

UK competent authorities for pesticide residues in food: annual report for 2021

Part 1: Annual Report of the United Kingdom Competent Authorities for pesticide residues in food on the 2021 control plans

Part 2: Results of the Great Britain Competent Authorities for pesticide residues in food on the 2021 control plans

Part 3: Results of the Northern Ireland Competent Authorities for pesticide residues in food on the 2021 control plans

Health and Safety Executive
Department for Environment Food and Rural Affairs (Defra)
Scottish Government
Welsh Government
Northern Ireland Government

The Health and Safety Executive (HSE) Food Monitoring Programmes check food and drink in Great Britain and Northern Ireland for traces of pesticide residues on behalf of Defra, the Northern Ireland Executive, the Scottish Government and the Welsh Government.

One of the purposes of the programme is to check whether residues found in food and drink are above the maximum residue levels (MRLs) set by law.

HSE administers a food monitoring programme that:

- when residues are detected, conducts risk assessments to identify whether the levels found are likely to impact on human health - this is done for all residues, whether or not the MRL is exceeded
- assesses the risk of residues detected on particular groups of vulnerable consumers such as babies, toddlers and the elderly
- where more than one pesticide is found with similar modes of action, identifies if the impact of the sum of the residues is of concern
- when problems are found, takes action including additional testing
- check that results align with those set by the regulatory regime when the law on using the pesticides or on pesticide residues in food were set
- communicates with suppliers and food producers - this communication often drives positive impact work for the supply chain

This report from HSE summarises the results from monitoring samples collected throughout 2021 and our conclusions about those results. It also describes the work that is being carried out in 2022.

Details of all the samples HSE have collected and tested are available at: [Pesticide Residues in Food Data](#)

If you have any comments about this report, please send them to pesticideresiduesteam@hse.gov.uk

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Executive summary

Pesticides used in farming can result in residues being left in the food which is produced. In order to provide a high level of protection for consumers, there are strict controls on the levels of pesticide residues that are permitted in food. The maximum permitted residue levels (MRLs) are not in themselves safety limits, but are based on the levels that occur if the pesticide has been used correctly. They are always set below, and usually well below, the level considered to be safe for consumers. We have an ongoing monitoring programme to analyse the levels of pesticides present in different foods and provide assurance that food in the UK complies with these strict rules.

This report contains details of the 2021 pesticide residues in food monitoring programme. It describes:

- how pesticides are regulated and the role that Maximum Residue Levels (MRLs) in foodstuffs form as part of these controls
- role of the Food Standards Agency in relation to this work
- make-up of the monitoring programme
- details of headline and key results
- how findings are assessed to determine any risks to consumers
- how follow-up action is taken on particular findings and results

HSE organises this monitoring programme and reports findings on behalf of Defra and the Governments of Scotland, Wales and Northern Ireland. The Pesticides Residues in Food Expert Committee provides advice to Government in relation to make-up of the programme and communication of results and publishes quarterly reports of the findings. Read the [Expert Committee on Pesticide Residues in Food \(PRiF\) annual report](#) for 2021.

Foodstuffs are sampled from a range of retail, wholesale, port, distribution depots and processor factory locations across the UK, as detailed in this report, and analysed for the presence of a large number of pesticides. The findings are assessed, initially for compliance with MRLs and also to determine whether there are any implications for the short and long-term health of those consuming the produce. Where appropriate, follow-up action may be taken to establish the cause of particular findings and determine whether compliance, enforcement or other action should be taken. Details of the programme's findings, assessments and associated activity are published in the quarterly reports.

The monitoring programme is risk-based – looking at those foods in which we expect to find residues. Overall results show that the vast majority of food we tested (97.45%) complied with legal limits for pesticides in that food. The compliance rates in this year's report are broadly similar with monitoring results in previous years.

The 2021 programme analysed 3,530 samples of 29 different foodstuffs.

- 48.64% of samples contained no residues.
- 48.81% of samples contained residues below the MRL.

- 2.55% of samples contained residues above the MRL.

The report breaks down these findings presenting separate results for: Great Britain and Northern Ireland; and types of foodstuffs (fruits and vegetables; starchy foods and grains, animal products; and miscellaneous foodstuffs). It also provides details of all samples containing residues above the MRL. All of the samples in which a residue was detected were checked for risk to consumers. The quarterly reports of 2021 programme contain details of 41 short-term risk assessments where it was concluded that further work was necessary, on findings detailed in this report, to assess potential impacts on consumers. Even where food contains a residue above the MRL, we rarely find any likely risk to the health of people who have eaten the food.

Roles of HSE and the Competent Authorities for pesticide residues

The term ‘pesticide residue’ means the chemical trace of a pesticide which may be found in or on our food. The agriculture and food industries use pesticides to help protect their crops from pests, including insects, weeds or fungal infections.

The UK competent authorities for pesticides and pesticide residues in food are:

- Defra (for England)
- Scottish Government
- Welsh Government
- Northern Ireland Government

Great Britain (GB) legislation states the three Great Britain competent authorities

- may co-operate to produce and deliver a Great Britain-control plan
- must produce and deliver a control plan in their territory
- must co-operate to prepare an annual report of the results

Northern Ireland (NI) is subject to Northern Ireland law, which requires them to have a control plan, and to publish their results annually.

In practice all four delegate these powers and responsibilities to the Health and Safety Executive (HSE). HSE delivers the requirements of a combined Great Britain control plan and Northern Ireland control plan.

The Great Britain programme included all sampling as required by Great Britain law¹ plus a common programme of additional national testing. The Northern Ireland

¹ Commission Implementing Regulation (EU) 2019/533 as retained in Great Britain law
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included all sampling required by EU law² plus an additional programme of national testing.

Samples were collected from across the UK and analysed centrally. For example, all samples of apples went to one laboratory.

HSE regularly publish clear, understandable monitoring results on the government website, Pesticides Residues in Food at data.gov.uk, and aim to do this as quickly as possible without compromise of the integrity of the programme.

HSE work with the Expert Committee on Pesticide Residues in Food (PRiF), which was formed in 2011, to carry on the work of the Pesticide Residues Committee which ceased to operate in 2010.

The members are appointed by ministers from Defra, the Scottish Government, the Welsh Government and the Department of Agriculture, Environment and Rural Affairs for Northern Ireland.

They give advice on the monitoring programme to:

- ministers
- the Chief Executive of the Food Standards Agency (FSA)
- the Health and Safety Executive's Chemicals Regulation Division (HSE CRD)

They meet four times a year and representatives from government departments attend the meetings as officials. HSE provides the committee's administration.

Background on pesticide regulation

Pesticides can only be used in UK agriculture if they are used in line with the law and guidance controlling their use.

On behalf of UK agricultural departments, the Health and Safety Executive authorises and controls pesticides for use in the UK, sets maximum residue levels for food traded in the UK, and monitors pesticide residues in the UK food supply. Maximum residue levels are set for and apply to food available in the UK no matter where the food was produced. The Food Standards Agency has overall responsibility for food safety.

Most residues come from pesticides being used on crops. To work effectively, pesticides must be used in the correct amounts and at the right time. The amount of residue in or on a food is dependent on:

- how much pesticide was used
- when it was applied in relation to harvest date
- how it is metabolised by plants and animals

² Commission Implementing Regulation (EU) 2020/585 as amended by Commission Implementing Regulation (EU) 2020/2041

- how it breaks down in the environment

In addition to this, residues can sometimes be present due to contamination (small amounts of pesticide that remain in the environment after legitimate use). Due to significant technical improvements in laboratory analysis, we now have the capability to detect very low levels of residues. So, it is possible that, as methods become more sensitive, we may find more residues.

HSE publish the results, including brand names, where samples were obtained and where possible who produced them. The open reporting system has encouraged producers and retailers to be responsible about their use of pesticides in their supply chains

Maximum Residue Levels

Maximum residue levels are set in law at the highest level of pesticide that the relevant regulatory body would expect to find in that crop when it has been treated in line with Good Agricultural Practice (GAP). When MRLs are set, effects of the residue on human health are also considered. The MRLs are set at a level where consumption of food containing that residue should not cause harm to consumers.

If a food has a higher level of residue than the MRL, it does not automatically mean that the food is not safe to eat. A residue above the MRL may show that the farmer has not used the pesticide properly. Some pesticides may be permitted for use in the country of export but not be permitted for use in Great Britain and Northern Ireland, and so the MRL may be set at the lowest level that official laboratories can normally detect.

This is known as the limit of determination (LOD). An LOD MRL is indicated by an asterisk after the level (i.e. 0.01* mg/kg).

The Food Standards Agency

The main objective of the FSA is to protect public health from risks that may be associated with the consumption of food (including risks caused by the way in which it is produced or supplied) and otherwise to protect the interest of consumers in relation to food. The FSA attends PRiF meetings as an assessor and works closely with us, and with HSE, on pesticide residues issues.

The FSA has responsibility for border monitoring of pesticides in food coming into the UK from outside the EU. This is delegated by FSA to the Port Health Authorities. Enforcement activity is carried out under Regulation 2019/1793 (previously 669/2009), which stipulates commodities and exporting countries that have a particular concern and are subject to additional controls. Testing of imports at the border is separate to the HSE monitoring programme.

Food Standards Agency update on Ethylene Oxide identified in Sesame seeds

Since early October 2020, there has been an ongoing incident concerning the presence of ethylene oxide residues in sesame seeds from India. Ethylene oxide is

permitted as a fumigant in some countries but is not approved for use on food in the UK or EU due to concern over its genotoxic and carcinogenic properties. A default MRL at the limit of detection applies under pesticide regulations.

FSA understands that it was used in India to address tightened UK and EU import checks due to repeated findings of salmonella contamination in sesame seeds coming into the EU from India.

Approximately two thirds of all sesame seeds used in the UK come from India. Sesame seeds have a wide range of food uses, including sale for direct consumption, in concentrated products such as sesame oil and tahini, as an ingredient in sauces and other processed food products and (often at very low levels), in bakery products. Consequently, seeds with residues of ethylene oxide above the MRL were used in a wide range and significant quantity of foods.

Although ethylene oxide is a genotoxic carcinogen (a substance which has potential to cause damage to genetic material) with no defined safe level of exposure, FSA's risk assessment indicated that the risk to individual consumers is low. Whilst enforcement action could be taken by HSE on the basis of pesticide MRL exceedance, it was agreed between HSE and FSA that the incident would be handled as a food safety incident under General Food Law. This allowed FSA and Local Authorities to liaise with food businesses to identify and remove affected products from the food chain. Although no longer bound to follow, the UK tried to be generally consistent with the EU approach to incident response, not least because of the substantial volume of (two-way, EU-UK) trade of implicated products. At the same time, the approach has been pragmatic, allowing the continued sale of products in which the sesame content is low, as long as the food business was unaware of possible contamination at the time of manufacture. Food businesses have also been allowed to continue the sale of products on the basis of a negative analytical result.

The incident is still continuing, with further notifications of affected products and there have also been intermittent reports of ethylene oxide contamination of other commodities from India, such as ginger and turmeric. UK regulators and enforcement officers continue to monitor the situation and remain vigilant.

Monitoring programme design

Incidents like these are taken into account when planning the monitoring programme, therefore in 2021 sesame seeds had been collected as part of the edible seed survey and in 2022 additional testing is planned of other foods. The planning of the annual programme takes into consideration a number of relevant influencing factors including, previous sampling results, analysis, national diet trends and evidence from other regulators to the programme. As the programme is designed to be one of monitoring to determine compliance with legal levels of pesticide residues in food rather than to be a reactive one it is unlikely to change significantly throughout the year, but as mentioned above, incidents that arise are taken into consideration for the following years programme.

The 2021 monitoring programme

HSE test food to determine whether the levels of any pesticides found meet legal trading levels and if there is any risk to people's health.

Collecting and testing samples

The size of the sample and the number of individual units of a food within each sample is set down in regulation. For example, for apples the sample must be made up of at least 10 apples and weigh at least 1 kilogram.

HSE send samples to the following laboratories to be tested:

- Agri-Food and Bioscience Institute (AFBI) – Belfast
- Fera Science Ltd – York
- SASA – Edinburgh

Residues tested for

HSE test food for a large list of pesticides in the laboratories. Over the last 18 years the number of pesticides we test for has risen. The increase is consistent with the current capability of most laboratories which test food for pesticide residues.

The choice of pesticides tested for in a survey depends on:

- which pesticides have been found before
- what we know is being used to grow specific foods, (that is, which pesticides are approved for certain crops)
- what we know about pesticides used in the UK and other countries
- what we know about pesticides being found in tests in other countries
- the risk residues of that pesticide may present
- the maximum residues levels set in law

Why HSE chose certain foods

There is a wide range of foods available in the UK throughout the year. To make the most of resources and ensure we test a wide range of food, the programme changes from year to year.

When we choose the foods to test, we take account of many factors. Some foods are so common in our diets that even if previous testing showed few or no residues, it is right to carry on checking them. Although there have been no recent health concerns, we continue to monitor staples like milk and bread because of their role in the UK diet.

We group the foods into 5 categories:

- fruit and vegetables
- animal products
- starchy food and grains

- miscellaneous groceries
- infant food

Other foods are less commonly consumed but are important in the diet of some groups of people; speciality fruit and vegetables are a good example. So, we check these to protect those who consume these foods most frequently or in the greatest amount. Some foods that are not staples in our diets are still included most years because we regularly find residues in them that are not compliant with the MRLs.

HSE work with PRiF to consider new trends in diets, for example the increased interest in and broader range available of gluten free food or meat substitutes such as soy or tofu in recent years. We bear in mind different shopping habits in the sampling programme, to include buying from street markets, greengrocers, or supermarkets.

We also take account of monitoring data from other countries including information from the EU Rapid Alert System for Food and Feed (RASFF). The RASFF system is used to share notifications of foods which could be a risk to human health.

40 foods of dietary importance are collected over a three-year period as part of a multi-annual control programme established in legislation. In 2021, aubergine, banana, beef, broccoli, eggs, grapes, infant food (cereal based), melon, mushrooms, olive oil, peppers and wheat formed part of this larger survey. The same foods were tested in Northern Ireland as part of a similar EU-wide programme.

Each year we publish our proposed list of foods to be sampled. In 2017 HSE developed, in conjunction with the PRiF, a monitoring matrix ranking tool which helps determine the priority of the relative surveys. This provides a more objective approach: [PRiF Residues in Food Minutes and Papers](#)

HSE publish detailed results from the programme every 3 months on gov.uk and data.gov.uk.

The reports are published in two parts. The first is the Quarterly Summary report which details the findings, risk assessments that were carried out and any comments from the committee. This part of the report is published on GOV.UK: [Pesticide Residues in Food results Quarterly Reports](#)

The other part of the report provides all the sample details, such as brand name information, what was detected in each sample, and what residues were sought and not found in each survey. This part of the report is published in an accessible format at: [Pesticide Residues in Food Data](#)

Report	Sample Collection	Report Published
Quarter 1 2021	January to March 2021	September 2021
Quarter 2 2021	Up to June 2021	December 2021
Quarter 3 2021	Up to September 2021	March 2022
Quarter 4 2021	Up to December 2021	July 2022

All the results for samples collected in 2021 are available for download at [Pesticide Residues in Food Data](#)

The information published includes:

- where and when samples were collected
- country of origin, as shown on labelling at the point of sampling
- brand names, if available
- pesticides detected and if so whether the residues were above the MRL
- reporting level for all pesticides tested for including those sought but not found

The advice of the PRiF was sought on the results obtained each quarter. Their detailed reports are available at [Pesticide Residues in Food results Quarterly Reports](#)

Part 1: Summary UK results

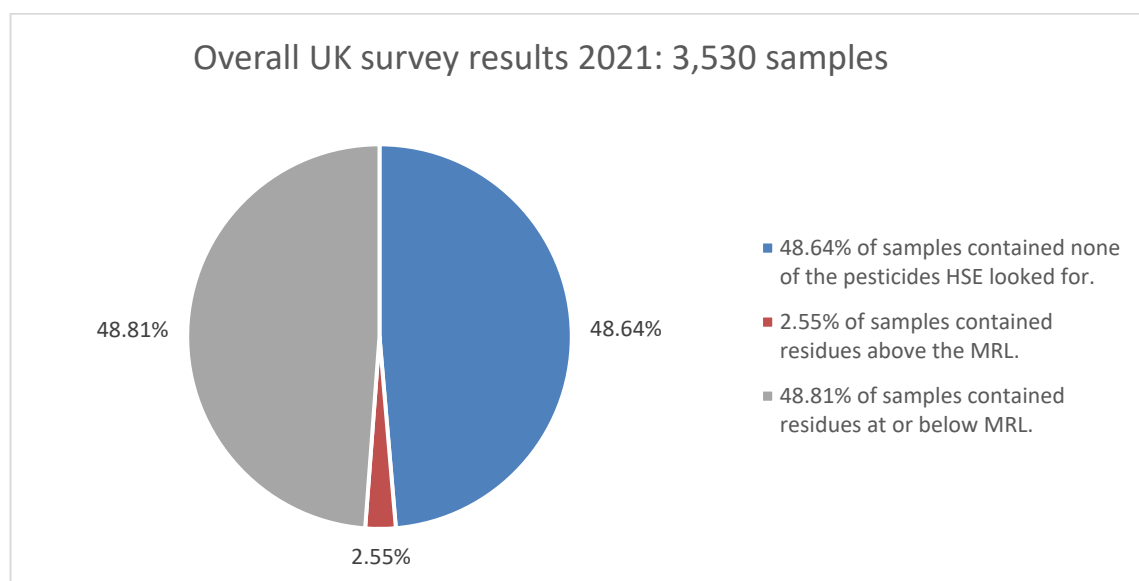
Summary of the results for UK (Great Britain and Northern Ireland Combined)

The programme tested 3,530 samples each for an appropriate range of pesticides. In total we tested around 913,000 food and pesticide combinations. For Great Britain and Northern Ireland combined, HSE surveyed 29 different commodities, collected 3,530 samples, and carried out 41 detailed risk assessments in 2021.

There were some differences in the foods surveyed between Great Britain and Northern Ireland. Fish was only surveyed in Northern Ireland. Edible seeds, nuts, peppers (processed), plant-based protein and soya-based drinks were only surveyed in Great Britain.

UK Survey results

- 1,717 samples (48.64%) contained none of the pesticides HSE looked for
- 1,723 samples (48.81%) had residues found at or below the MRL
- 90 Samples (2.55%) had residues above the MRL



All of the samples in which a residue was detected were checked for risk to consumers by means of a risk assessment screening mechanism. In the PRiF quarterly reports of 2021 we published results of 41 detailed short-term risk assessments where we wanted to consider in more detail whether there was a concern for human health. Northern Ireland and Great Britain results are assessed together for risk so these assessments cover samples from both surveys.

HSE refer information about food samples to the FSA where, following risk assessment, we have concerns about the potential risk to health of people eating these foods.

As part of procedures HSE refer samples of UK produce to HSE's enforcement team if they contain residues of pesticides not authorised for use in the UK on those crops. Where HSE could not identify an obvious reason for the residues, they investigated with the grower or supplier to determine how these residues could have arisen.

The monitoring programme is risk-based – it looks at those foods in which we expect to find residues. Because of this, we cannot say that the results represent the UK food supply as a whole.

Foods being sampled in 2022

- Apples (eating and cooking)
- Apricots
- Avocado (Great Britain only)
- Barley products
- Beans with pods
- Bread (gluten free)
- Bread (ordinary)
- Brussel sprouts
- Cabbage
- Cherries
- Cucumber
- Fish (sea)
- Game (Northern Ireland only)
- Grapes
- Infant food (fruit and vegetable)
- Lettuce
- Milk
- Oat products
- Pasta (Great Britain only)
- Peaches and nectarines
- Pork
- Potatoes
- Spices (chilli, cayenne and curry powder) (Great Britain only)
- Spinach
- Strawberries
- Sundried tomatoes (Great Britain only)
- Tomatoes
- Wine

Sampling locations

Each year, samples are collected from different places throughout the UK (Great Britain and Northern Ireland). At least two towns or cities are chosen from each government region. In 2021, we collected over 3,014 samples from retail outlets in towns or cities in the UK. Government inspectors collected 516 samples from places such as wholesalers, ports, supermarket distribution depots and processor factories. This allows samples to be collected from non-retail sources making the surveys more representative of the food chain.

2021 Survey Towns and Cities

Northern Ireland

- Ballycastle
- Ballymoney
- Belfast
- Coleraine
- Derry
- Newry

Scotland

- Aberdeen
- Edinburgh

England

- Brighton
- Bury St Edmunds
- Dagenham
- Gateshead
- Ipswich
- Maidstone
- Manchester
- Mansfield
- Nottingham
- Sheffield
- Stockton on Tees
- Stoke on Trent
- Stratford
- Swindon
- Tamworth
- Wirral
- York

Wales

- Cardiff
- Swansea

Foods tested in 2021

As some foods are available at different times throughout the year from different parts of the world, we may collect samples of these foods over 3, 6, 9 or 12 months. We sometimes report results of tests every 6 months rather than every 3 months. We do this when there are only a small number of samples in a survey or when we do not expect there to be many residues of interest in the results because analysing larger batches of samples is more economical.

We publish detailed results from the programme every three months. Reports for 2021 are available at: [Pesticide Residues in Food results Quarterly Reports](#)

Quarter 1 2021	Quarter 2 2021	Quarter 3 2021	Quarter 4 2021
Aubergine	Asparagus	Aubergine	Asparagus
Banana	Aubergine	Banana	Aubergine
Beans with pods	Banana	Beans with pods	Banana
Beef	Beans with pods	Beef	Beans with pods
Berries & small fruit	Beef	Berries & small fruits	Beef
Broccoli	Berries & small fruits	Bread	Berries & small fruits
Cheese (soft)	Broccoli	Broccoli	Bread
Eggs	Cheese (soft)	Cheese (soft)	Broccoli
Fish (white)	Eggs	Edible seeds	Cheese (soft)
Grapes	Fish (white)	Eggs	Eggs
Melon	Grapefruit	Fish (white)	Fish (white)
Milk	Grapes	Grapefruit	Grapefruit
Mushrooms	Melon	Grapes	Grapes
Peppers	Milk	Infant food (cereal)	Melon
Potatoes	Mushrooms	Melon	Milk
Raspberries	Olive Oil	Milk	Mushrooms
Rice	Peppers	Mushrooms	Nuts
	Potatoes	Olive oil	Olive oil
	Raspberries	Peppers	Peppers
	Spring greens & kale	Plant based protein	Peppers (processed)
	Wheat	Potatoes	Potatoes
		Raspberries	Raspberries
		Rice	Spring greens & kale
		Soya based drinks	Wheat
		Spring greens & kale	

Analysis of Risks to UK consumer health

Consumer Risk Assessment

HSE conducts a screening assessment of all the residues we find in the pesticide residues in food monitoring programme. If screening identifies any dietary intakes exceeding the relevant health-based reference values, then we conduct more detailed risk assessments, to consider whether there are any implications for health. Detailed risk assessments, where needed, are presented in the quarterly reports. If we understand that a pesticide residue has a risk of genotoxicity we will include this in the commentary.

Pesticide dietary intakes are assessed using models that combine data on the levels of residues in food with food dietary consumption values. If intakes are within the health-based reference values, then taking account of the precautions built into the model assessments we conclude that an effect on health is not anticipated. If dietary intakes exceed the reference values this does not automatically mean there are expected adverse health effects. However, this acts as a 'trigger' for HSE to consider these cases more thoroughly.

HSE conducts both short-term (acute) and long-term (chronic) assessments based on the residues found in the pesticide residues in food monitoring programme surveys. Each of these is tailored accordingly. Further information on the nature of HSE's assessments and approach is provided in the bullet points below. More detail, with reference to international assessment contexts, is available in the quarterly reports and on [HSE's website](#)

- For acute assessment, we use short-term estimation values that use the highest residue found in a commodity and short-term consumption values for calculating short-term dietary intakes. These are then compared to the ARfD, a suitable health-based reference value for effects that could be caused by a single day or one-off consumption of a higher than usual residue. For acute assessment we consider the variation in residues that could occur within a residue sample, and a variability (multiplication) factor is included for that purpose, in order to address exposure to a higher than usual residue in a single item, such as a single apple or potato.
- For chronic assessment, we use long-term estimation values (based on median residues and long-term consumption values for calculating long-term dietary intakes) for each commodity survey and compare to the ADI, a suitable health-based reference value for life-time. The issue is more fully considered in regulatory contexts pre-authorisation and at the time of MRL review. Then the issue is considered across all commodities (so more precautionary) by pesticide levels determined in GAP compliant trials, intended to address highest likely residues that might arise following pesticide use according to label recommendations.

- For fruit and vegetables that have peel or skin that might not be consumed we present alternative risk assessments for 'without peel -flesh only' where peel versus pulp residue distribution data is available. As standard, we present a 'worst case' assessment for when all of the peel is consumed with the fruit.
- We calculate dietary intakes for different consumer groups, from infants, toddlers and children of varying age, to adults, elderly, and vegetarians, to take account of people with low bodyweights and varying dietary habits. As such the assessments we perform are protective for all consumers.
- For multiple residues, we consider the possible implications to health of more than one pesticide being found in samples (sometimes called the 'cocktail effect'). We currently focus in detail on selected groups that we think are a priority to consider based on toxicity considerations and prevalence.

Action taken

FSA were aware of all findings and risk assessments. For foods labelled as UK and with residues over the MRL, or with brand-owners based in the UK, the producers were contacted.

For foods labelled as or established as produced overseas with residues over the MRL full details were forwarded to the FSA to consider forwarding via the INFOSAN network operated by the World Health Organisation. This would enable future preventative actions.

For a few pesticides we cannot exclude genotoxic potential. These pesticides are not authorised for use in the UK or EU, and the evaluator (EFSA in all we have examined in 2021) considered it was not possible to exclude this risk nor to set safety levels. It is unlikely a pesticide company or an organisation representing users would find it economical to provide a modern data package for older pesticides, particularly when not authorised in Great Britain or the EU. But HSE cannot set higher MRLs or enable the risk assessment to be completed. without that information. Therefore, the issue of the approach to residues needs to be resolved via the pesticide or residues review process.

In the meantime, HSE has ensured that a lower than normal detection limit is used for these pesticides, to give a broader picture of incidence and inform future considerations.

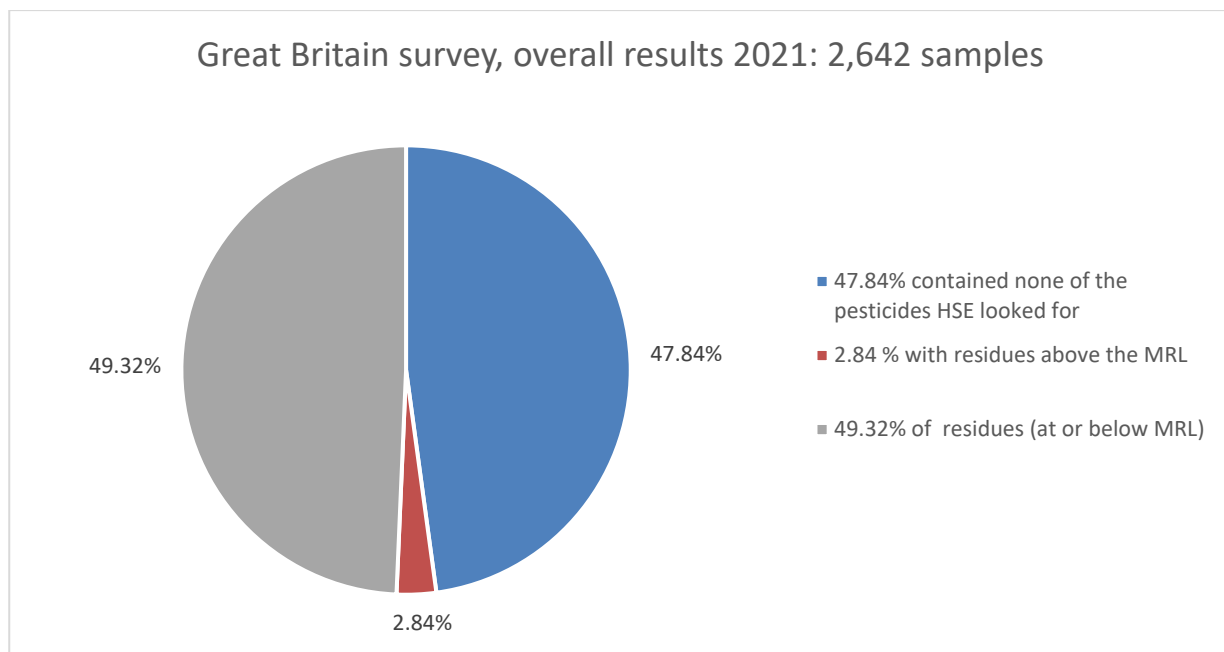
Part 2: Results from the Great Britain 2021 Programme:

Overall results

In 2021, HSE tested 2,642 samples from 28 different food surveys sampled in 27 towns and analysed for up to 397 different pesticides.

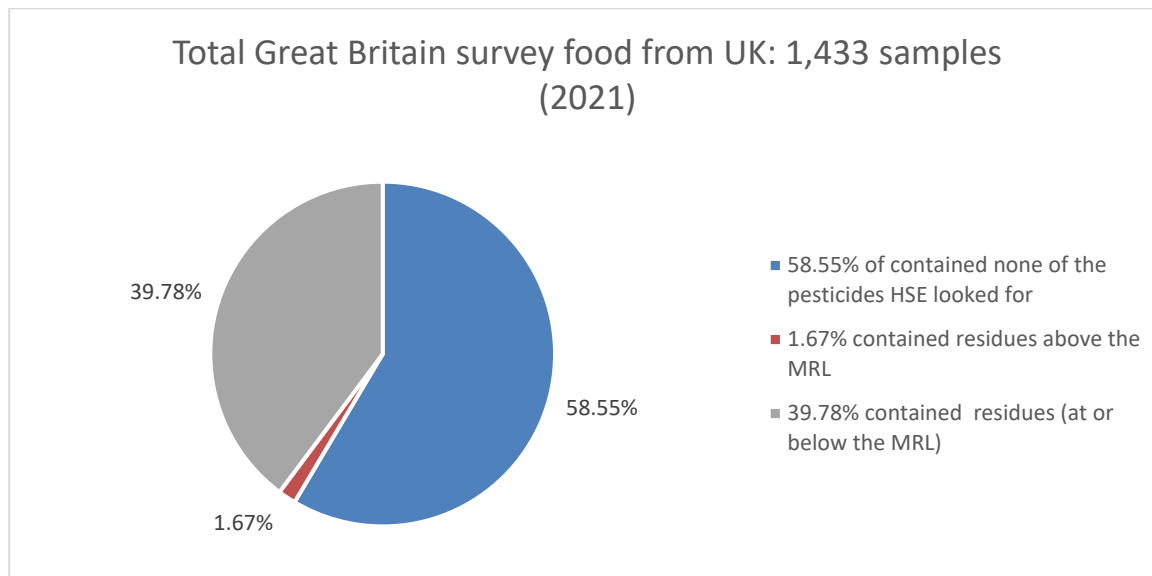
Great Britain Survey results:

- 1,264 samples (47.84%) contained none of the pesticides HSE looked for
- 1,303 samples (49.32%) had residues at or below the MRL
- 75 samples (2.84%) had residues over the MRL



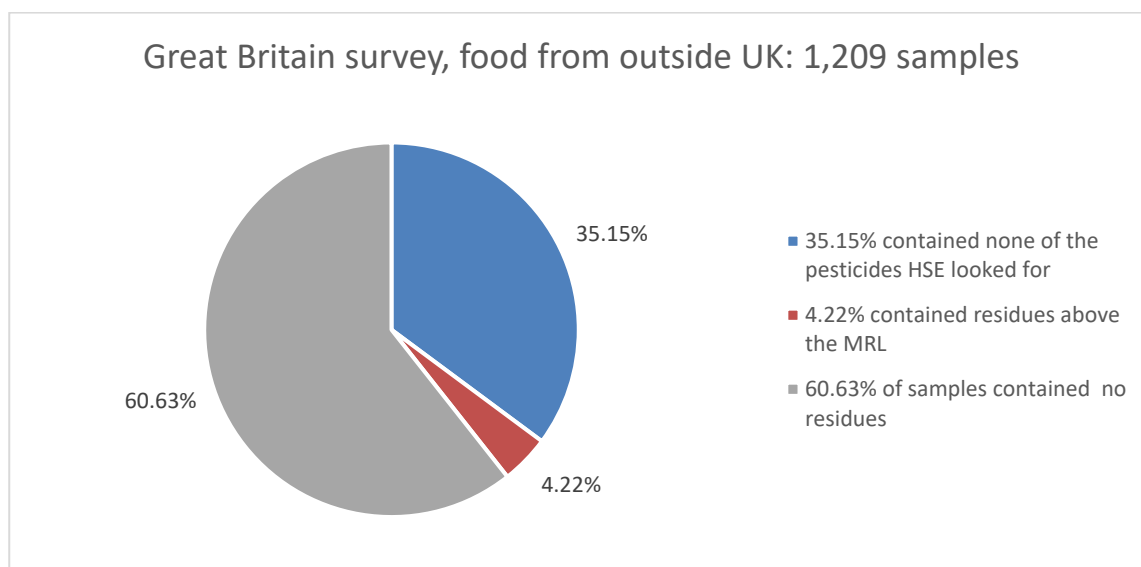
Food sampled from Great Britain, UK origin

- 839 samples (58.55%) contained none of the pesticides HSE looked for
- 570 samples (39.78%) had residues found at or below the MRL
- 24 samples (1.67%) had residues above the MRL



Food sampled from Great Britain, non-UK origin

- 425 samples (35.15%) contained none of the pesticides HSE looked for
- 733 samples (60.63%) had residues found at or below the MRL
- 51 Samples (4.22%) had residues above the MRL



Great Britain Fruit and Vegetable Results

For the Great Britain survey, the HSE Monitoring programme collected 1,405 samples of fruit and vegetables and tested for up to 396 pesticides.

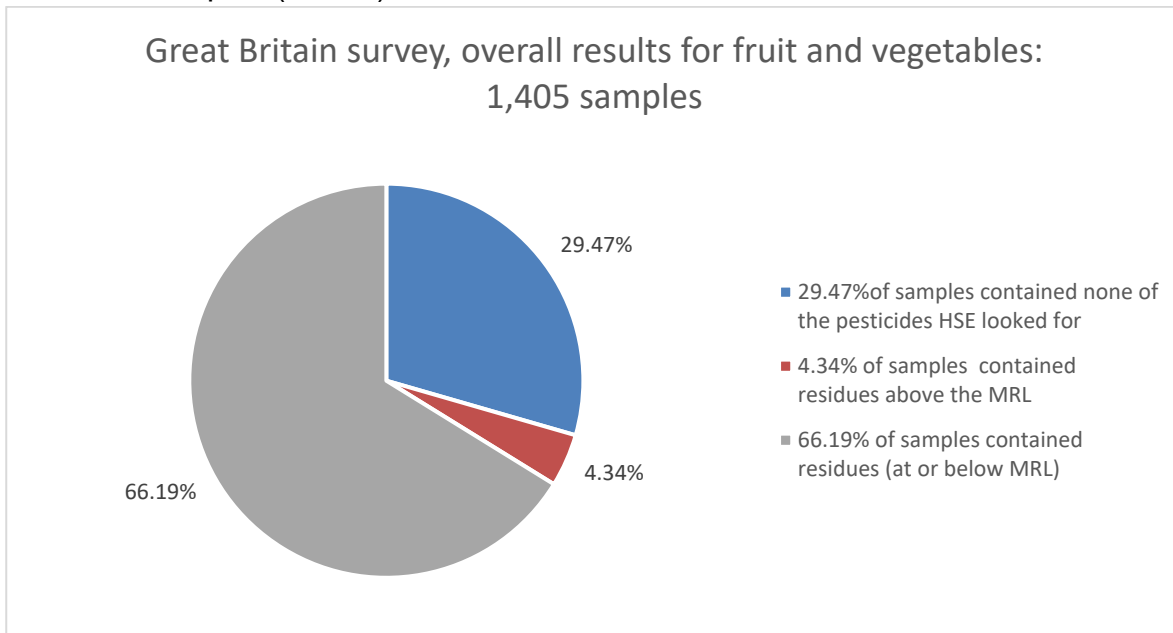
HSE found 16 samples with residues above the MRL in the survey of beans with pods where we have continued to find higher numbers of exceedances. HSE also found 9 MRL exceedances in surveys of berries and small fruits and 8 in grapefruit.

In 2021 an emergency authorisation was authorised under Article 53 of Regulation 1107/2009 for 'Exirel 10SE' containing cyantraniliprole for use on blackberries and raspberries in England and Scotland. Produce treated in line with the emergency authorisation could be traded if residues of cyantraniliprole were detected within the previous temporary MRL (0.9 mg/kg) that was initially established for residues arising from the use of the emergency authorisation. Therefore, HSE applied this higher MRL to results when growers could show evidence of application of the product in line with the terms of the emergency authorisation.

In 2021 HSE found no residues above the MRL in samples of grapes or potatoes.

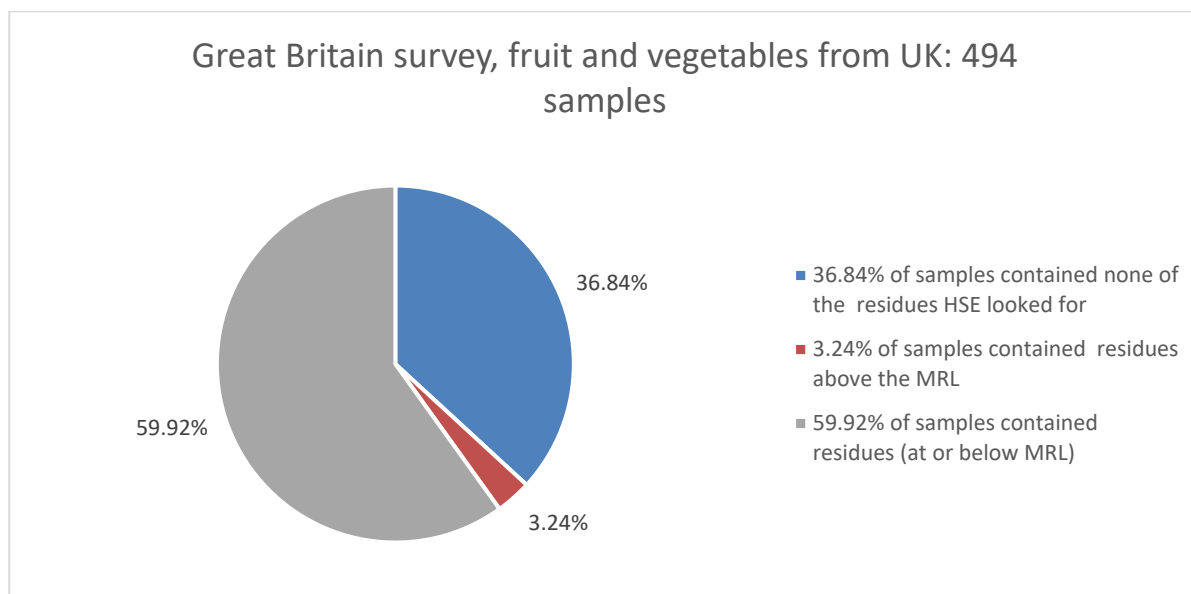
Great Britain Fruit and vegetable results

- 414 samples (29.47%) contained none of the pesticides HSE looked for.
- 930 samples (66.19%) had residues found at or below the MRL.
- 61 samples (4.34%) had residues above the MRL



Fruit and Vegetables from the UK

- 182 samples (36.84%) contained none of the pesticides HSE looked for
- 296 samples (59.92%) had residues found at or below the MRL
- 16 samples (3.24%) had residues above the MRL



Fruit and vegetables results by food type

Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Asparagus	48	2	3	1
Aubergine	97	65	6	33
Banana	96	68	7	69
Beans with pods	96	49	16	42
Berries and small fruits	97	70	9	59
Broccoli	97	52	1	24
Grapefruit	96	88	8	96
Grapes	108	106	0	102
Melon	120	84	2	54
Mushrooms	97	40	2	18
Peppers	96	75	1	52
Potatoes	141	82	0	17
Raspberry	120	88	3	68
Spring greens and kale	96	61	3	44

Great Britain Starchy Food and Grain Results

For the Great Britain survey, the HSE monitoring programme collected 348 samples of starchy food and grains in 2021.

The Great Britain programme collected and analysed bread, rice, and wheat.

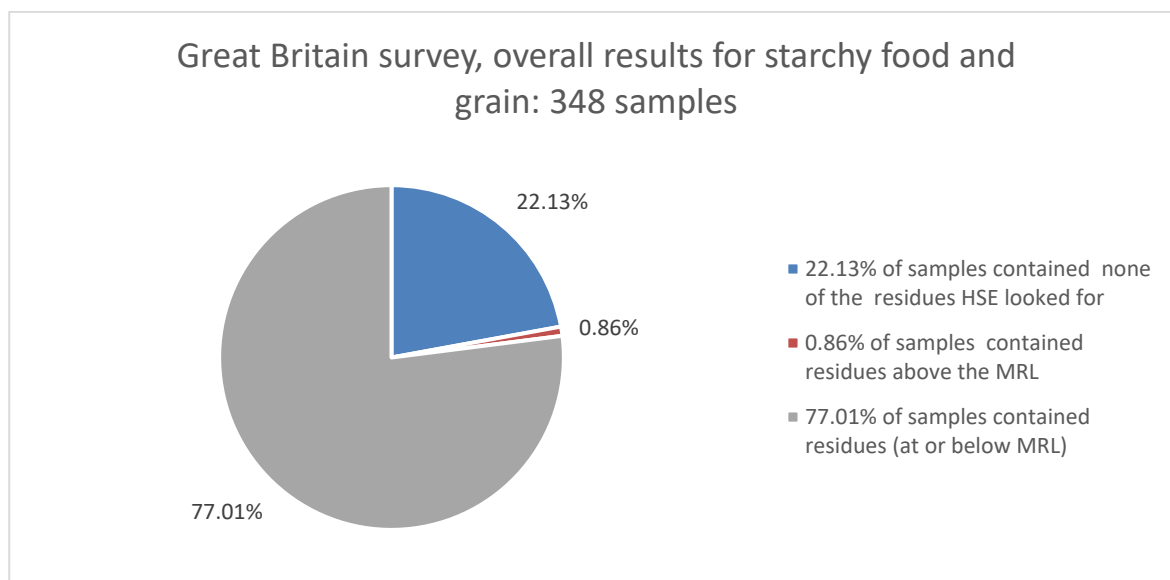
HSE found residues above the MRL in 2 samples of basmati rice containing tricyclazole, the MRL for tricyclazole was lowered in 2017. Rice growers were given time to comply with the current MRL to take account of the long shelf life of basmati rice. The number of tricyclazole exceedances found in HSE surveys of rice has fallen in 2021.

1 sample of speciality bread was identified with a residue of BAC (benzalkonium chloride) above the MRL.

Glyphosate was sought in all 288 samples of wheat and bread in the Great Britain surveys, 87 samples contained residues of glyphosate, but all the residues were found to be below the MRL.

Great Britain Survey results starchy foods and grain

- 77 samples (22.13%) contained none of the pesticides HSE looked for
- 268 samples (77.01%) had residues found at or below the MRL
- 3 samples (0.86%) had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Bread	216	185	1	106
Rice	60	30	2	20

Wheat	72	53	0	23
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Applying processing factors to find MRLs for bread (and other processed foods)

MRLs apply to all traded foods, including foods used as ingredients. The law specifies the level applied to foods as they are traded. For almost all foods that means their raw, unprocessed form. But MRLs also apply to prepared and processed foods in which case the effect of processing needs to be taken into account.

To check that prepared and processed foods were made with ingredients that complied with MRLs, we use appropriate processing factors, based on scientific studies of the effect of preparation and processing. Different forms of processing remove, concentrate or dilute residues and the effect may also vary depending on the food and pesticide concerned.

The use of processing factors enables checks that the original ingredient was compliant with MRLs. Food manufacturers should have information on how they check their ingredients and on their recipes and preparation techniques – for instance, how much water is added or removed, or how much of an ingredient is used to make a food. We always contact them when there is possible non-compliance so that they can share their own information about processing factors

Great Britain Animal products results

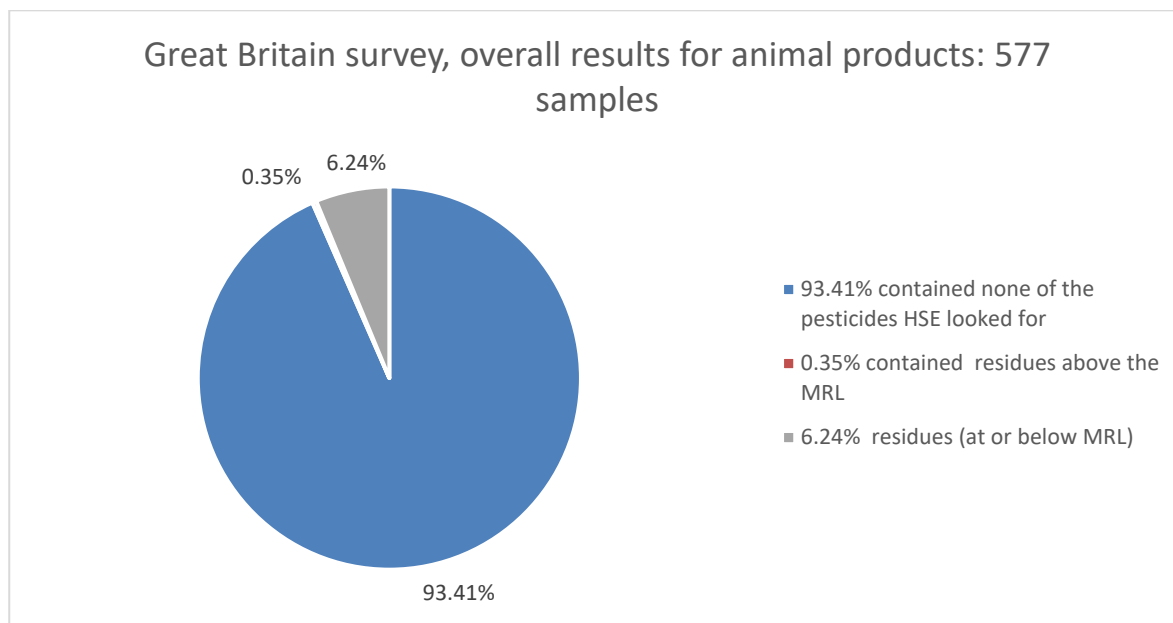
For the Great Britain survey, the HSE monitoring programme collected 577 samples of animal products in 2021.

The Great Britain programme collected and analysed beef, cheese, eggs, and milk.

HSE found 2 residues of chlorate above the MRL in samples of cheese (soft) where information was not supplied to determine if the chlorate footnote (see page 27) applied. In two other samples there was evidence that the chlorate residue arose from using chlorinated water or disinfection processes where chlorate was used.

Great Britain survey results animal products

- 539 samples (93.41%) contained none of the pesticides HSE looked for
- 36 samples (6.24%) had residues found at or below the MRL
- 2 samples (0.35%) had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Beef	84	0	0	0
Cheese (soft)	96	35	2	1
Eggs	96	1	0	0
Milk	301	0	0	0

DDT

This year we found DDT in one sample of cheese and one sample of eggs. The levels we found would not be expected to have an effect on health, and overall are consistent with the continued decline of this pesticide in the environment.

The use of DDT is banned in the UK and banned or heavily restricted in many countries worldwide. It isn't allowed for use on food crops anymore, but it is still used in some countries outside Europe 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 UK, 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 break down, 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.

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.

For residues found in fish in 2021, we can tell from the chemical form detected by the laboratories whether the residues are from historic use (which is what we usually find). PRiF explain this every time DDT detections are published to try to make it as clear as they 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.

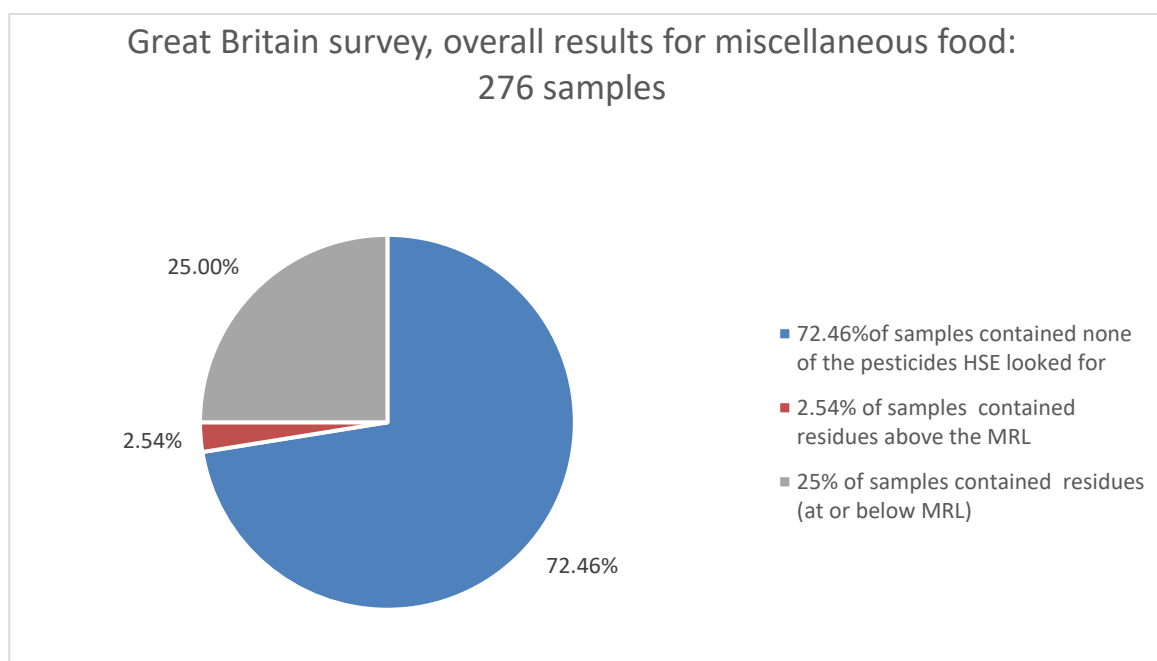
Great Britain Miscellaneous Foods Results

For the Great Britain survey, the HSE monitoring programme collected 276 samples of miscellaneous foods in 2021.

The Great Britain programme collected and analysed edible seeds, nuts, olive oil, processed peppers, plant-based protein and soya-based drinks.

Great Britain survey results miscellaneous foods

- 200 samples (72.46%) contained none of the pesticides HSE looked for
- 69 samples (25.00%) had residues found at or below the MRL
- 7 samples (2.54%) had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Edible seeds	48	11	0	1
Nuts	48	16	3	0
Olive oil	85	28	0	9
Peppers (processed)	24	10	2	9
Plant based protein	36	4	2	0
Soya based drinks	35	0	0	0

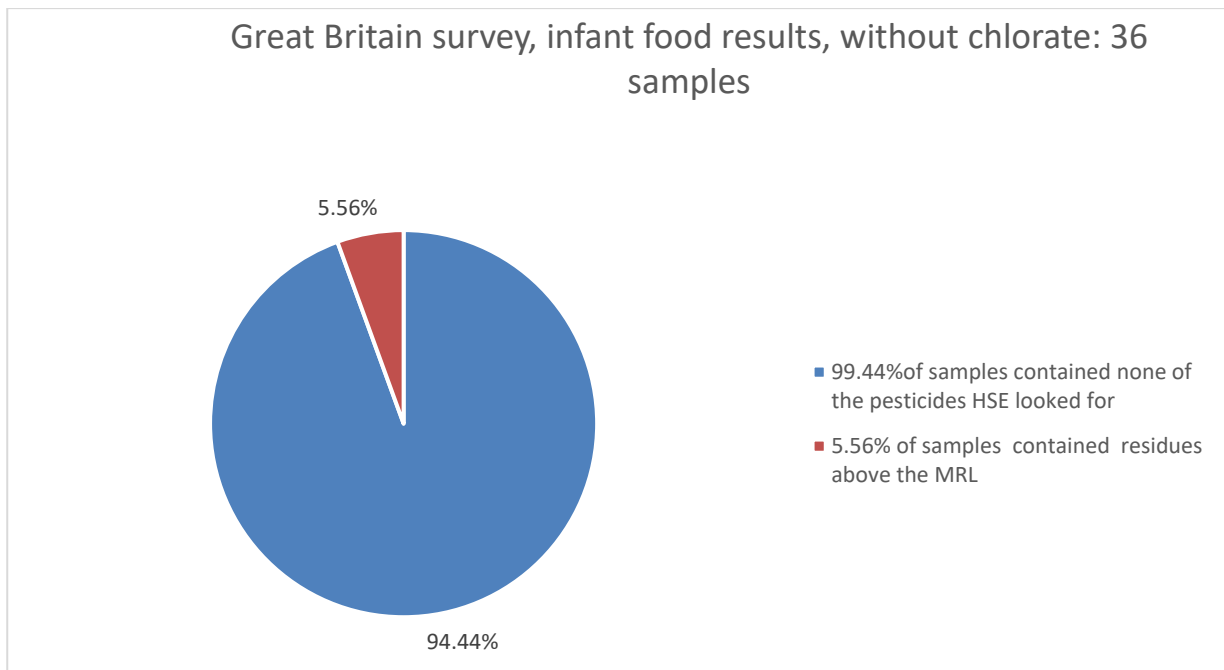
Great Britain Infant Food Results

For the Great Britain survey, the HSE monitoring programme collected 36 samples of infant food in 2021.

Infant food and infant formula (baby milk) have their own MRLs which are set separately. Health departments are responsible for this legislation. However, these foods have been included in the UK's national monitoring programme alongside other foods for many years and as part of the multi-annual control plan.

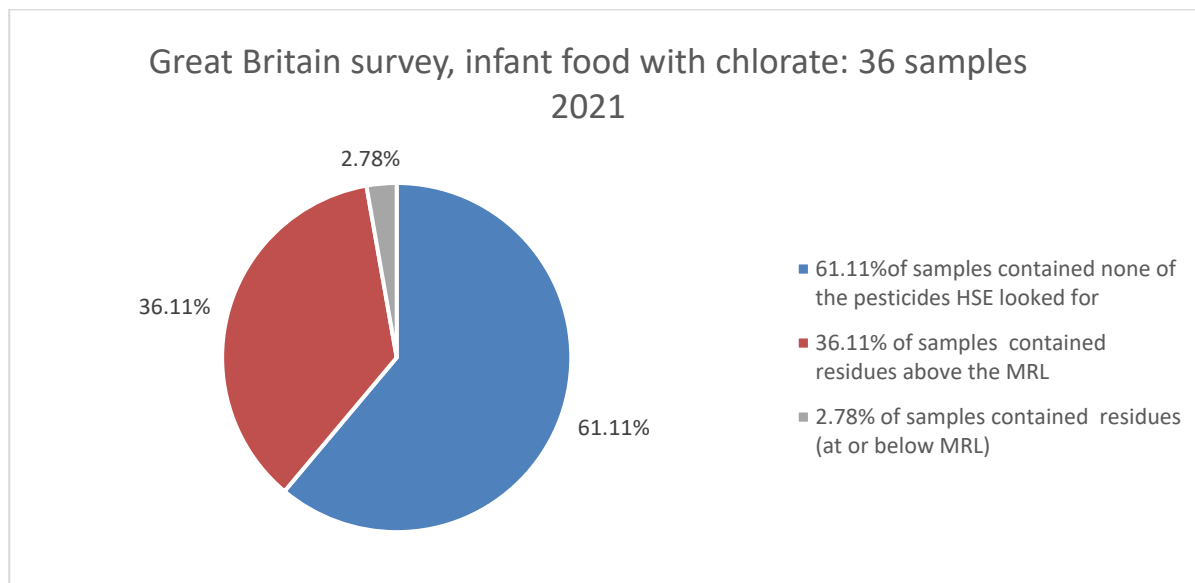
Great Britain survey results infant food

- 34 samples (94.44%) contained none of the pesticides HSE looked for
- none had residues found at or below the MRL
- 2 samples of infant food also had residues above the MRL these were diphenylamine and fosetyl (sum)



When the chlorate exceedances are included in the numbers:

- 22 samples (61.11%) contained none of the pesticides HSE looked for
- 1 sample (2.78%) had a residue found at or below the MRL
- 13 samples (36.11%) had residues above the MRL



We are not advising that food companies change their existing practices as a result of these findings.

Companies are aware of the new MRLs that came into force for many foods in June 2020. HSE continues to work with companies to ensure compliance and safety in this area.

Biocides are important tools for maintaining microbiological food safety and any changes in practice to comply with current pesticide MRLs need to be carefully considered to ensure food safety is not compromised.

The pesticide sodium chlorate is a residual broad action weed killer that is not authorised for use in the UK or EU. However, we are confident that the residues we are detecting come from use of chlorine-based disinfectants used to maintain microbiological safety (to control microorganisms that cause food poisoning), either at food processing premises, or at public water works (chlorination) and not from use of pesticides used on plants. We are grateful for the information supplied by food producers and suppliers on this topic and, in particular, in response to our findings.

MRLs for most foods are set in a way that means HSE can take account of these uses. However, baby food legislation for which Health Departments are responsible does not do so in the same way. The PRiF included information on how this issue is being considered in their 2021 Annual report

Residues over the MRL

All the Great Britain 2021 samples with residues over the MRL are listed in the Residues over the MRL table on page 28

In each case HSE has written to the brand owner or the sampling point, asking for comments on how the residue occurred. We provide advice on how to prevent recurrence, including technical advice to assist in identifying the source of the residue where necessary. We offer the opportunity for brand owners or suppliers to range additional testing. All the information obtained is reviewed by the PRiF Committee before the results are published.

It is not possible to identify with absolute certainty the source or reason for every individual residue above the MRL. However, with the assistance of the PRiF Committee and the cooperation of growers and brand owners we can identify some groups of results for which we think it is reasonable to reach a conclusions on both reasons for the breaches and some risk management decisions.

Chlorate

MRLs for chlorate recognise the crucial role of chlorate-related compounds as biocides in water treatment and food hygiene. For most foods where residues are unavoidably incurred by such uses a footnote in the legislation allows HSE to waive the MRL, provided the producer supplies evidence that this is the case. In the cases identified as MRL breaches in this section no such evidence was supplied.

Infant food and chlorate

Foods for infants, including infant formula, is covered by separate legislation to other foods.

For infant food a default MRL of 0.01 mg/kg applies for most pesticides including chlorate. Unlike with other foods, for infant foods there is no mechanism to take account of chlorate residues incurred from non-pesticide sources.

We have evidence indicating that chlorate breaches were due to use of mains drinking water or other potable water. Great Britain health departments lead on infant food legislation. Risk management action is for them. They are working on clarifying the legislation for chlorate. HSE and FSA are providing provides technical support and information.

Beans with pods and LOD MRLs

Residues above the MRL do not necessarily mean the grower did not follow Good Agricultural Practice. A number of the MRLs have an asterisk (*) next to them, which means that the MRL is set at the limit of determination (the lowest level that can normally be detected by official laboratories).

This often means the pesticide has no authorised uses in the UK (or previously EU) on those crops. We cannot identify whether particular pesticides are authorised in other

countries and so whether a residue is applied legally there. Provided the food meet the MRL requirements, it is legal to trade.

Anyone can apply for a higher MRL be set by HSE for trade in Great Britain. However, this needs to be supported with sufficient data/evidence for HSE to assess the suitability of the proposed MRL. This process may not be cost-effective for some producers.

Residues over the MRL

Asparagus (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
3260/2021	Fine Asparagus	Mexico	flonicamid (sum)	0.07	0.03*	Yes
3531/2021	Asparagus	Peru	methomyl	0.02	0.01*	No
3615/2021	Asparagus	Mexico	flonicamid (sum)	0.2	0.03*	Yes

Aubergine (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0093/2021	Aubergine	The Netherlands	chlorate	1.6	0.4	Yes
2175/2021	Aubergine	Spain	chlorate	0.7	0.4	No
3916/2021	Baby Egg plant	Uganda	profenofos	0.2	0.01*	Yes
3541/2021	Aubergine	UK	chlorate	0.6	0.4	No
2677/2021	Aubergine	UK	flonicamid (sum)	1	0.5	No
4256/2021	Baby Aubergine	Kenya	profenofos	0.02	0.01*	No

Banana (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
3576/2021	Banana (eating)	Ecuador	imazalil	0.6	0.01*	Yes
3599/2021	Plantain	Colombia	buprofezin	0.04	0.01*	Yes
1032/2021	Banana (eating)	Ecuador	Fosetyl (sum)	2.1	2*	No
4024/2021	Banana (eating)	Ecuador	imazalil	0.2	0.01*	Yes
4054/2021	Plantain	Ecuador	imazalil	0.4	0.01*	Yes
4248/2021	Banana (eating)	Ecuador	chlorpyrifos	0.03	0.01*	Yes
4171/2021	Plantain	Guatemala	chlorpyrifos	0.05	0.01*	Yes

Beans with pods (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
3504/2021	Speciality Beans	Kenya	bupirimate	0.08	0.05*	No
3505/2021	Speciality Beans	India	dimethoate	0.04	0.01*	Yes
			omethoate	0.1	0.01*	Yes
			profenofos	0.02	0.01*	Yes
3810/2021	Speciality Beans	India	diafenthiuron	1.1	0.01	Yes
3829/2021	Speciality Beans	India	profenofos	0.05	0.01*	Yes
3830/2021	Speciality Beans	India	hexaconazole	0.02	0.01*	No
3832/2021	Speciality Beans	India	hexaconazole	0.03	0.01*	Yes
3869/2021	Speciality Beans	Pakistan	profenofos	0.7	0.01*	Yes
3872/2021	Speciality Beans	Pakistan	profenofos	0.03	0.01*	Yes
3732/2021	Speciality Beans	Mexico	bifenthrin	0.1	0.01*	Yes
			dithiocarbamates	1.6	1	No
			sulfoxaflor	0.05	0.01*	Yes
4001/2021	Speciality Beans	Spain	dithiocarbamates	1.2	1	No
4188/2021	Speciality Beans	India	hexaconazole	0.03	0.01*	Yes
3995/2021	Speciality Beans	India	chlorpyrifos	0.03	0.01*	Yes
4193/2021	Speciality Beans	India	dimethoate	0.4	0.01*	Yes
			hexaconazole	0.2	0.01*	Yes
			omethoate	0.2	0.01*	Yes
			profenofos	0.3	0.01*	Yes
4238/2021	Speciality Beans	India	profenofos	0.04	0.01*	Yes
4259/2021	Speciality Beans	India	captan (sum)	0.8	0.03*	Yes
			dimethoate	0.02	0.01*	No
			hexaconazole	0.08	0.01*	Yes
			omethoate	0.1	0.01*	Yes
4299/2021	Speciality Beans	India	dinotefuran	0.02	0.01	No

Berries and small fruits (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
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3924/2021	Fresh: Blackberries	Mexico	thiamethoxam	0.02	0.01*	Yes
0299/2021	Frozen: Blackberries	Serbia	dithiocarbamates	0.1	0.05*	Yes
2836/2021	Frozen: Blackberries	Serbia	dithiocarbamates	0.1	0.05*	Yes
3139/2021	Frozen: Blackberries	UK	dithiocarbamates	0.2	0.05*	Yes
0623/2021	Fresh: Blackberries	UK	cyantraniliprole	0.04	0.01*	Yes
5533/2021	Fresh: Blackberries	UK	cyantraniliprole	0.03	0.01*	Yes
5914/2021	Fresh: Blackberries	UK	cyantraniliprole	0.04	0.01*	Yes
0709/2021	Frozen: Blackberries	UK	flonicamid (sum)	0.06	0.03*	No

Bread (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0777/2021	Speciality Bread: Scones	UK	BAC (sum)	0.4	0.1	Yes

Broccoli (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0050/2021	Fresh	Kenya	chlorpyrifos	0.06	0.01*	Yes
			dimethoate	0.04	0.02	No

Cheese (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0851/2021	Mozzarella	Italy	chlorate	0.6	0.1	Yes
5502/2021	Mozzarella	Italy	chlorate	0.3	0.1	Yes

Grapefruit (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
3511/2021	Star Ruby Grapefruit	Turkey	chlorpyrifos-methyl	0.04	0.01*	Yes

			prochloraz (sum)	0.1	0.03*	Yes
3517/2021	Pink Grapefruit	Turkey	chlorpyrifos	0.02	0.01*	No
			pirimiphos-methyl	0.04	0.01*	Yes
3553/2021	Rio Red Grapefruit	Turkey	chlorpyrifos-methyl	0.08	0.01*	Yes
3569/2021	Grapefruit	Morocco	chlorpyrifos	0.1	0.01*	Yes
3893/2021	Red Grapefruit	Turkey	chlorpyrifos-methyl	0.07	0.01*	Yes
			fenbutatin oxide	0.4	0.01*	Yes
3925/2021	Star Ruby Grapefruit	Cyprus	imazalil	4.4	4	No
3061/2021	Ruby Red Pink Grapefruit	South Africa	imazalil	4.3	4	No
3742/2021	Grapefruit	South Africa	glufosinate (sum)	0.09	0.05	No

Infant food (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0955/2021	Rusks	UK	chlorate	0.02	0.01*	No
0980/2021	Creamed Porridge	EU	chlorate	0.5	0.01*	Yes
1411/2021	Rusks	UK	chlorate	0.02	0.01*	No
1778/2021	Rusks	UK	chlorate	0.02	0.01*	Yes
			diphenylamine	0.02	0.01*	Yes
1954/2021	Rusks	UK	chlorate	0.02	0.01*	Yes
2335/2021	Rusks	UK	chlorate	0.02	0.01*	No
2790/2021	Rusks	UK	chlorate	0.02	0.01*	No
2873/2021	Rusks	UK	chlorate	0.02	0.01*	No
2984/2021	Rusks	UK	chlorate	0.02	0.01*	Yes
3147/2021	Rusks	UK	chlorate	0.03	0.01*	Yes
3209/2021	Reduced Sugar Rusks	UK	chlorate	0.03	0.01*	Yes
5785/2021	Organic Raspberry and Apple Soft Oaty Bars	UK	fosetyl (sum)	0.5	0.01*	Yes
5811/2021	Rusks	UK	chlorate	0.02	0.01*	Yes

Melon (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0095/2021	Honeydew	Spain	chlorate	0.3	0.08	Yes
3232/2021	Honeydew	Spain	chlorate	0.3	0.08	Yes

Mushroom (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
1208/2021	Chestnut	Ireland	BAC (sum)	0.2	0.1	No
3189/2021	Chestnut	UK	mepiquat	0.1	0.09	No

Nuts (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0217/2021	Brazil Nuts	Brazil	inorganic bromide	57	50	No
1830/2021	Brazil Nuts	UK	inorganic bromide	56	50	No
1406/2021	Cashew Nuts	the Netherlands	inorganic bromide	63	50	No

Peppers (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
3550/2021	Fresh	UK	flonicamid (sum)	0.4	0.3	No

Peppers (Processed) (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0466/2021	Green Sliced Jalapeno Peppers	Turkey	famoxadone	0.02	0.01*	No
0958/2021	Pepper Quarters	Poland	ethephon	0.06	0.05*	No

Plant based protein (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
2818/2021	Quorn fillets	UK	BAC (sum)	0.5	0.1	Yes
2523/2021	Quorn Mince	UK	BAC (sum)	0.7	0.1	Yes

Raspberry (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
1528/2021	Frozen	UK	dithiocarbamates	0.07	0.05*	No
0355/2021	Fresh	UK	flonicamid (sum)	0.04	0.03*	No
2573/2021	Frozen	UK	chlorothalonil	0.04	0.01*	Yes
			propamocarb (sum)	0.06	0.01*	Yes
			spirodiclofen	0.04	0.02*	Yes

Rice (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
0144/2021	Basmati	UK	buprofezin	0.02	0.01*	No
			thiamethoxam	0.09	0.01*	Yes
			tricyclazole	0.1	0.01*	Yes
2347/2021	Basmati	UK	tricyclazole	0.02	0.01*	Yes

Spring greens and kale (Great Britain)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg) ⁺	MRL exceedance after allowing for measurement uncertainty
5561/2021	Kale	UK	prosulfocarb	0.02	0.01*	No
0363/2021	Spring Greens	UK	tebuconazole	0.08	0.02*	Yes
1419/2021	Spring Greens	UK	cyantraniliprole	0.02	0.01*	No
			tebuconazole	0.03	0.02*	No

Analytical Measurement Uncertainty

No measurement can ever be guaranteed to be exact; this can be caused by many things. Measurement uncertainty is a calculated indicator of our confidence in the accuracy of the amount of pesticide the laboratory detected. It is not expressing a doubt about which pesticides we have found. It has been agreed for reporting purposes that measurement uncertainty will only be applied to any result that contained a residue over the MRL. In line with the international guidance, we use a default value of 50% for measurement uncertainty. This means that when a sample has a residue over the MRL we subtract 50% of the reported result (for instance, 10mg/kg becomes 5 mg/kg) and check the adjusted value against the MRL. All residues still over the MRL after 50% measurement uncertainty has been applied are highlighted as breaching the law in our quarterly reports.

Measurement uncertainty can only be applied by a regulatory authority. In the UK, this role is taken on by the HSE's Chemicals Regulation Division. It should not be applied by the food industry to determine whether a product is compliant with an MRL.

Part 3: Results from the Northern Ireland Programme

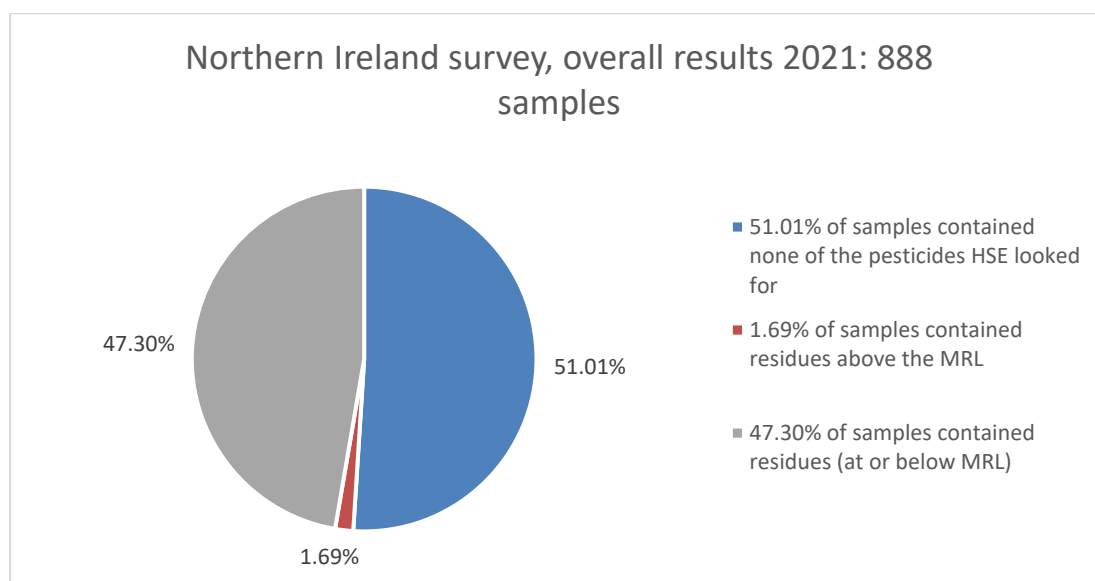
Overall results

In 2021, HSE tested 888 samples from 24 different food surveys sampled in 6 towns and analysed for up to 397 different pesticides.

Some food that is produced in Northern Ireland is specifically labelled as product of Northern Ireland, but most is labelled as UK produced. The results therefore distinguish between UK and non-UK labelled food.

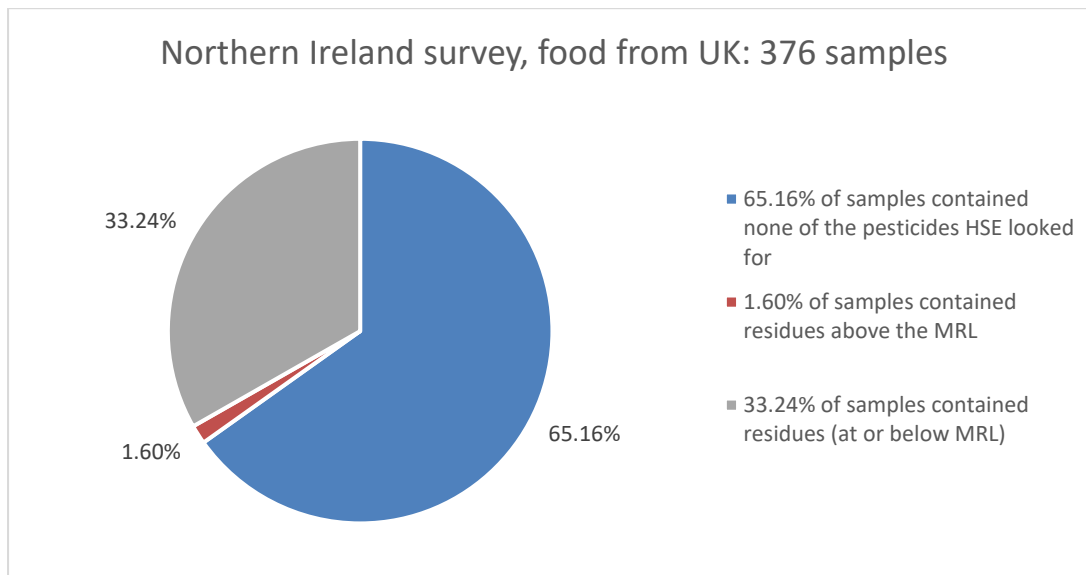
Northern Ireland Survey results

- 453 samples (51.01%) contained none of the pesticides HSE looked for
- 420 samples (47.30%) had residues at or below the MRL
- 15 samples (1.69%) had residues over the MRL



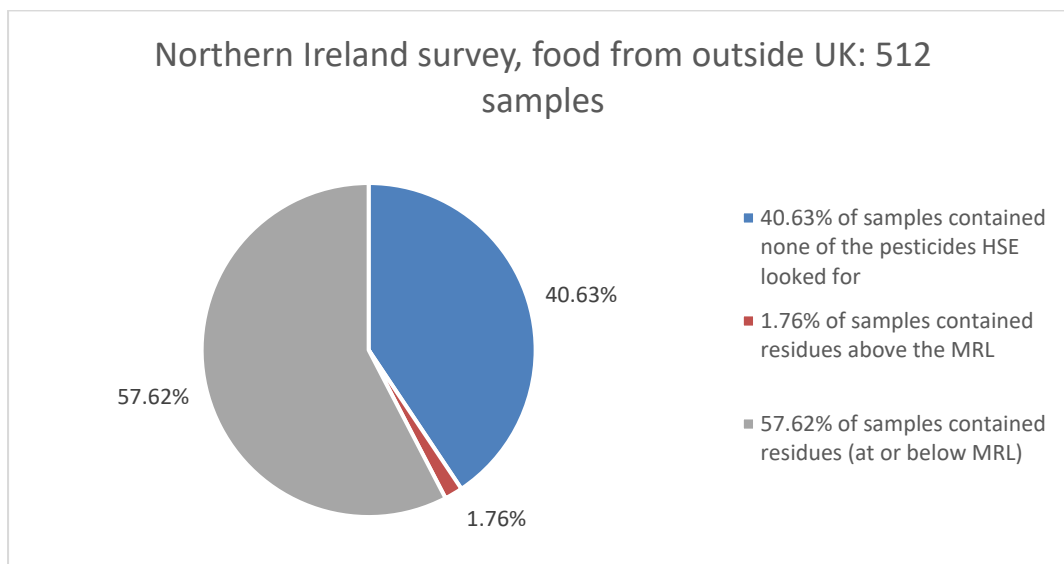
Food from UK

- 245 samples (65.16%) contained none of the pesticides HSE looked for
- 125 samples (33.24%) had residues found at or below the MRL
- 6 samples (1.60%) had residues above the MRL



Food from Outside UK

- 208 samples (40.63%) contained none of the pesticides HSE looked for
- 295 samples (57.62%) had residues found at or below the MRL
- 9 Samples (1.76%) had residues above the MRL



Northern Ireland Fruit and Vegetable Results

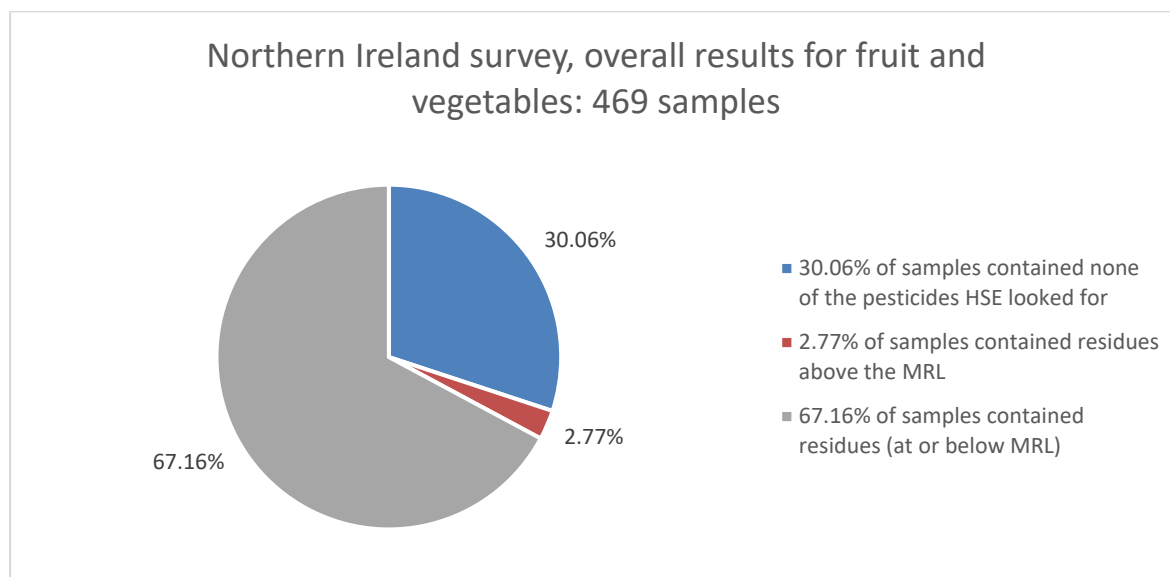
For the Northern Ireland survey, the HSE Monitoring programme collected 469 samples of fruit and vegetables and tested for up to 396 pesticides.

HSE found 13 samples with residues above the MRL. We found 3 MRL exceedances in the beans with pods survey, and 2 MRL exceedances in the spring greens and kale survey.

In 2021 HSE found no residues above the MRL in samples of grapes or potatoes.

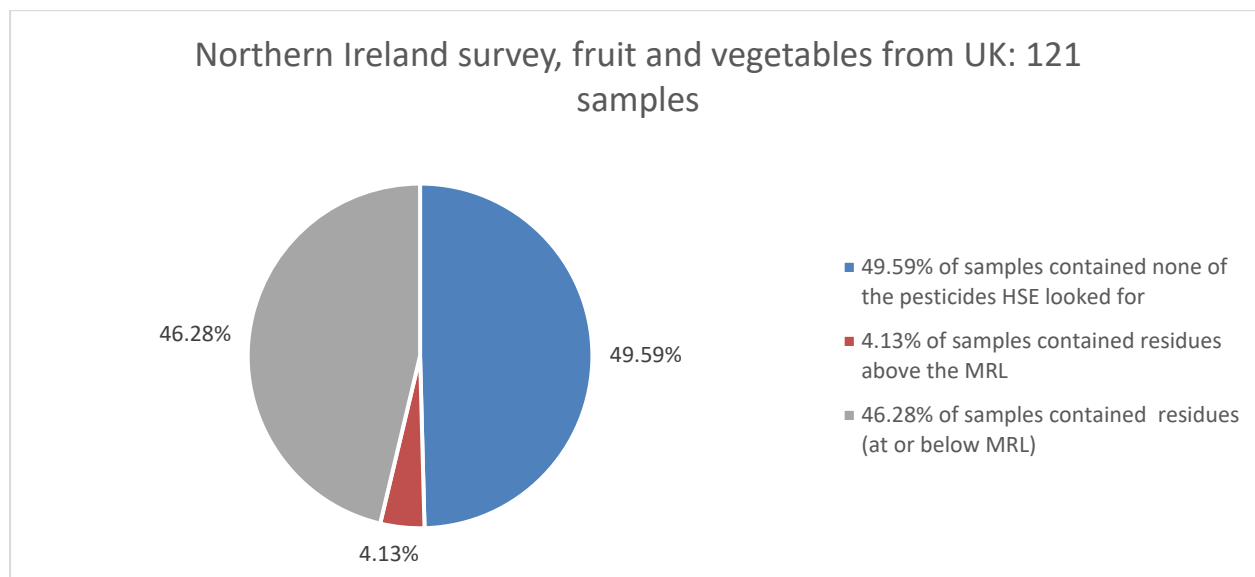
Northern Ireland survey results fruit and vegetable

- 141 samples (30.06%) contained none of the pesticides HSE looked for.
- 315 samples (67.16%) had residues found at or below the MRL.
- 13 samples (2.77%) had residues above the MRL



Fruit and Vegetables from UK

- 60 samples (49.59%) contained none of the pesticides HSE looked for
- 56 samples (46.28%) had residues found at or below the MRL
- 5 samples (4.13%) had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Asparagus	12	0	1	0
Aubergine	36	29	1	12
Banana	36	27	0	26
Beans with pods	24	11	3	6
Berries and small fruits	36	28	1	21
Broccoli	36	19	1	10
Grapefruit	37	36	1	37
Grapes	36	33	0	31
Melon	36	24	0	16
Mushrooms	36	21	1	12
Peppers	36	29	1	22
Potatoes	36	14	0	3
Raspberry	36	23	1	17
Spring greens and kale	36	21	2	16

Northern Ireland Starchy Food and Grain Results

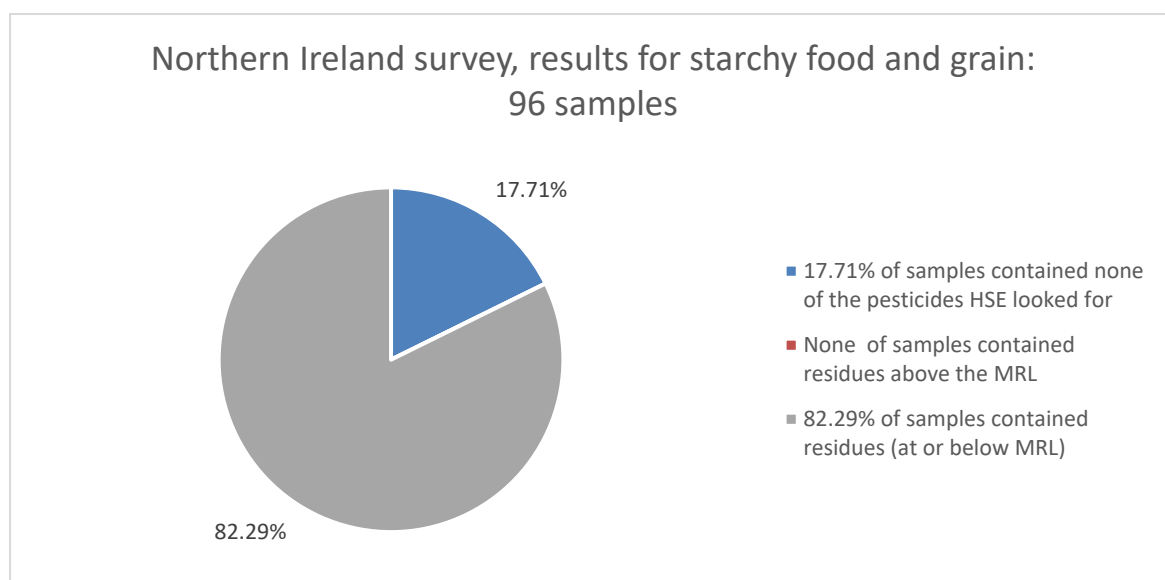
For the Northern Ireland survey, the HSE monitoring programme collected 96 samples of starchy food and grains in 2021.

The Northern Ireland programme collected and analysed bread, rice, and wheat.

Glyphosate was sought in all 72 samples of wheat and bread in the Northern Ireland surveys, 23 samples contained residues of glyphosate, all the residues were found to be below the MRL.

Northern Ireland survey results starchy food and grain

- 17 samples (17.71%) contained none of the pesticides HSE looked for
- 79 samples (82.29%) had residues found at or below the MRL
- None of the samples had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Bread	48	43	0	26
Rice	12	5	0	3
Wheat	36	31	0	11

Applying processing factors to find MRLs for bread (and other processed foods)

MRLs apply to all traded foods, including foods used as ingredients. The law specifies the level to apply to foods as they are traded. For almost all foods that means their raw, unprocessed form. But MRLs also apply to prepared and

processed foods in which case the effect of processing needs to be taken into account.

To check that prepared and processed foods were made with ingredients that complied with MRLs, we use appropriate processing factors, based on scientific studies of the effect of preparation and processing. Different forms of processing remove, concentrate or dilute residues, and the effect may also vary depending on the food and pesticide concerned.

The use of processing factors enables checks that the original ingredient was compliant with MRLs. Food manufacturers should have information on how they check their ingredients and on their recipes and preparation techniques – for instance, how much water is added or removed, or how much of an ingredient is used to make a food. We always contact them when there is possible non-compliance so that they can share their own information about processing factors

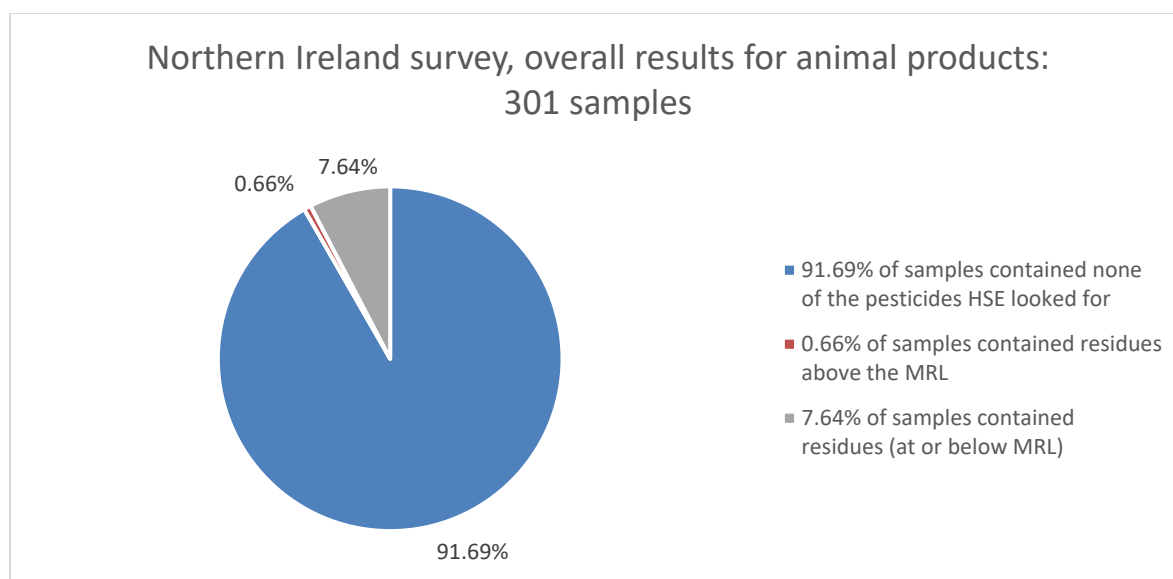
Northern Ireland Animal products results

For the Northern Ireland survey, the HSE monitoring programme collected 301 samples of animal products in 2021.

The Northern Ireland programme collected and analysed beef, cheese, eggs, fish and milk.

Northern Ireland survey results animal products

- 276 samples (91.69%) contained none of the pesticides HSE looked for
- 23 samples (7.64%) had residues found at or below the MRL
- 2 samples (0.66%) had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Beef	72	2	1	0
Cheese (soft)	72	0	0	0
Eggs	36	0	1	0
Fish (white)	73	21	0*	2
Milk	48	0	0	0

*No MRLs are applied to fish

DDT

This year we found DDT in seven samples of fish. The levels we found would not be expected to have an effect on health, and overall are consistent with the continued decline of this pesticide in the environment.

The use of DDT is banned in the UK and banned or heavily restricted in many countries worldwide. It isn't allowed for use on food crops anymore, but it is still used in some countries outside Europe 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 UK, 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 break down, 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.

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.

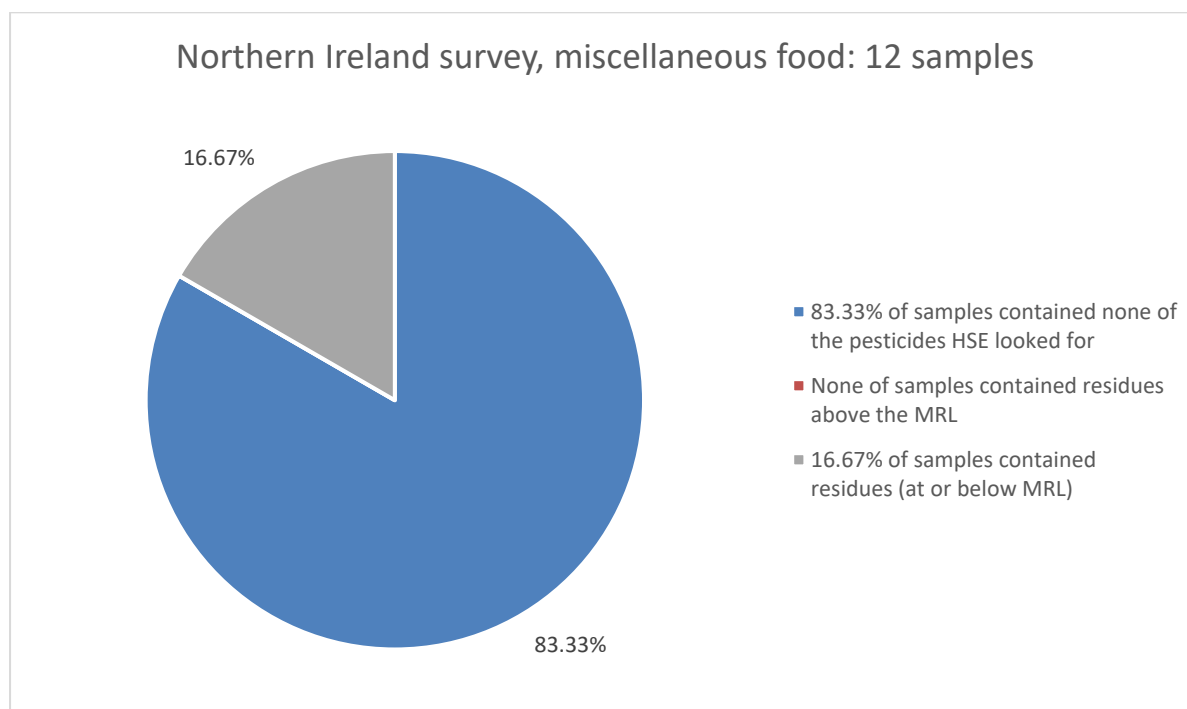
For residues found in fish in 2021, we can tell from the chemical form detected by the laboratories whether the residues are from historic use (which is what we usually find). PRiF explain this every time DDT detections are published to try to make it as clear as they can that the results show food producers are not using DDT today. However, there are occasional media stories about DDT and various links and associations, which do not make this distinction.

Northern Ireland Miscellaneous Foods Results

For the Northern Ireland survey, the HSE monitoring programme collected 12 samples of miscellaneous foods in 2021.

The Northern Ireland programme collected and analysed olive oil

- 10 samples (83.33%) contained none of the pesticides HSE looked for
- 2 samples (16.67%) had residues found at or below the MRL
- None of the samples had residues above the MRL



Food sampled	Number of samples tested	Number of samples containing residues at or below MRL	Number of samples containing residues above the MRL	Number of samples containing more than one pesticide
Olive oil	12	2	0	0

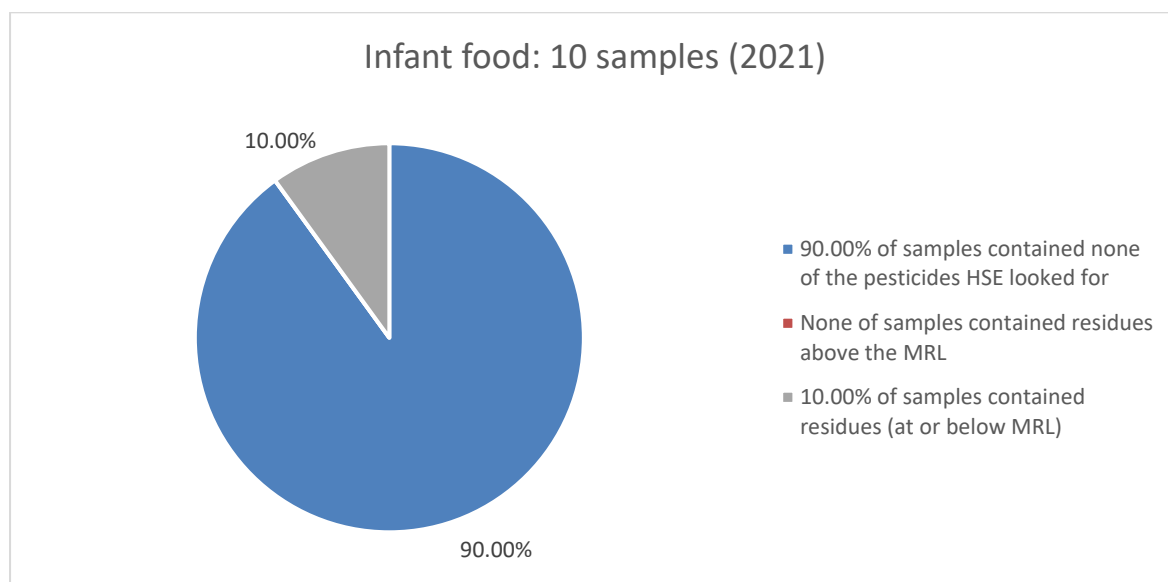
Northern Ireland Infant Food Results

For the Northern Ireland survey, the HSE monitoring programme collected 10 samples of infant food in 2021.

Infant food and infant formula (baby milk) have their own MRLs which are set separately. Health departments are responsible for this legislation. However, these foods have been included in the UK's national monitoring programme alongside other foods for many years and as part of the multi annual control plan.

Northern Ireland survey results infant food

- 9 samples (90%) contained none of the pesticides HSE looked for
- 1 samples (10%) had residues found at or below the MRL
- None of the samples had residues above the MRL



Residues over the MRL

All the Northern Ireland 2021 samples with residues over the MRL are listed in the Residues over the MRL Table on page 45

In each case HSE has written to the brand owner or the sampling point, asking for comments on how the residue occurred. We provide advice on how to prevent recurrence, including technical advice to assist in identifying the source of the residue where necessary. We offer the opportunity for brand owners or suppliers to range additional testing. All the information obtained is considered by the PRiF before the results are published.

It is not possible to identify with absolute certainty the source or reason for every individual residue above the MRL. However, with the assistance of the PRiF and the cooperation of growers and brand owners we can identify some groups of results for which we think it is reasonable to reach a conclusions on both reasons for the breaches and some risk management decisions.

Chlorate

MRLs for chlorate recognise the crucial role of chlorate-related compounds as biocides in water treatment and food hygiene. For most foods where residues are unavoidably incurred by such uses post-harvest that HSE can waive the MRL provided the producer supplies evidence that this is the case. In the cases identified as MRL breaches in this section no such evidence was supplied.

Eggs

One sample of eggs contained an isolated residue of cyromazine over the MRL. The farm was visited by Northern Ireland officials, and the source was identified as a veterinary product authorised for use to keep flies levels down in the litter. No offences were identified. The farm received advice on preventing a recurrence.

Beans with pods and LOD MRLs

Residues above the MRL do not necessarily mean the grower did not follow Good Agricultural Practice. A number of the MRLs have an asterisk (*) next to them, which means that the MRL is set at the limit of determination (the lowest level that can normally be detected by official laboratories).

This often means the pesticide has no authorised uses in the UK (or previously EU) on those crops. We cannot identify whether particular pesticides are authorised in other countries and so whether a residue is applied legally there. Provided the food meet the MRL requirements, it is legal to trade.

Anyone can apply for a higher MRL be set by HSE for trade in Great Britain. However, this needs to be supported with sufficient data/evidence for HSE to assess the suitability of the proposed MRL. This process may not be cost-effective for some producers.

Residues over the MRL: Samples collected in Northern Ireland

Asparagus (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
2420/2021	Asparagus	Mexico	flonicamid (sum)	0.04	0.03*	No

Aubergine (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
5621/2021	Aubergine	Spain	chlorate	0.7	0.4	No

Beans with pods (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
3071/2021	Runner Beans	Kenya	BAC (sum)	0.4	0.1	Yes
1990/2021	Green Beans	Morocco	propamocarb (sum)	0.2	0.1	No
0669/2021	Green Beans	Morocco	linuron	0.02	0.01*	Yes

Beef (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
5978/2021	Diced Irish stewing beef	Ireland	DDAC (sum)	0.2	0.1	No

Berries and small fruits (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
0416/2021	Frozen: Blackberries	Serbia	dithiocarbamates	0.2	0.05*	Yes

Broccoli (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for
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						measurement uncertainty
3167/2021	Frozen	UK	fosetyl (sum)	32	10	Yes

Eggs (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
1585/2021	Hens	UK	cyromazine	0.04	0.01*	Yes

Grapefruit (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
5656/2021	Red Grapefruit	South Africa	sulfoxaflor	0.3	0.15	No

Mushroom (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
0667/2021	Button	UK	deltamethrin	0.08	0.05	No

Peppers (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
2610/2021	Fresh	The Netherlands	2-phenylphenol	0.03	0.01*	Yes

Raspberry (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
0019/2021	Frozen	UK	dithiocarbamates	0.08	0.05*	No

Spring greens and kale (Northern Ireland)

Sample ID	Food Type	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
2391/2021	Spring Greens	UK	fluazifop-p (sum)	0.02	0.01*	No
5658/2021	Kale	UK	prosulcarb	0.03	0.01*	Yes

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Annex 1 – Laboratory Quality Control

The samples collected in 2021 for each survey were analysed at one of 3 official laboratories.

Each laboratory tests all the samples for as survey. Sending all the samples of one type to one laboratory gives economies of scale for the programme as well as enabling laboratories to develop or improve analytical methodology within particular areas.

Each laboratory is accredited by the UK Accreditation Service (UKAS) to ISO/IEC 17025:2017 for the analyses performed.

Each laboratory is required to take part in independent proficiency tests relevant to the monitoring programme and share their scores with HSE. During 2021 they also took part in relevant proficiency testing organised by the EU Reference Laboratory.

During 2021 the laboratories were required to follow the Analytical Quality Control and Method Validation Procedures for Pesticide Residues Analysis in Food and Feed.

Laboratory	UKAS Testing Accreditation number
Agri-Food and Biosciences Institute (AFBI), Belfast	2632
Fera Science Ltd, York	1642
SASA, Edinburgh	1406