animal products)	Chlorpropham and 4-hydroxychlorpropham-O-sulphonic acid (4-HSA), expressed as chlorpropham This definition applies only to animal products
chlorpropham (sum)	Chlorpropham (Chlorpropham and 3-chloroaniline, expressed as Chlorpropham) This definition applies to all foods except potatoes and animal products
DDAC (sum)	Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C ₈ , C ₁₀ and C ₁₂)
DDT (sum)	DDT (sum of p,p'-DDT, o,p'-DDT, p-p'-DDE and p,p'-TDE (DDD) expressed as DDT)
Dichlorprop	Sum of Dichlorprop, including dichlorprop-p and its conjugates, expressed as dichlorprop
dicofol (sum)	Dicofol (sum of p, p' and o,p' isomers)
Dimethenamid	Dimethenamid-p (Dimethenamid-p including other mixtures of constituent isomers (sum of isomers))
dimethoate (sum)	Dimethoate (sum of dimethoate and omethoate expressed as dimethoate)
disulfoton (sum)	Disulfoton (sum of disulfoton, disulfoton sulfoxide and disulfoton

	sulfone expressed as disulfoton)
dithiocarbamates	Dithiocarbamates are a group of pesticides that are chemically similar. Testing for them individually in routine analysis is not possible, so MRLs are set for a test for the group.
endosulfan (sum)	Endosulfan (sum of alpha- and beta-isomers and endosulfan-sulphate expresses as endosulfan)
fenamiphos (sum)	Fenamiphos (sum of fenamiphos and its sulphoxide and sulphone expressed as fenamiphos)
fenchlorphos (sum)	Fenchlorphos (sum of fenchlorphos and fenchlorphos oxon expressed as fenchlorphos)
fensulfothion (sum)	Fensulfothion (sum of fensulfothion, its oxygen analogue and their sulfones, expressed as fensulfothion).
fenthion (sum)	Fenthion (fenthion and its oxygen analogue, their sulfoxides and sulfone expressed as parent)
fenvalerate & esfenvalerate (all isomers)	Fenvalerate (any ratio of constituent isomers (RR, SS, RS & SR) including esfenvalerate)
fipronil (infant food)	Sum of fipronil and fipronil-desulfinyl, expressed as fipronil This definition applies to foods for babies only
fipronil (sum)	Fipronil (sum Fipronil and sulfone metabolite (MB46136) expressed as Fipronil) This definition applies to all foods except foods for babies
flonicamid (sum)	Flonicamid (sum of flonicamid, TNFG and TNFA) This definition applies to all food except animal products
fluazifop-p-butyl (sum)	Fluazifop-P-butyl (fluazifop acid (free and conjugate))
folpet (sum)	Sum of folpet and phthalimide, expressed as folpet
haloxyfop (sum)	Haloxyfop including haloxyfop-R (Haloxyfop-R methyl ester,

	haloxyfop-R and conjugates of haloxyfop-R expressed as haloxyfop-R)
Heptachlor (infant food)	Sum of heptachlor and trans heptachlor epoxide This definition applies to foods for babies only
Heptachlor (sum)	Heptachlor (sum of heptachlor and heptachlor epoxide expressed as heptachlor) This definition applies to all foods except infant foods
hexachlorocyclohexane (sum)	Hexachlorocyclohexane (HCH), sum of isomers, except the gamma isomer This definition applies to all foods except animal products (For animal products the alpha and beta isomers have separate MRLs)
Malathion	Malathion (sum of malathion and malaoxon expressed as malathion)
MCPA (animal products)	[Residue definition, animal products] MCPA, MCPB and MCPA thioethyl expressed as MCPA This definition applies to animal products only
MCPA (sum)	MCPA and MCPB (MCPA, MCPB including their salts, esters and conjugates expressed as MCPA) This definition applies to all foods except animal products
mepanipyrim (sum)	Mepanipyrim and its metabolite (2-anilino-4-(2-hydroxypropyl)-6-methylpyrimidine) expressed as mepanipyrim
methiocarb (sum)	Methiocarb (sum of methiocarb and methiocarb sulfoxide and sulfone, expressed as methiocarb)
methomyl (sum)	Sum of methomyl and thiodicarb expressed as methomyl
oxydemeton-methyl (sum)	Oxydemeton-methyl (sum of oxydemeton-methyl and demeton-S-methylsulfone expressed as oxydemeton-methyl)

parathion-methyl (sum)	Parathion-methyl (sum of Parathion-methyl and paraoxon-methyl expressed as Parathion-methyl)
Permethrin	Permethrin (sum of isomers)
phorate (sum)	Phorate (sum of phorate, its oxygen analogue and their sulfones expressed as phorate)
phosmet (sum)	Phosmet (phosmet and phosmet oxon expressed as phosmet) This definition applies to all foods except animal products
pirimicarb (sum)	Pirimicarb This definition applies to most products Pirimicarb (sum of Pirimicarb and Desmethyl pirimicarb expressed as Pirimicarb) applies to poultry, eggs and honey.
Prothioconazole (sum)	Prothioconazole (sum of prothioconazole-desthio and its glucuronide conjugate, expressed as prothioconazoledesthio) This definition applies to animal products only
PTU & propineb	Sum of PTU and propineb This definition applies to food for babies only
quintozene (sum)	Quintozene (sum of quintozene and pentachloro-aniline expressed as quintozene)
Prochloraz (sum)	Prochloraz (sum of prochloraz and its metabolites containing the 2,4,6-Trichlorophenol moiety expressed as prochloraz)
Terbufos (sum)	Terbufos (sum of terbufos, its sulfoxide and sulfone) This definition applies only to foods for babies
thiamethoxam (sum)	Thiametoxam (sum of thiametoxam and clothianidin expressed as thiametoxam) There are <u>also</u> separate clothianidin MRLs
tolyfluanid (sum)	Tolyfluanid (Sum of tolyfluanid and dimethylaminosulfotoluidide expressed as tolyfluanid)

triadimefon & triadimenol	Triadimefon and triademenol
vinclozolin (animal products)	Vinclozolin, iprodione, procymidone, sum of compounds and all metabolites containing the 3,5-dichloroaniline moiety expressed as 3,5-dichloroaniline This definition applies to animal products only
vinclozolin (sum)	Vinclozolin (sum of vinclozolin and all metabolites containing the 3,5-dichloroaniline moiety, expressed as vinclozolin) This definition applies to all foods except animal products

Glossary

This is a 'standard' glossary which defines the key terms used in the PRiF reports. Not all the terms listed here are used in this particular report.

Acceptable Daily Intake (ADI): This is the amount of a chemical which can be consumed every day for a lifetime in the practical certainty, on the basis of all known facts, that no harm will result. It is expressed in milligrams of the chemical per kilogram of body weight of the consumer. The starting point for the derivation of the ADI is usually the 'no observed adverse effect level' (NOAEL) that has been observed in animal studies for toxicity. This is then divided by an uncertainty factor (most often 100) to allow for the possibility that animals may be less sensitive than humans and also to account for possible variation in sensitivity between individuals. The studies from which NOAELs and hence ADIs are derived take into account any impurities in the pesticide active substance as manufactured, and also any toxic breakdown products of the pesticide.

Acetylcholine: Acetylcholine is a neurotransmitter, a chemical that carries signals through the nervous system. *See cholinergic*

Acetylcholinesterase: This is an enzyme which degrades acetylcholine and is involved in the regulation of nerve impulses.

Acute Reference Dose (ARfD): The definition of the ARfD is similar to that of the ADI, but it relates to the amount of a chemical that can be taken in at one meal or on one day without appreciable health risk to the consumer. It is normally derived by applying an appropriate uncertainty factor to the lowest NOAEL in studies that assess acute toxicity or developmental toxicity.

As a matter of policy the EU does not use NOAELs from tests that involve deliberate administration of pesticides to humans to determine ADIs and ARfDs. However, where such data have been ethically and scientifically derived some authorities, e.g. the World Health Organization, do consider such data. Where human data are used there is usually less uncertainty in the resulting reference value compared to extrapolating from animal tests to humans, and a lower uncertainty factor (most often 10) is used to account for the variation in sensitivity between individuals.

The initial risk assessments in PRiF reports use the agreed EU reference values. However, where intakes are above the EU value and a reference value based on acceptable human data is available a refined assessment, which is a more appropriate indicator of the risk, is also reported.

Analyte: This is the name for the substance that the PRiF surveys look for and measure if present; it could be a pesticide itself or a product from a pesticide when it is degraded, or metabolised.

COLEACP (Europe-Africa-Caribbean-Pacific Liaison Committee): It aims to promote the competitive export of fresh fruit, vegetables, flowers and ornamental plants from the ACP. Its specialised information and advisory services are open to all ACP companies in the horticultural export sector and are financed by the European Commission. It has two overriding objectives to enable ACP companies to comply with European food safety and traceability requirements and to consolidate the position of small-scale producers in the ACP horticultural export sector.

Cholinergic: In relation to the animal nervous system, processes and structures are cholinergic if they release or use acetylcholine.

Cryogenic Milling: Processing of commodities at very low temperatures can be achieved by milling/grinding pre-frozen samples in the presence of dry ice, a procedure known as 'cryogenic milling'.

Extensions of Authorisations for Minor Use (EAMUs): Users and authorisation holders of agricultural Plant Protection Products (PPP) may apply to have the authorisation of specific PPP's extended to cover uses additional to those authorised and shown on the manufacturer's product label. For many reasons, label recommendations of approved pesticides do not cover the control of every problem which may arise. This is particularly true for crops that are grown on a comparatively small scale in the UK as well as for pests and diseases that occur less often or which are new to the UK. As part of the process evidence on residues that would arise from the use is required, and consumer safety is evaluated and if necessary a specific MRL set. EAMU is pronounced "emu": these types of authorisations are also informally called "off labels" .

Good Agricultural Practice in the Use of Pesticides (GAP): The nationally authorised safe uses of pesticides under conditions necessary for effective and reliable pest control (the way products should be used according to the statutory conditions of approval which are stated on the label). GAP encompasses a range of pesticide applications up to the highest authorised rates of use, applied in a manner which leaves a residue which is the smallest practicable. Authorised safe uses are determined at the national level and include nationally registered recommended uses, which take into account public and occupational health and environmental safety considerations. Actual conditions include any stage in the production, storage, transport, distribution and processing of food commodities and animal feed.

High-level Consumer: A term used in UK risk assessment calculations to describe the amount of food consumed by a person. In line with internationally agreed approaches, the PRiF uses the 97.5th percentile value, which is generally about three times the average amount consumed. This takes account of different eating patterns that may occur throughout the population.

Human Data: See under Acute Reference Dose

Import Tolerance: an MRL set for imported products where the use of the active substance in a plant protection product on a commodity is not authorised in the European Community (EC) or an existing EC MRL is not sufficient to meet the needs of international trade. All import tolerances are assessed for consumer safety.

Imported: The tables in the reports record whether the sample was of UK origin, or imported. This can mean different things depending on the commodity. See also 'Origin'. The PRiF report the country from where the produce has been imported only if this is clear from the packaging or labelling.

JMPR: Joint FAO/WHO Meeting on Pesticide Residues, which conducts scientific evaluations of pesticide residues in food.

LOD (Limit of Determination) and LOD MRLs: The Limit of Determination (LOD) is the lowest concentration of a pesticide residue or contaminant that can be routinely identified and quantitatively measured in a specified food, agricultural commodity or animal feed with an acceptable degree of certainty by the method of analysis.

LOD MRL (Maximum Residue Levels set at the LOD): For some pesticides and commodities, insufficient trials data are available on which to set a maximum residue level or there may be no use of the pesticide on that crop. In these cases, the MRL may be set at a default level, i.e. at the limit of determination (LOD) where analytical methods can reasonably detect the presence of the pesticide. **These MRLs are not based on Good Agricultural Practice (GAP).**

Off-Label: See EMAUs. **Maximum Residue Level (MRL):** The maximum concentration of a pesticide residue (expressed as mg/kg) legally permitted in or on food commodities and animal feeds. MRLs are based on good agricultural practice data and residues in foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable.

MRLs are intended primarily as a check that GAP is being followed and to assist international trade in produce treated with pesticides. **MRLs are not in themselves 'safety limits'**, and exposure to residues in excess of an MRL does not automatically imply a hazard to health.

The MRLs applicable in the UK are now largely set under EC legislation.

Maximum Residue Levels (MRLs) reflect levels of pesticides that could occur in produce, which has been treated in accordance with good agricultural practice. Where pesticides do not give rise to readily detectable residues, or are not approved for use on particular commodities, MRLs are set at the lowest level which can be identified in routine laboratory analysis. Thus, they provide a mechanism for statutory controls on pesticides in produce which is put into circulation and for monitoring correct use of these chemicals.

If no use of a pesticide on a crop is identified when MRLs are set the tolerance for that pesticide/crop combination is set at the limit of determination (effectively zero). Limit of determination MRL are marked by a '*'

MRLs are established under the Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuff) (England and Wales) Regulations 1999 (as amended), the Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuff) (Scotland) Regulations 2000 and the Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuff) Regulations (Northern Ireland) 2002. These Regulations list all statutory MRLs established under UK national or EC

procedures. Today, virtually all these MRLs are set under an ongoing EC programme and the Regulations are amended periodically as levels are set for increasing numbers of pesticides.

There are a number of pesticides which do not yet have statutory MRLs. In the absence of such MRLs we advise suppliers to adhere to any appropriate levels established by the Codex Alimentarius Commission (CAC) a United Nations body established to promote global trading standards. Codex MRLs are not statutory but have been risk-assessed when set and provide a suitable standard in the absence of a statutory MRL.

MRLs may be extended to composite and processed products but levels are not specifically laid down in legislation. They are derived by calculation on an individual basis.

Maximum Residue Levels set at the LOD (LOD MRL): See LOD MRL For some pesticides and commodities, insufficient trials data are available on which to set a maximum residue level or there may be no use of the pesticide on that crop. In these cases, the MRL may be set at a default level, i.e. at the limit of determination (LOD) where analytical methods can reasonably detect the presence of the pesticide. **These MRLs are not based on Good Agricultural Practice (GAP).**

MRL exceedances: When a residue is found at a level higher than that set for the MRL.

MRL Exceedances and Relationship with the Acceptable Daily Intake (ADI): Before permitting any use of a pesticide, a detailed assessment is made to ensure that residues in foods derived from commodities comply with MRLs and will not give rise to unacceptable risks to consumers. MRLs do take account of consumer safety aspects and, in effect, are set at levels below safety limits. However, MRLs must not be confused with safety limits, which are expressed in terms of the acceptable daily intake (ADI) of a particular pesticide residue from all sources. The ADI (expressed as mg/kg bw/day) is the amount of chemical that can be consumed every day of an individual's entire lifetime in the practical certainty, on the basis of all known facts, that no harm will result. See ADI for further information.

Whenever unexpectedly high or unusual residues occur during monitoring, the risk to consumers, from exposure to residues at the highest levels found, is assessed by comparison of predicted intakes with the ADI or ARfD as appropriate.

No MRL: For certain pesticides an MRL may not have been set.

Metabolite: A degradation or conversion product from a pesticide when it is metabolised.

Multiple Residues: In this report this term is used to describe when more than one pesticide is found in an individual food sample. It may have arisen because the crop was treated at different times with pesticides applied singularly, or when pesticides are applied as mixtures (several pesticides mixed in the spray tank at the same time) or the marketed pesticide product contains more than one pesticide or any combination of these three situations. Mixtures may be used in response to specific pest pressures and also as part of strategies to minimise pesticide resistance building up on pest populations.

NEDI: National Estimate of Daily Intake. An estimate of intake of pesticide in the diet over the long-term to compare to the ADI. The NEDI is based on median or mean residue levels and a high level consumption (97.5th percentile value) for the daily amounts of the food item consumed over the long term. For further details on the calculation of NEDIs please refer to section 3 of the data requirements handbook: www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/applicant-guide/the-applicant-guide-contents.

NESTI: National Estimate of Short Term Intake. An estimate of peak intake of pesticide in the diet to compare to the ARfD. The NESTI is based on the highest residue found multiplied by a variability factor (see glossary description) and a high level consumption (97.5th percentile value) for the amount of the food item consumed over a single day. For further details on the calculation of NESTIs please refer to section 3 of the data requirements handbook: www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/applicant-guide/the-applicant-guide-contents.

Neurotoxicity: Neurotoxicity is the effect of substances (called neurotoxins) which alter the normal working of an animal's nervous systems and/or damage the nervous tissue.

No Observed Adverse Effect Level (NOAEL): The greatest concentration or amount of a substance, found by experiment or observation, which causes no detectable adverse alteration of morphology, functional capacity, growth, development or life span of the target organism under defined conditions of exposure.

Origin: The brand name annex reports the origins of the samples tested. This can mean different things depending on the commodity. For example, butter is often labelled as 'UK origin'; however, the majority of it comes in bulk from New Zealand and is split into smaller blocks and packaged in the UK. Lettuce is a fresh produce and 'UK origin' usually means that it has been grown and packaged in the UK. Processed commodities such as cereal bars often contain multiple raw ingredients, each of which may come from a different source/origin. Therefore, the origin of the produce usually reflects the place where it was manufactured. The PRiF report the origin as stated on the packaging or labelling of the commodity concerned, unless other more accurate information is available to indicate that the origin is from elsewhere. Some products are listed as 'unknown origin' because the labelling does not give this information.

Parent: The chemical form of a pesticide as applied to plants, as opposed to metabolites and breakdown products.

Percentile: A percentile is a value that divides a sample of measurements at a specific point when they are listed in ascending order of magnitude. For example, the 97.5th percentile from a food consumption survey is a value that is equal to or more than 97.5% of the measurements and equal to or less than 2.5% of the measurements. So in a sample of 40 daily food consumption values, the 97.5th percentile is equal to or more than 39 of the measurements. Such high percentile estimates of food consumption are used in risk assessments as they are more protective than using average consumption levels.

Permitted Level (PL): The permitted levels (expressed as mg/kg), in specific commodities, of some substances which can be classified as pesticides but are controlled under the Miscellaneous Food Additives Regulations 1995 (S.I. 1995 No. 3187).

Pesticide: A pesticide is any substance, preparation or organism prepared or used for destroying any pest. The majority of pesticides sought by the PRiF in its monitoring are those used to control pests in agricultural crops, although non-agricultural products may be included where there is a specific reason for doing so, e.g. where there are implications in terms of possible intakes of residues.

Probabilistic Modelling: The usual estimates of consumer exposure use single high values for both consumption amounts and residue levels. Whilst these are based on realistic UK dietary survey data and residue levels, they tend to overestimate most representative intakes. This is because they do not take into account actual variations in both amounts consumed and residue levels. Probabilistic modelling is a technique that considers all the possible different combinations of consumption and residue levels. This provides information on the probability of particular intakes occurring.

Rapid Alert System for Food and Feed (RASFF): The European Commission's Rapid Alert System for Food and Feed (RASFF) allows member authorities (EU and EFTA member States) to quickly exchange information about measures taken when responding to risks detected in food or feed. This exchange of information helps authorities in countries inside the European single market to act more rapidly and in a coordinated way in response to a possible health threats caused by food or feed.

RASFFs notifications about pesticide residues are sent when a residue is over the MRL taking into account measurement uncertainty and a potential consumer risk has been identified. For pesticide residues in food traded in the single market this means when a risk assessment has identified that risk to people eating the food cannot be ruled out.

More information is available on the European Commission website at https://ec.europa.eu/food/safety/rasff_en

Relationship between GAP and MRLs: The MRL can be defined as the maximum concentration of a pesticide residue (expressed as mg/kg) likely to occur in or on food commodities and animal feeds, after the use of the pesticide according to the GAP.

Reporting Limit: The reporting limit is the lowest calibrated level employed during analysis to detect residues. The reporting limit may vary slightly from laboratory to laboratory depending on the equipment available and operating procedures used.

'None were detected above the Set RL': This term is used in the Brand Name Annex, where no residues were found above their reporting limit.

Residue: Residues may be present in vegetable and animal products following the application(s) of a pesticide(s). They may not only include the pesticide that was applied but

other degradation or reaction products and metabolites that may be of toxicological significance. The levels or amounts of residues present are expressed in milligrams of the chemical in a kilogram of crop/food/commodity (mg/kg), or parts per million.

Risk Assessment: A risk assessment is carried out when residues are found in foods to determine whether, at the levels found, they present a concern for consumer health or not. Consumer risk assessments are routinely conducted as part of the approval process for pesticides and are based on residue trials. Approval of a pesticide is only recommended when the consumer risk is acceptable.

Safety Factor: Values used in extrapolation from experimental studies in animals (usually 100) or humans (usually 10) to the population: for PRiF assessments this represents a value by which the NOAEL is divided to derive an ADI or ARfD. The value depends on the nature of the effect, the dose-response relationship, and the quality of the toxicological information available. The use of such a factor accounts for possible differences in susceptibility between the animal species tested and humans, and for variation between different individuals in the population. The terms 'uncertainty factor' and 'assessment factor' are also sometimes used for this factor; the PRiF will use 'safety factor'.

Sample: The nature of all samples is as designated in the EC's 'sampling' Directive – 2002/63/EC. Examples are: apple – at least 10 apples weighing at least 1 kg; grapes – at least 5 bunches, weighing at least 2 kg.

Technical Exceedances: When an MRL has been set at the LOD because there have been no data to support a higher level. In the context of this report, 'technical exceedances' always relate to produce from third countries.

Variability Factor: A value that describes the variation in residue levels between the highest unit level and the average level in samples made up of many units. Internationally this is agreed to be the 97.5th percentile unit residue level divided by the average of the sum. The variability factor multiplied by the measured residue level from a composite sample (i.e. a sample made up by mixing several units before analysis) gives an estimate of the likely higher residue levels that may have occurred in individual units. These estimated higher levels are used in short-term risk assessments involving fruit and vegetables where consumers eat only a portion of a single item, e.g. melon, or a small number of units e.g. apples and potatoes.

Ware: Ware potatoes, sometimes referred to as main crop potatoes, are harvested between August and November, and are available throughout the period August to June because they are stored under controlled temperature after October.