PESTICIDE USAGE SURVEY
REPORT 314

SOFT FRUIT
IN THE UNITED KINGDOM
2022

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A NATIONAL STATISTICS SURVEY

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The UKSA has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Statistics.
Designation can be broadly interpreted to mean that the statistics:
• meet identified user needs;
• are well explained and readily accessible;
• are produced according to sound methods; and
• are managed impartially and objectively in the public interest.

Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed.

If you have any enquiries or feedback on the statistics included in this report, they can be directed to the contact given below:

Pesticide Usage Survey Team – e-mail: PUS@fera.co.uk Telephone: 0300 100 0321

DATA USES

The data are used for a number of purposes including:

- Quantifying pesticide usage and changes in the use of active substances over time;
- Policy, including assessing the economic and/or environmental implications of the introduction of new active substances and the withdrawal/non-authorisation of pesticide products (the data reported to organisations such as the OECD and EU enabling the UK to honour international agreements); evaluating changes in growing methods and Integrated Pest Management where this has an impact on pesticide usage;
- Informing the pesticide risk assessment (authorisation) process;
- Informing the targeting of monitoring programmes for residues in food and the environment;
- Contributing to assessing the impact of pesticide use, principally as part of the Pesticides Forum's Annual Report;
- Responding to enquiries (for example, Parliamentary Questions, correspondence, queries under the Freedom of Information Act or Environmental Information Regulations, etc.);
- Providing information to assist research projects which can support all the above activities;
- Training/teaching programmes which are designed to improve practice in the use of pesticides by the farming/training industries;
- Informing the Wildlife Incident Investigation Scheme (WIIS) programme to help identify potential misuse of pesticides.

REVISIONS POLICY

This report presents a comprehensive summary of data for soft fruit crops grown and taken to harvest in 2022. We will provide information on any revisions we make to the report or the datasets if any inaccuracies or errors occur. Details of any revisions, including the date upon which they were changed, will appear on the following website:

https://pusstats.fera.co.uk/published-reports

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OVERVIEW OF MAIN FINDINGS

This report contains information on all aspects of pesticide usage during the 2021/2022 growing season on soft fruit crops comprising strawberries, blackcurrants, redcurrants & whitecurrants, gooseberries, blueberries, raspberries, blackberries, hybrid berries and grapevines. A total of 297 holdings growing soft fruit were visited throughout the United Kingdom and the area of soft fruit grown on these holdings represented 37% of the total area of soft fruit grown nationally. The data on the area of pesticide treatments and the amounts of active substances applied have been raised to give estimates of national pesticide usage.

The area of soft fruit grown in the United Kingdom had increased by 12% since 2014 but decreased by 8% since 2020. Four crops accounted for 88% of the total area of soft fruit grown in 2022; strawberries (28%), grapevines (26%), blackcurrants for processing (22%) and raspberries (12%). An estimated 41% of the total area of soft fruit crops was grown in London & South East Region, 18% in Scotland, 16% in the West Midlands, 11% in Eastern Region, 7% in the South West, 3% in East Midlands, 2% in Wales, 1% in Yorkshire & the Humber, 1% in the North West and less than 1% in the North East and Northern Ireland.

Approximately 43% of the total pesticide-treated area (including macro-biological control agents) was cropped with strawberries, 31% with vines, 15% with blackcurrants for processing and 6% with raspberries.

In 2022, 42% of the area of soft fruit grown was grown under protection (including temporary tunnels throughout the United Kingdom and permanent structures in Scotland and Northern Ireland). For blackberries, 89% of the area grown was under protection, strawberries 87%, raspberries 81% and blueberries 64%.

Fungicides accounted for 56% of the total pesticide treated area in 2022, insecticides 13%, biological control agents 11%, sulphur 9%, herbicides 8%, molluscicides & repellents, acaricides and physical control agents 1% each and disinfectants, growth stimulants, and growth regulators less than 1% each. In terms of weight of pesticides applied, fungicides accounted for 49% of the total, sulphur 42%, herbicides 4%, insecticides 2%, physical control agents 1%, and molluscicides & repellents, acaricides, disinfectants, growth stimulants and growth regulators less than 1% each.

The most extensively used fungicide formulations applied were fenhexamid, cyprodinil/fludioxonil and boscalid/pyraclostrobin, which together accounted for 11% of the total pesticide treated area. Sulphur was used as a fungicide on almost all crops, but mainly on vines and blackcurrants for processing. Sulphur was also used as an acaricide, mainly on blackcurrants for processing for big bud mite control. Sulphur accounted for 21% of the total pesticide treated area of vines and for 15% of the total pesticide treated area of blackcurrants for processing.

The most extensively used herbicide formulations were glyphosate, carfentrazone-ethyl and pendimethalin, which together accounted for 65% of the herbicide treated area in 2022.

Pyrethroids were the most extensively used insecticides, accounting for 34% of the insecticide treated area, followed by the tetramic acid derived spirotetramat (23%) and the micro-organism derived spinosad (21%). Lambda-cyhalothrin was the principal pyrethroid active substance recorded.

Neoseiulus cucumeris was the most extensively used biological control agent in 2022, accounting for 40% of the area treated with biological controls, followed by *Phytoseiulus persimilis* (25%) and *Orius* spp. (8%).

Two acaricides accounted for 76% of the total acaricide area treated; bifenazate (40%) and clofentezine (36%). Only two molluscicide active substances were encountered, ferric phosphate and metaldehyde. Ferric phosphate accounted for 98% of the total area treated with molluscicides and repellents, with metaldehyde and the repellent calcium chloride accounting for 1% each.

There was no use of soil sterilants encountered in 2022.

OBSERVATIONS ON THE 2022 REPORT AND CHANGES SINCE 2020

The total registered pesticide treated area in the United Kingdom in 2022 has decreased by 12% since 2020. Similarly, the weight of pesticides applied has also decreased by 9% over the same period. This decline in usage was seen across all major pesticide groups except for sulphur. The UK cropping area has also decreased by 8% since 2020, which is largely due to the 20% decrease in the area of strawberries grown since 2020. This decrease in area grown and the fact that strawberries are relatively intensively treated compared to other soft fruit crops is likely to have contributed to much of the overall decrease in pesticide usage.

Since 2020, there has been a 13% decrease in the fungicide treated area and a 16% decrease in weight applied. There has also been a decrease (20%) in the area treated with fungal biopesticides since 2020, with 18,854 treated hectares recorded in 2020 compared to 15,110 in 2022. The weight of fungal biopesticides applied has also decreased from 15,526 kilograms in 2020 to 10,518 kilograms in 2022. Again, the decrease in the area grown for strawberries is likely to have contributed to this change since 2020. However, fungal biopesticides still accounted for 13% of the total fungicide treated area in 2022 and this figure was similar (14% of the total fungicide treated area) for 2020.

In contrast, the use of sulphur has increased by 8% in terms of area treated and by 11% in terms of weight applied since 2020. This increase in use could in part be due to the 17% increase in the planted area of grapevines in 2022. Sulphur is often used on soft fruit crops, for example for the control of powdery and downy mildew on vines, but it can also be used as an acaricide for mite control, particularly big bud mite control on blackcurrants.

The area treated with acaricides has decreased by 29% since 2020, with 3,827 treated-hectares recorded in 2020, compared to 2,702 treated-hectares in 2022. There has also been a 13% decrease in the insecticide area treated since 2020. The weight of insecticides applied has more than halved from 7,146 kilograms in 2020 to 3,499 kilograms in 2022. This is largely due to the decrease in use of fatty acids, which have very high rates of application compared to other insecticides. Fatty acids accounted for 4,601 kilograms of insecticide active substance use in 2020, in contrast to 1,728 kilograms in 2022. The area treated with insecticidal biopesticides has also decreased since 2020, with 1,618 treated hectares recorded in 2020 compared to 1,333 treated hectares in 2022.

There has been a 14% decrease in the herbicide treated area since 2020 and a 19% decrease in the weight applied. This could again be due to the decrease in area of soft fruit grown in the UK since 2020. In addition, the very hot and dry conditions experienced in summer 2022 could have had an impact on weed growth and contributed to a reduction in usage. Furthermore, the increase in substrate grown crops (pots, bags and troughs) rather than soil grown crops and the increase in the use of cultivation methods for weed control is likely to have contributed to this change.

The area treated with macro-biological control agents (living predators, parasites and nematodes) has decreased by 55% since 2020 (49,439 treated hectares in 2020 compared to 22,139 treated hectares in 2022). However, this could again be in part due to the 20% reduction in the area grown for strawberries, which are grown extensively under tunnels. The treated area for 2022 is comparable to 2018 (24,246 treated-hectares) and higher than the treated area for 2014 (3,869 treated- hectares) and 2016 (13,208 treated-hectares).

Usage of soil sterilants has declined significantly since 2014 and was confined to recent plantings of strawberry and raspberry crops in 2014 and 2016 and raspberry crops in 2018 and 2020. There was no use of soil sterilants encountered in 2022 following the withdrawal of dazomet in 2020.

In terms of treated area, there has been a 32% decrease in the use of molluscicides & repellents since 2020 and a 56% decrease in weight applied. This change is in part due to a decrease in the use of metaldehyde, which was withdrawn in March 2022, part way through the survey period. The metaldehyde treated area has decreased from 881 hectares in 2020 to just 8 hectares in 2022. The increased use of substrates (pots, bags, troughs) rather than soil grown crops is also likely to contribute to a decreased use in molluscicides.

INTRODUCTION

The Expert Committee on Pesticides (ECP) advises government on all aspects of pesticide use. In order to discharge this function, the Committee must regularly monitor the usage of all pesticides. It needs accurate data on the usage of individual pesticides.

As part of the on-going process for obtaining data, the Pesticide Usage Survey Teams of:

- Fera Science Ltd., a joint venture between Capita PLC and the Department for Environment, Food & Rural Affairs (Defra);
- Science & Advice for Scottish Agriculture (SASA), a division of the Scottish Government's Agriculture and Rural Delivery Directorate;
- and the Agri-Food & Biosciences Institute (AFBI), Department of Agriculture, Environment and Rural Affairs (DAERA)

conducted surveys of pesticide usage in soft fruit crops in 2021/22 by contacting holdings throughout the United Kingdom during the winter of 2022/23.

This was the seventh survey of pesticide usage on soft fruit crops in the United Kingdom and the eleventh survey of pesticide usage on soft fruit crops carried out by the Great Britain Pesticide Usage Survey Teams. The previous report for the United Kingdom was published in 2022 covering pesticide usage on soft fruit crops in 2020 (Ridley et. al., 2022). Other reports for the United Kingdom covered harvest years 2010, 2012, 2014 2016, 2018 and 2020.

Since 2010, all surveys of pesticide usage in agriculture and horticulture have been fully co-ordinated by the survey teams of England & Wales, Scotland and Northern Ireland. The methodology used for sample selection and the collection of data from sample holdings is identical in each region. Reports are produced of pesticide usage throughout the United Kingdom. All teams have undertaken United Kingdom Statistics Authority (UKSA) audits and the data are accredited as National Statistics.

Additional data on crop agronomy are collected for all surveys but may not be presented within the report. For additional data relating to the surveys please refer to the contacts below.

Information on all aspects of pesticide usage in the United Kingdom as a whole, or for Wales or the Defra regions of England, may be obtained from the Pesticide Usage Survey Team at Fera Science Ltd., Sand Hutton, York, UK YO41 1LZ.

For further information please contact:

The survey team – e-mail: PUS@fera.co.uk Telephone: 0300 100 0321
Or visit the website: https://pusstats.fera.co.uk/home

Alternatively, please contact: Fera at: science@fera.co.uk

Further data relating specifically to Scotland may be obtained from the Pesticide Usage Survey Team at SASA. Also available at:
http://www.sasa.gov.uk/pesticides/pesticide-usage/pesticide-usage-survey-reports

Copies of reports on pesticide usage in Northern Ireland may be obtained from His Majesty's Stationery Offices. Also available at:

https://www.afbini.gov.uk/articles/pesticide-usage-monitoring-reports

INTRODUCTION (*cont*.)

Previous reports for the United Kingdom, Great Britain, England & Wales and Northern Ireland can also be viewed and downloaded on the Internet at:

https://pusstats.fera.co.uk/home

Whilst Scotland, Northern Ireland and Wales are included within the report as individual countries, England is split into Government Office regions. Please visit the following link for more information:

https://pusstats.fera.co.uk/assets/images/ukMap.svg

EXPLANATORY NOTES FOR THE 2022 REPORT

This report is based on almost 36,000 rows of application data. The following are some explanatory notes to help the reader.

Authorised/non-authorised pesticides, biopesticides/biological control agents: terminology and classification for purposes of this report.

Previous soft fruit reports (prior to 2016) used the term 'registered' pesticides; however, the requirements of Regulation 1107/2009 mean that we need to change the terminology used in this report.

- Pesticides products require to be **'authorised'**; their constituent active substances require to be **'approved'**.
- Biopesticides (such as *Bacillus subtilis*) also require to be **'authorised'**.
- Biological control agents (usually living parasites or predators) do ***not*** require authorisation.

'Pesticides': For clarity, this report refers to all authorised active substances and pesticides products (including biopesticides) simply as 'pesticides' and 'active substances'. All biopesticides have been grouped with either insecticides or fungicides depending on their intended target, be it a fungal pathogen or insect pest.

'Biological control agents': This category includes macro-biological control agents such as predatory mites and parasitic wasps. Prior to 2015, biopesticides and biological control agents were grouped together. However, this report treats biological control agents separately since they do ***not*** require authorisation. Although, it is important to note that non-native biological control agents are still required to be licensed by the manufacturers of biological control products. Please see the following link: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/plant-health/non-native-biocontrol-agents.cfm for information on non-native invertebrates which require a license.

'Basic substances': This includes active substances whose primary use is not as a plant protection product but may be of value for plant protection. Criteria for their approval are laid down and specific provisions are set to ensure that such active substances, as far as they do not have an immediate or delayed harmful effect on human and animal health nor an unacceptable effect on the environment, can be legally used in the EU after having been approved as 'basic' under retained Regulation (EC) 1107/2009. Sodium chloride and vinegar, used as herbicides and milk used as a fungicide were basic substances encountered in 2022. Their use is minor and therefore not considered in the figures for this report, however a breakdown of the area treated and weight applied for these substances is presented in appendix 2 on page 73.

Volumetric Rates

Because of the range of crops grown and the differing methods of application, the water volumes used vary from crop to crop and from grower to grower. The range of water volumes used by horticultural growers varies from 150-200 litres per hectare, which are similar to the water volumes used for many arable crops, up to 2,000 litres per hectare for crops such as strawberries. Whilst rates per hectare are generally applicable to broad acre crops, many applications to soft fruit crops are based on volumetric rates where there is a dilution rate based on the number of grams or millilitres of product used per litre of water. Therefore as the volume of water goes up, so does the rate of application. As such, some of the rates in the report may seem high, but they are only high because they are being compared to the best available data on a product database which may in fact be using a lower volume of water to calculate an application rate.

Reasons for use

The level of information relating to reasons for use declines from survey to survey as more information is collected from computer-based farm management systems that don't necessarily record this information. The original justification for the use of a specific product is within agronomists' recommendations, although the justifications for use are not always transferred to the farm management software.

Where quoted in the text or within figures, reasons for application are the grower's stated reasons for use of that pesticide product on that crop and may not always seem entirely appropriate. Reasons for use data were available for 35% of the treated area (including the use of living biological control).

Use of crop covers

Detailed information on the use of crop covers can be found within the crop agronomy section for each crop. Crop covers include polythene, woven fleece and temporary tunnels such as French and Spanish polythene tunnels. For England and Wales only temporary crop covers are included in this report. Details on soft fruit crops grown under permanent polythene tunnels and glasshouse structures can be found within the Edible Protected Crops report for the UK.

However, this report includes glasshouse, permanent and temporary polythene structures for both Scotland and Northern Ireland. The decision to include permanent structures in Scotland and Northern Ireland was taken in 2014 to reduce the burden on growers who grew both protected and outdoor soft fruit crops on their farm and were being asked to take part in a pesticide usage survey (either as part of the edible protected crops or soft fruit surveys) each year.

DEFINITIONS AND APPROACHES USED IN THIS REPORT

a) 'Pesticide' is used throughout this report to include commercial formulations containing active substances of insecticides, acaricides, molluscicides, fungicides, herbicides, disinfectants, physical control agents, growth stimulants and growth regulators. All biopesticides have been grouped with either insecticides or fungicides depending on their intended target, be it a fungal pathogen or insect pest.

b) 'Treated area' is the gross area treated with a pesticide, including all repeat applications. For Tables 7 – 11 this includes repeat applications of individual active substances. All other figures relate to the areas treated with each product, which may include single or multiple active substances.

c) 'Weight applied' within the figures presented in this report relates to the weight of formulations applied.

d) Where individual pesticides are mentioned in the text, they are listed in descending order of use by hectares treated.

e) The term 'formulation(s)' used within the text is used to describe either single active substances or mixtures of active substances contained within an individual product. It does not refer to any of the solvents, pH modifiers or adjuvants also contained within a product that contribute to its efficacy.

f) 'Other pesticides', where referred to as a pesticide group within the text of this report, include disinfectants, physical control agents, growth stimulants and growth regulators.

g) 'Other pesticides', referred to in Tables 5 and 6, include those that are used on less than 0.1% of the total soft fruit treated area.

h) 'Fresh Market' – refers to crops where the primary use is for picking and selling to consumers without processing and includes sales direct to the public or to supermarkets for re-sale to the public. A small proportion of this crop may go for processing if it cannot be sold into the fresh market.

i) 'Processing' – refers to crops where the primary use includes processing before sale to consumers. Processing includes the production of beverages (including wine), freezing, jam and preserves.

j) 'Pesticide applications' included those applied prior to planting and as such may appear as inappropriate uses.

k) Where highlighted in the text the amount of active substance is calculated from the weight of product applied per hectare multiplied by the proportion of each individual active substance within a product. Arthropod biological control agents are applied by number rather than weight, so there is no associated weight.

l) 'Non-authorised pesticides', including biological control agents, are those that do not require to be, and have not been put through, the Health and Safety Executives' (HSE) pesticide approval process. They include macro-biological control agents such as predatory mites and parasitic wasps, physical control agents and disinfectants used for general cleansing and disinfection which are subject to the biocidal products regime. However, non-native biological control agents are still required to be licensed in the UK.

m) 'Physical control agents' such as maltodextrin, which is based on potato starch, work by blocking insect spiracles causing death by suffocation. Other physical control agents include garlic, which repels and prevents insect pests landing on the crop.

n) 'Pollinators' are regularly used to improve fruit set within soft fruit crops, particularly where crops such as strawberries are grown under tunnels which prevent the entry of naturally occurring pollinators. Where pollinators, such as bumble and honey bees are present in the crop, they also influence the timing of insecticide usage.

o) 'EAMU' – Extension of Authorisation for Minor Use (formerly known as Specific Off-Label Approvals or SOLAs).

p) The average number of applications indicated in the text for each crop, e.g. page 12, is based on the occurrence of a chemical group on at least 10% of the area grown (Table 3). Within tables 4a, b and c, the average number of applications is calculated only on the areas using each chemical group and therefore the minimum number of applications is always going to be 1.

q) 'Full product label rate' refers to the maximum rate, in litres or kilograms per hectare, indicated on a product label, permitted on a specific crop.

r) 'Volumetric rates' – some products are applied using a standard dilution rate in a set volume of water. As growers' water volume rates/hectare vary it is not possible to compare the actual rates with a pre-set maximum product rate.

TRENDS

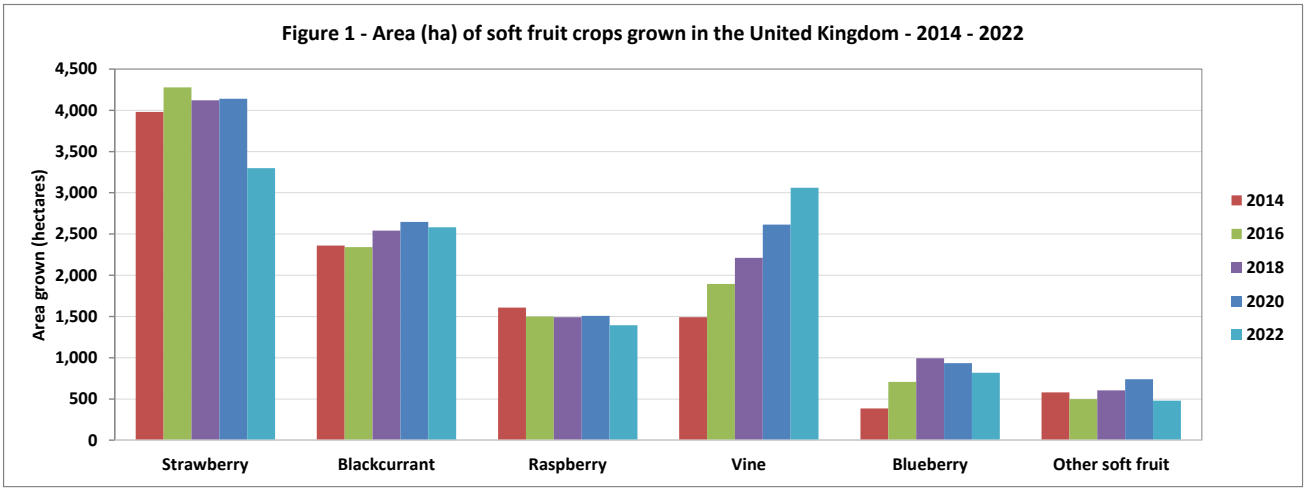


Figure 1 - Area (ha) of soft fruit crops grown in the United Kingdom - 2014 - 2022
Area grown (hectares)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Strawberry
Blackcurrant
Raspberry
Vine
Blueberry
Other soft fruit
2014
2016
2018
2020
2022

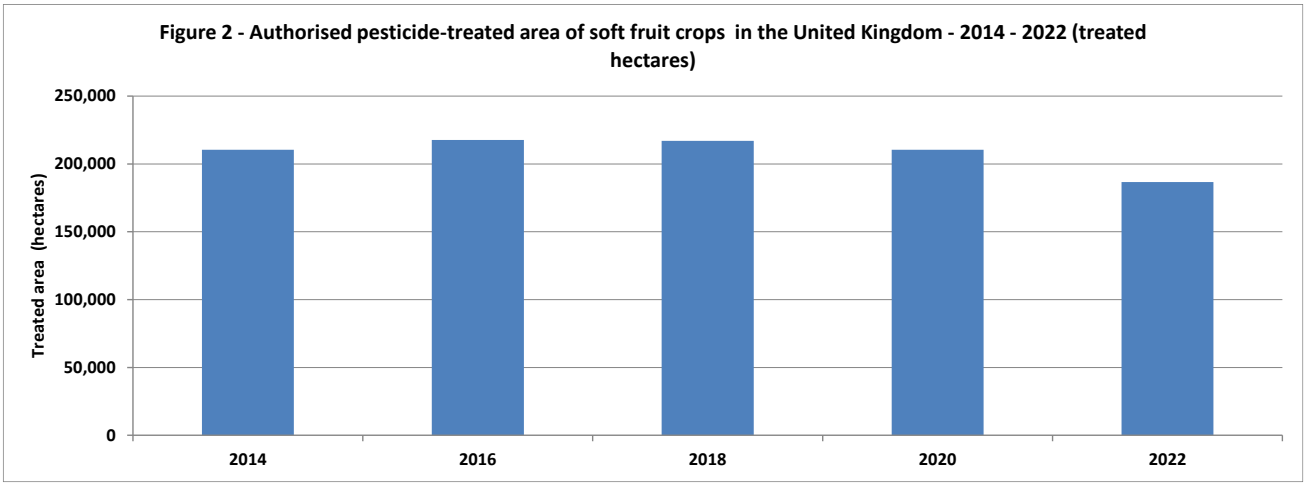


Figure 2 - Authorised pesticide-treated area of soft fruit crops in the United Kingdom - 2014 - 2022 (treated hectares)
Treated area (hectares)
250,000
200,000
150,000
100,000
50,000
0
2014
2016
2018
2020
2022

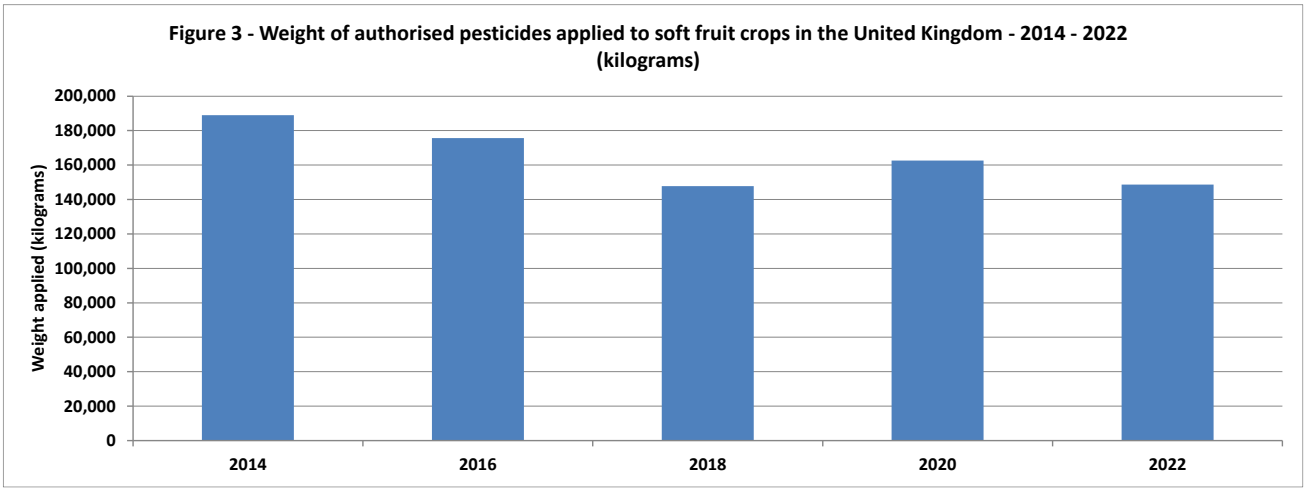


Figure 3 - Weight of authorised pesticides applied to soft fruit crops in the United Kingdom - 2014 - 2022 (kilograms)
Weight applied (kilograms)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2014
2016
2018
2020
2022

TRENDS (*cont*.)

Figure 4 - Area of soft fruit crops treated with the major pesticide groups in the United Kingdom - 2014 - 2022 (treated hectares)

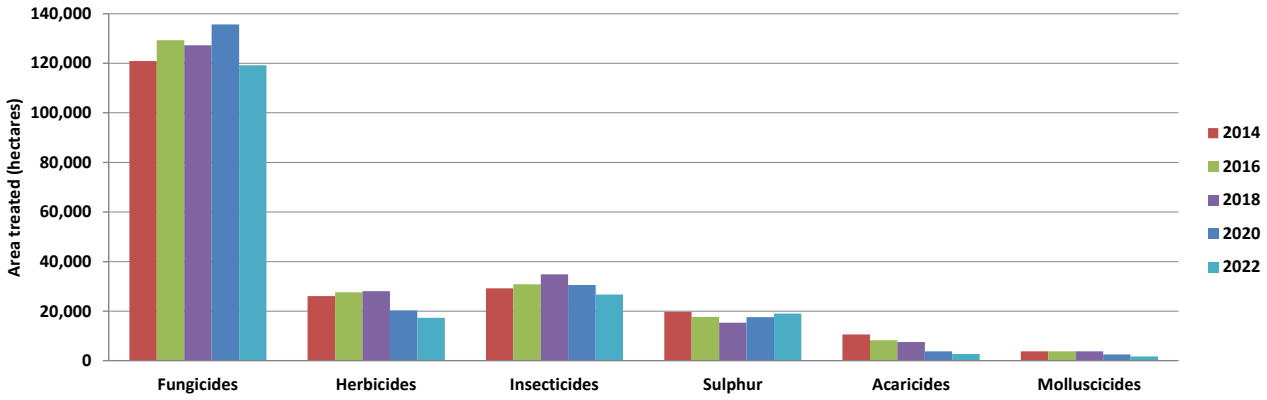
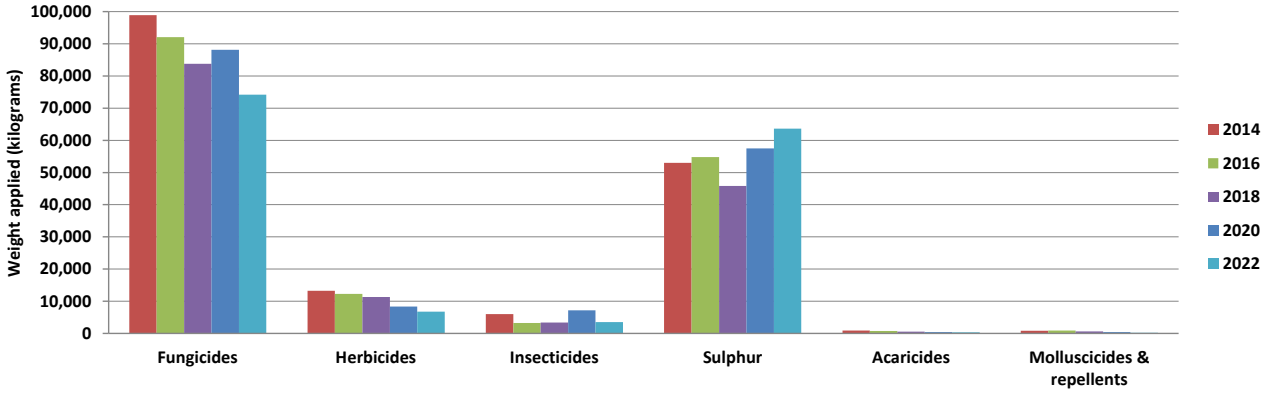


Figure 5 - Weight of the major pesticide groups applied to soft fruit crops in the United Kingdom - 2014 - 2022 (kilograms)



CROPS

Information concerning 10 main types of soft fruit crops and data on pesticide usage were collected from 1,921 fields/blocks, or groups of fields/blocks treated with the same pesticide applications, grown on 297 holdings throughout the United Kingdom. Crops included in the survey were: strawberries; blackcurrants (for fresh market and processing – see definitions on page 6); redcurrants & whitecurrants; gooseberries; blueberries; raspberries; blackberries; hybrid berries (which included boysenberry, jostaberry, loganberry, tayberry and tummelberry); and grapevines. Small areas of chokeberry, elderberry, haskap berry (also known as honeyberry), kiwi fruit, saskatoon and sea buckthorn were also recorded (1% of the sampled area), but not included in the survey for confidentiality reasons.

The sample accounted for 37% of the total area of soft fruit crops grown in the United Kingdom during the 2021/22 season.

Please note - All pie-charts within this report should be read clockwise from the top, as both the pie segments and the contents of the key appear in the same order.

The charts, Figure 6 and 7, show the regional distribution and relative area of crops grown in the United Kingdom. Figures are based on 2022 June Survey data for the UK. Where June Survey estimates were not available for individual crops, the areas surveyed in 2022 have been used to make estimates of the areas grown. Please also see Appendix 2 – methodology for information on how the raising factors were calculated for this survey.

Figure 6 - Regional distribution of soft fruit crops in the United Kingdom (June Survey data) - 2022

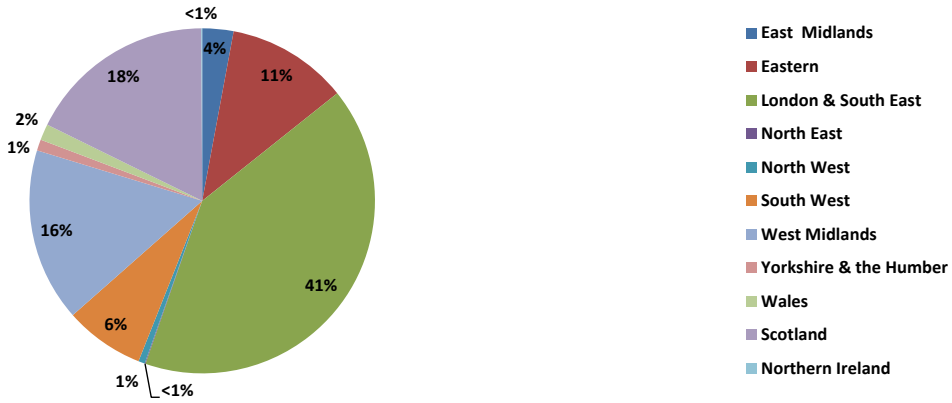
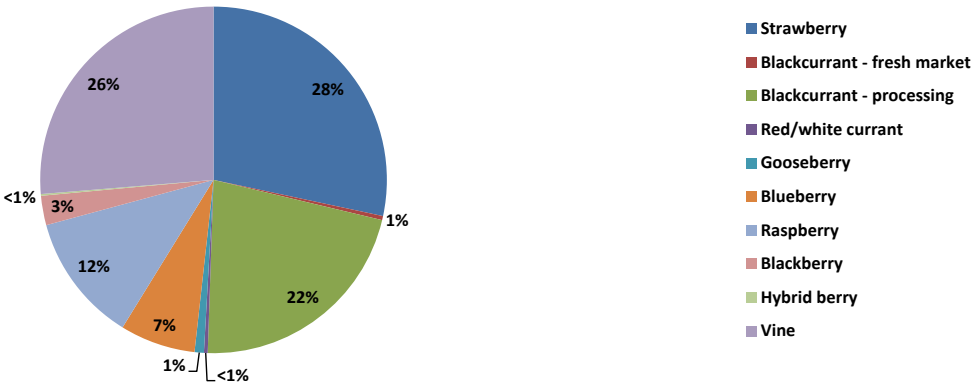


Figure 7 - Relative areas of the different soft fruit crops in the United Kingdom (June Survey data) - 2022



PESTICIDE USAGE

Figure 8 includes June Survey data from each region and the estimated total pesticide treated areas in each region. It compares the percentage of the total area of soft fruit crops grown with the percentage of the total treated area of soft fruit crops in the United Kingdom.

Figure 8 - Comparison of regional distribution and treated area of soft fruit crops in the United Kingdom - 2022

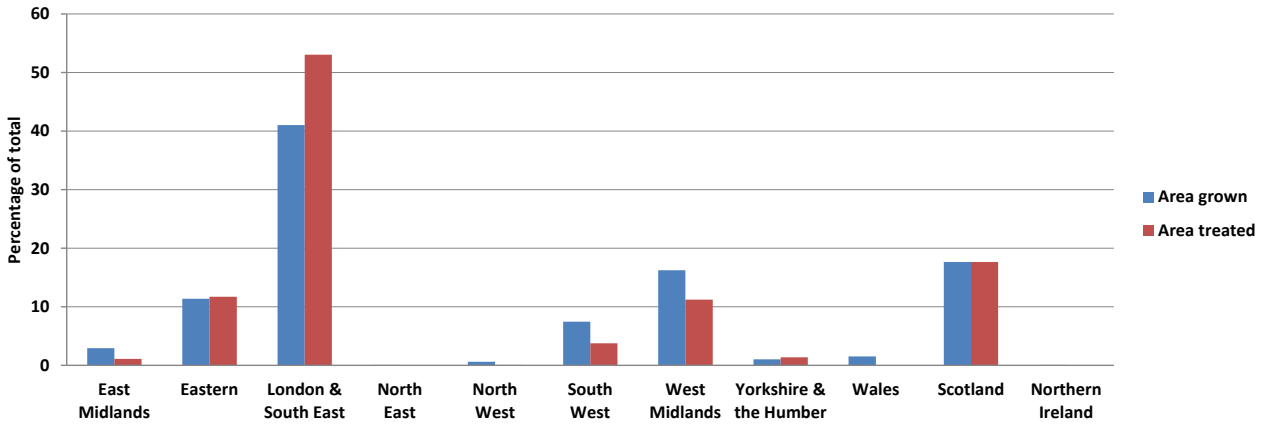
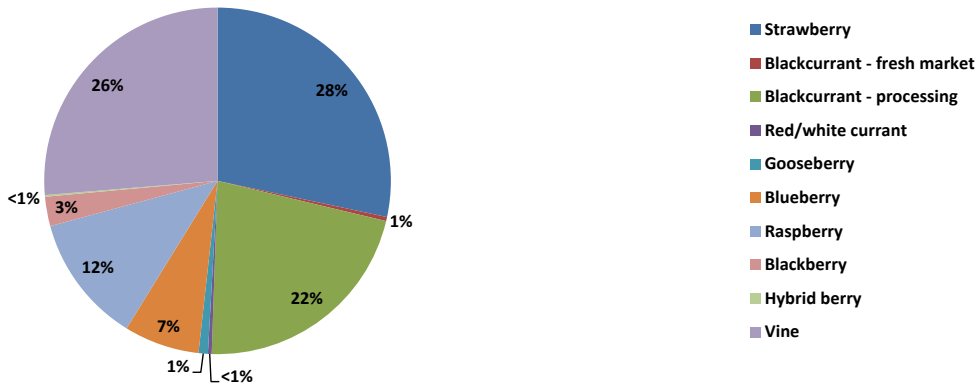


Figure 9 expresses the percentage (also found in Figure 8) of the estimated total treated area in each region.

Figure 9 - Relative areas of the different soft fruit crops in the United Kingdom (June Survey data) - 2022



PESTICIDE USAGE (*cont*.)

Figure 10 details the distribution and importance of each chemical group as a percentage of the total UK pesticide treated area and weight of pesticides applied. Other pesticides include disinfectants, physical control agents, growth stimulants and growth regulators.

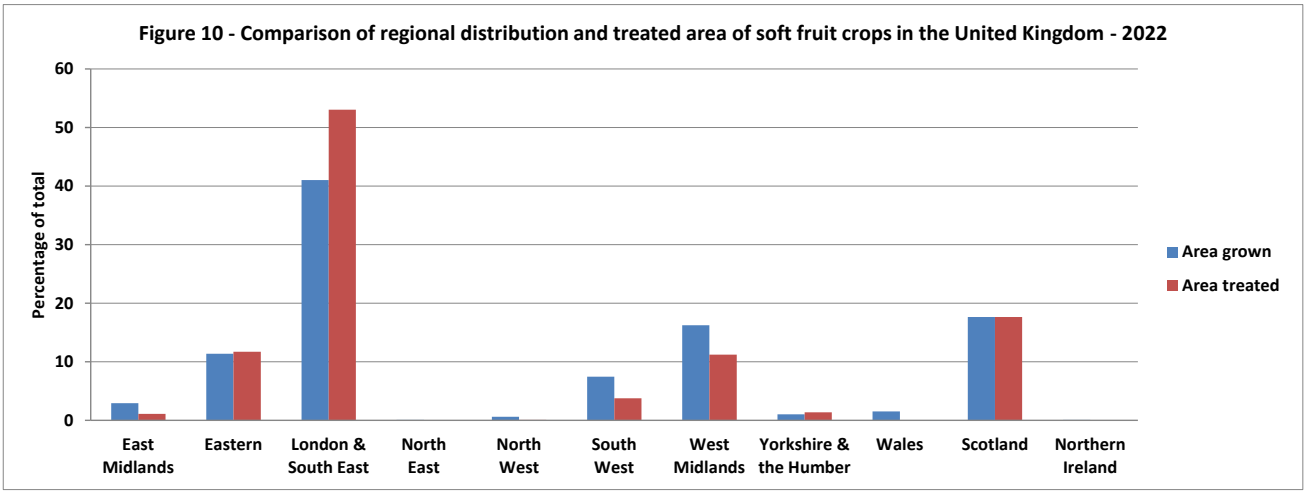
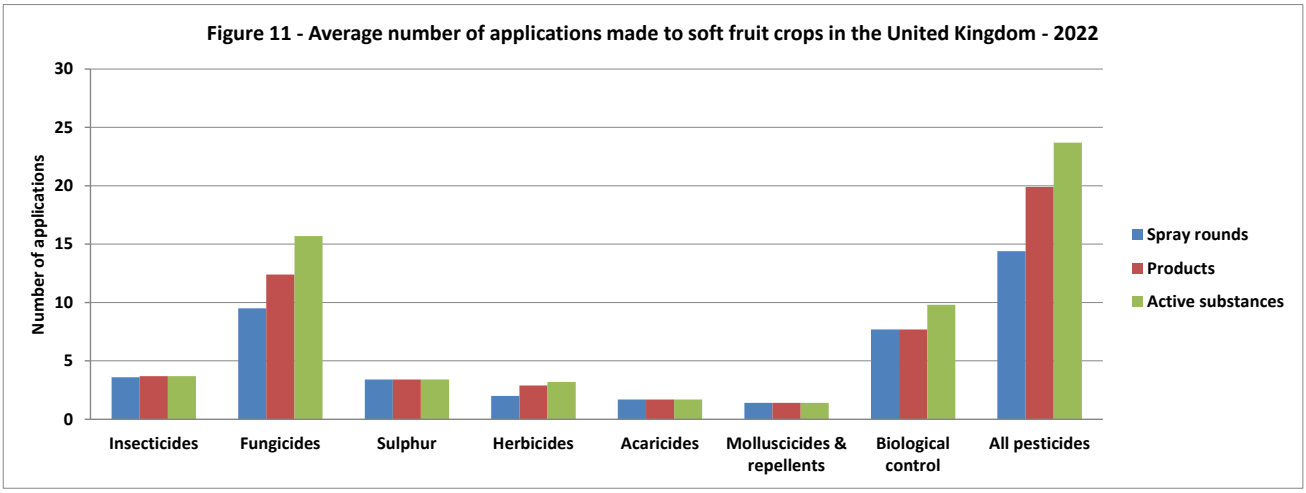


Figure 11 is based on Tables 4a, 4b and 4c (in Appendix 1 – Application Tables) and shows the average number of spray rounds (number of passes of application machinery into a field), pesticide products and number of active substances used on each crop.

Spray rounds can include a single product or a tank mix of several products. These tank mixes can include multiple insecticides, fungicides, herbicides, acaricides etc. or can include mixtures of all chemical groups. Products can include formulations of more than one active substance.

This explains why, in the chart below, the number of spray rounds is always the smallest number and active substances the largest. The use of tank mixing and multiple spray rounds results in overall treated areas greater than the area grown.



PESTICIDE USAGE ON STRAWBERRIES

- **3,297 hectares of strawberries grown in the United Kingdom**
- **89,943 treated hectares**
- **43.7 tonnes of formulation applied**
- **2% of strawberries remained untreated**
- **Strawberries received on average 15 fungicide, 9 biological control agent, 4 insecticide, 3 sulphur, 2 acaricide, 1 herbicide and 1 molluscicide spray rounds**
- **71% of the crop was one year old or less, 24% was between 1 & 2 years and 5% was over 2 years old**
- **19% of the crop was grown directly in the soil with the remainder being grown in bags or troughs. Approximately 79% of the crop was grown on a table-top system to ease picking and reduce pest pressure**
- **22% of the crop was either planted through a ground mulch (polythene or woven fabric), bags were placed on a mulch or a ground mulch was used beneath the table-tops**
- **85% of all crops by area grown was covered by tunnels**
- **90% of the harvested crop area was grown for the fresh-market, 9% for pick-your-own and 1% for processing**
- **The main varieties encountered included Malling Centenary, Murano, Favori and Magnum**

Figure 12 - Usage of pesticides on strawberries - 2022

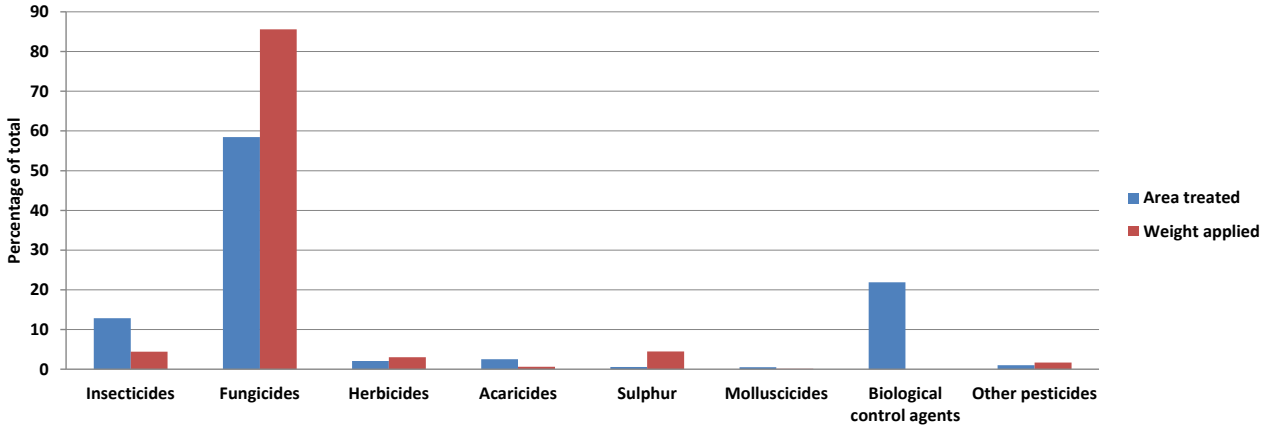


Figure 13 - Timing of pesticide applications on strawberries - disease and weed control - 2022

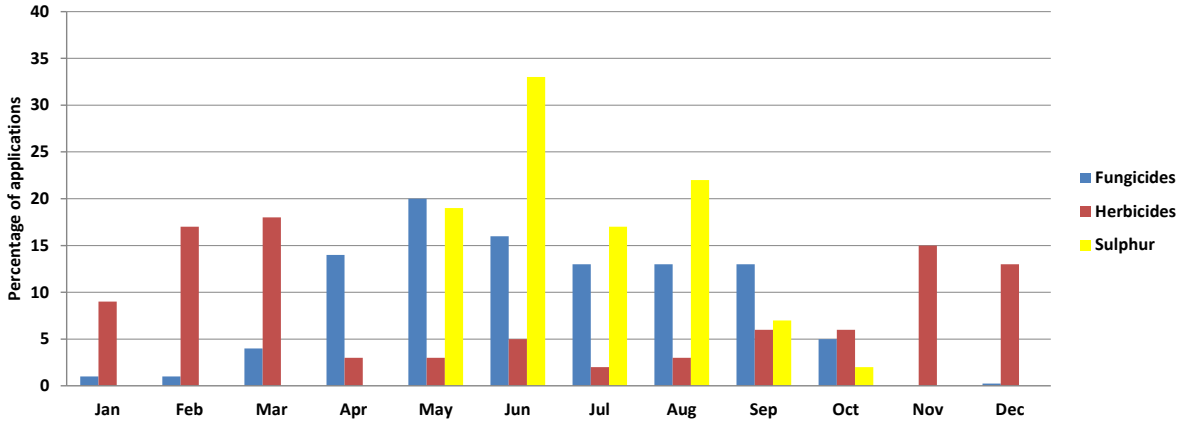
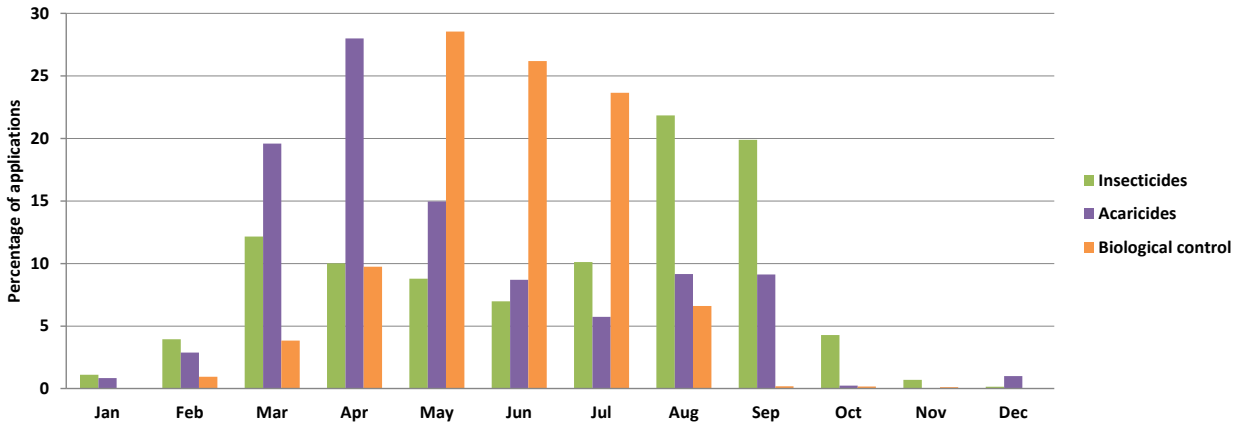


Figure 14 - Timing of pesticide applications on strawberries - pest control - 2022



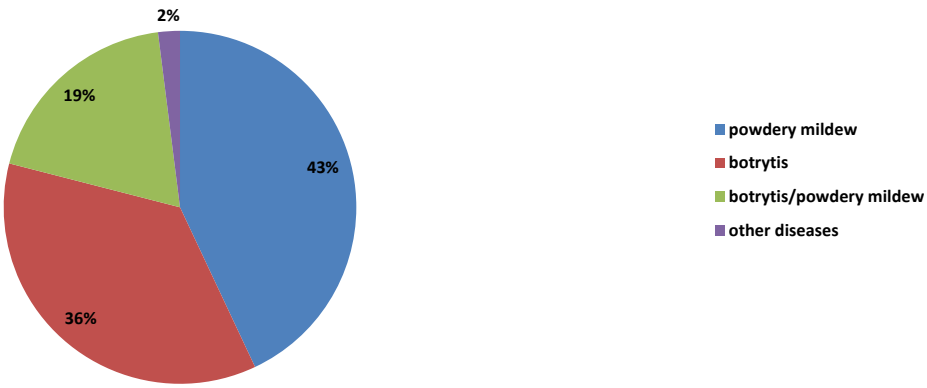
Strawberries – Fungicides

- **Formulation area treated: 52,582 hectares**
- **Weight of formulations applied: 37.4 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Difenoconazole/fluxapyroxad	4,921	360	0.09	0.79	1.96	0.98
Bacillus subtilis strain QST 713	4,621	322	0.09	0.46	3.18	0.70
Fenhexamid	3,689	2,288	0.07	0.60	1.91	0.83
Fluopyram/trifloxystrobin	3,635	1,437	0.07	0.68	1.67	0.99
Cyprodinil/fludioxonil	3,236	1,970	0.06	0.65	1.56	0.97

Use of the commodity chemical potassium hydrogen bicarbonate (potassium bicarbonate) for powdery mildew control accounted for 5% of the fungicide treated area, but for 38% of the weight of fungicides applied, reflecting its relatively high rate of application.

Figure 15 - Strawberries - Reasons for use of fungicides (where given)



Strawberries – Sulphur

- **Formulation area treated: 527 hectares**
- **Weight of formulations applied: 2.0 tonnes**

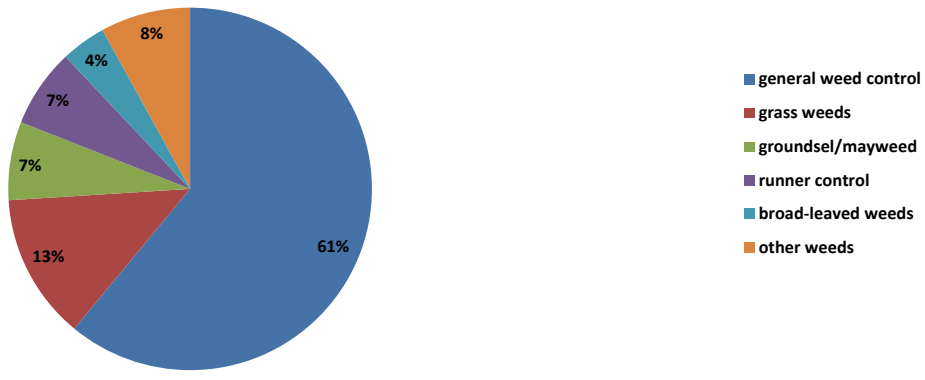
Usage of sulphur accounted for 1% of the area treated and 4% of the weight applied. Control of powdery mildew was the only reason cited for sulphur use on strawberries.

Strawberries – Herbicides

- **Formulation area treated: 1,862 hectares**
- **Weight of formulations applied: 1.3 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Glyphosate	459	569	0.25	0.14	1.00	0.76
Carfentrazone-ethyl	326	7	0.18	0.09	1.06	0.64
Isoxaben	173	34	0.09	0.05	1.16	0.87
Pendimethalin	161	189	0.09	0.05	1.01	0.93
Clethodim	153	20	0.08	0.04	1.00	0.74

Figure 16 - Strawberries - Reasons for use of herbicides (where given)



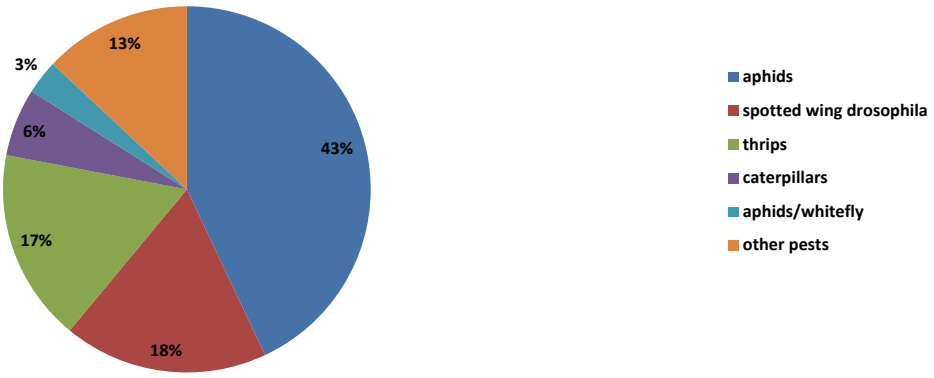
Strawberries – Insecticides

- **Formulation area treated: 11,572 hectares**
- **Weight of formulations applied: 1.9 tonnes**

The five most common formulations were:

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Spirotetramat	2,820	276	0.24	0.70	1.22	0.98
Spinosad	2,651	178	0.23	0.47	1.77	volumetric
Cyantraniliprole	2,012	149	0.17	0.37	1.71	0.99
Lambda-cyhalothrin	1,918	15	0.17	0.45	1.38	0.62
Bacillus thuringiensis var. *kurstaki*	941	369	0.08	0.11	2.62	volumetric

Figure 17 - Strawberries - Reasons for use of insecticides (where given)



Strawberries – Biological control

- **Formulation area treated: 19,711 hectares**
- **Weight of formulations applied: N/A**
- **The five most common biological control agents were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of biological control – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Neoseiulus cucumeris	8,711	.	0.44	0.47	5.22	.
Phytoseiulus persimilis	4,476	.	0.23	0.40	3.62	.
Orius laevigatus	1,739	.	0.09	0.11	4.64	.
Orius spp.	1,626	.	0.08	0.24	2.06	.
Aphelinus abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Ephedrus cerasicola/Praon volucre	1,201	.	0.06	0.25	1.62	.

Neoseiulus cucumeris was used primarily for the control of thrips; *Phytoseiulus persimilis* for the control of two-spotted spider mite; *Orius laevigatus* and *Orius* spp*.* for thrip control and *Aphidius* spp./*Ephedrus cerasicola* and *Praon volucre* for aphid control.

Bumble bees alone were important for the pollination of 53% of the area of crops grown. Honey bees alone, a combination of both honey bees and bumble bees, or flies were important for pollination of a further 19% and no pollinators were specified for the remaining 28% of the area grown.

Strawberries – Acaricides

- **Formulation area treated: 2,283 hectares**
- **Weight of formulations applied: 0.3 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of acaricide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Bifenazate	1,091	107	0.48	0.28	1.16	0.68
Clofentezine	559	105	0.24	0.16	1.02	0.94
Etoxazole	316	12	0.14	0.10	1.00	volumetric
Cyflumetofen	223	45	0.10	0.07	1.00	1.00
Abamectin	93	1	0.04	0.02	1.54	volumetric

Where specified, 93% percent of acaricide applications were for two-spotted spider mite alone, with the remaining 7% for both aphids and two-spotted spider mite.

Strawberries – Other pesticides

Molluscicide applications comprised 1% of the total treated area of strawberries. Ferric phosphate accounted for 99% of the molluscicide-treated area, metaldehyde the remaining 1%.

Unspecified physical control agents accounted for 1% of the pesticide treated area and 2% of the weight of pesticides applied to strawberries.

PESTICIDE USAGE ON BUSH FRUIT

Blackcurrants – fresh market

- 44 hectares of blackcurrants grown for the fresh market in the United Kingdom
- 174 treated hectares
- 0.1 tonnes of formulation applied
- 32% of blackcurrants – fresh market remained untreated
- Blackcurrants grown for the fresh market received on average 3 fungicide, 2 sulphur, 2 herbicide, 2 acaricide and 1 insecticide spray rounds
- 13% of the crop was five years old or less, 46% was between six and ten years and 41% was over ten years old
- All crops encountered were grown in the soil and there was no use of tunnels
- Approximately 56% of the crop area was grown for the pick-your-own market and 44% for fresh market
- Ben Conan, Ben Sarek, Ebony and Ben Lomond were the four main varieties encountered

Figure 18 - Usage of pesticides on blackcurrants - fresh market - 2022

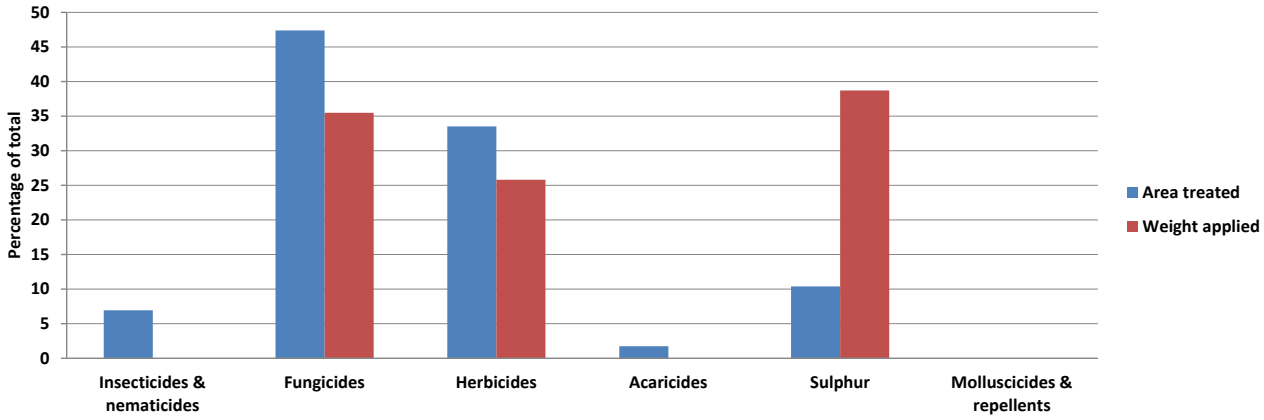
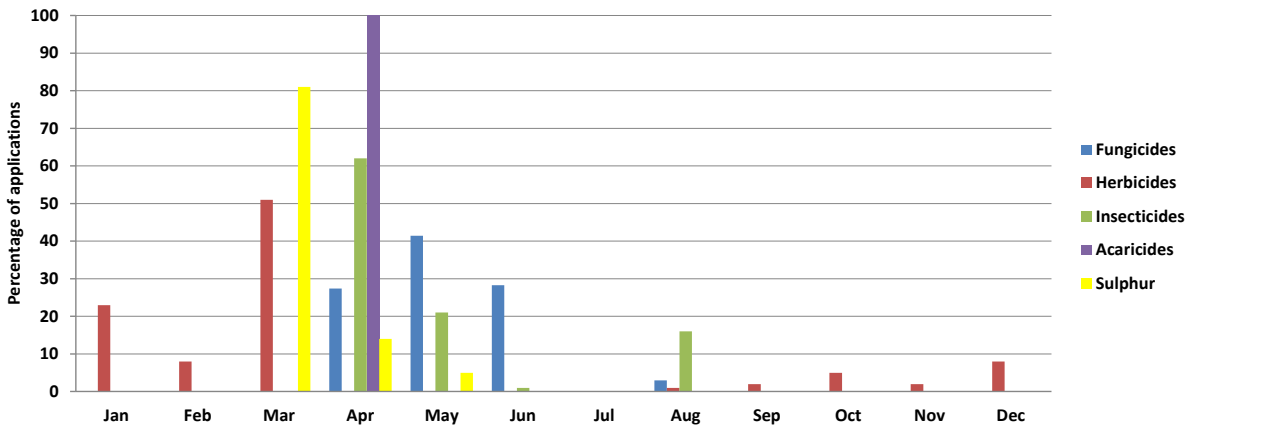


Figure 19 - Timing of pesticide applications on blackcurrants - fresh market - 2022

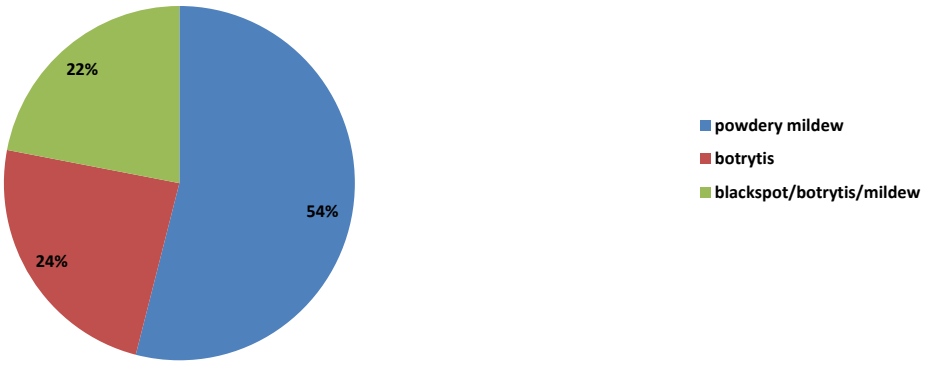


Blackcurrants – fresh market – Fungicides

- **Formulation area treated: 82 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Cyprodinil/fludioxonil	25	16	0.31	0.31	1.85	1.00
Boscalid/pyraclostrobin	24	10	0.29	0.47	1.16	0.86
Myclobutanil	13	1	0.15	0.16	1.78	1.00
Pyrimethanil	7	3	0.08	0.16	1.00	0.50
Penconazole	5	<1	0.06	0.04	2.54	0.98

Figure 20 - Blackcurrants - fresh market - Reasons for use of fungicides (where given)



Sulphur accounted for 10% of the area treated and 38% of the weight of pesticides applied to blackcurrants for fresh market. Seventy-two percent of sulphur applications were used for mildew, 26% for big bud mite and the remaining 2% for both botrytis and mildew.

Blackcurrants – fresh market – Herbicides

- **Formulation area treated: 58 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Glyphosate	13	9	0.23	0.29	1.05	0.83
Pendimethalin	12	6	0.20	0.24	1.13	0.99
Flufenacet/metribuzin	8	3	0.14	0.19	1.00	1.00
Clopyralid	7	1	0.12	0.15	1.00	1.00
Propyzamide	6	3	0.11	0.14	1.00	0.74

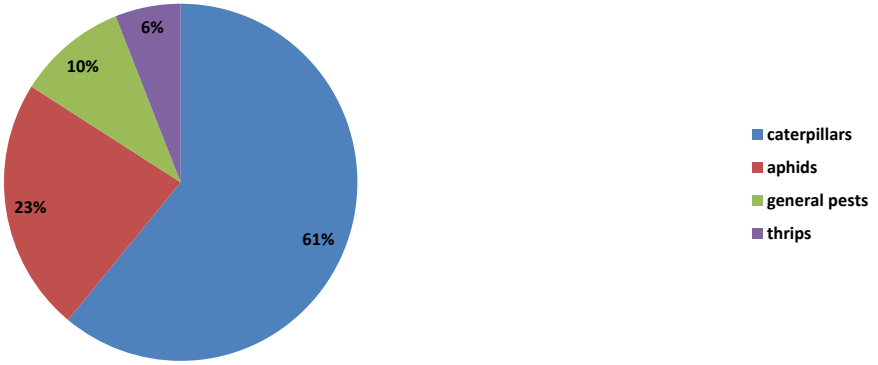
Figure 21 - Blackcurrants - fresh market - Reasons for use of herbicides (where given)

Blackcurrants – fresh market – Insecticides

- **Formulation area treated: 12 hectares**
- **Weight of formulations applied: <0.001 tonnes**
- **The four formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Lambda-cyhalothrin	7	<1	0.60	0.16	1.00	0.91
Spirotetramat	3	<1	0.21	0.06	1.00	1.00
Thiacloprid	2	<1	0.13	0.04	1.00	1.00
Spinosad	1	<1	0.06	0.02	1.00	1.00

Figure 22 - Blackcurrants - fresh market - Reasons for use of insecticides (where given)



Blackcurrants – fresh market – Other pesticides

There was limited usage of acaricides, molluscicides and physical control agents on blackcurrants – fresh market.

Honeybees situated on the farm were important for the pollination of 35% of the area of crops grown. No pollinators were specified for the for the remaining 65% of the area grown.

Blackcurrants - processing

- **2,537 hectares of blackcurrants grown for processing in the United Kingdom**
- **32,424 treated hectares**
- **40.8 tonnes of formulation applied**
- **3% of blackcurrants grown for processing remained untreated**
- **Blackcurrants grown for processing received on average 4 fungicide, 3 herbicide, 2 insecticide, 2 sulphur and 2 molluscicide spray rounds**
- **59% of the crop was five years old or less, 29% was between six and ten years and 12% was over ten years old**
- **All crops encountered were grown in the soil and there was no use of tunnels**
- **6% of the crop was not harvested as it had either been recently planted or been pruned back to regenerate the crop and improve fruiting in future years**
- **Ben Starav, Ben Klibrek, Ben Gairn, Ben Alder and Ben Hope were the five main varieties grown**

Figure 23 - Usage of pesticides on blackcurrants - processing - 2022

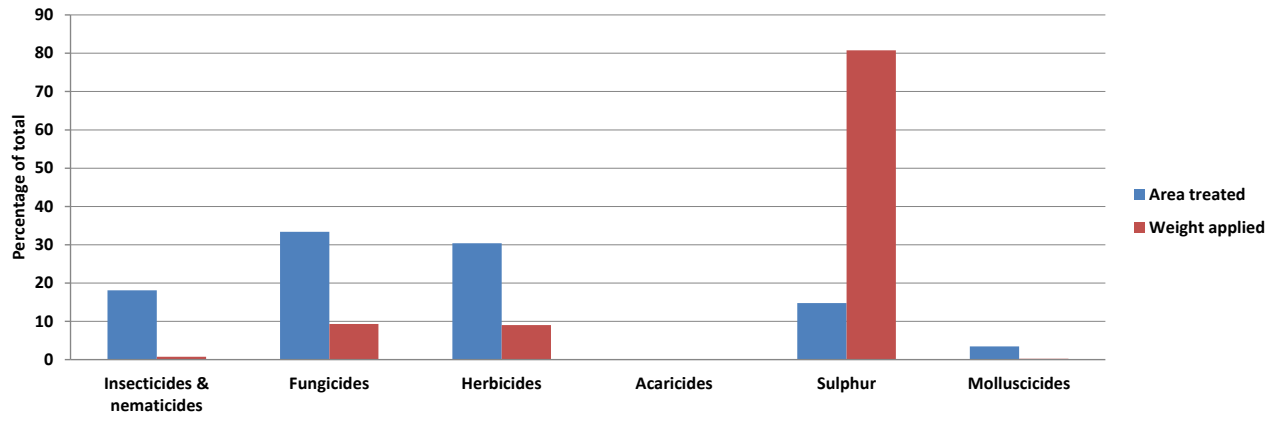
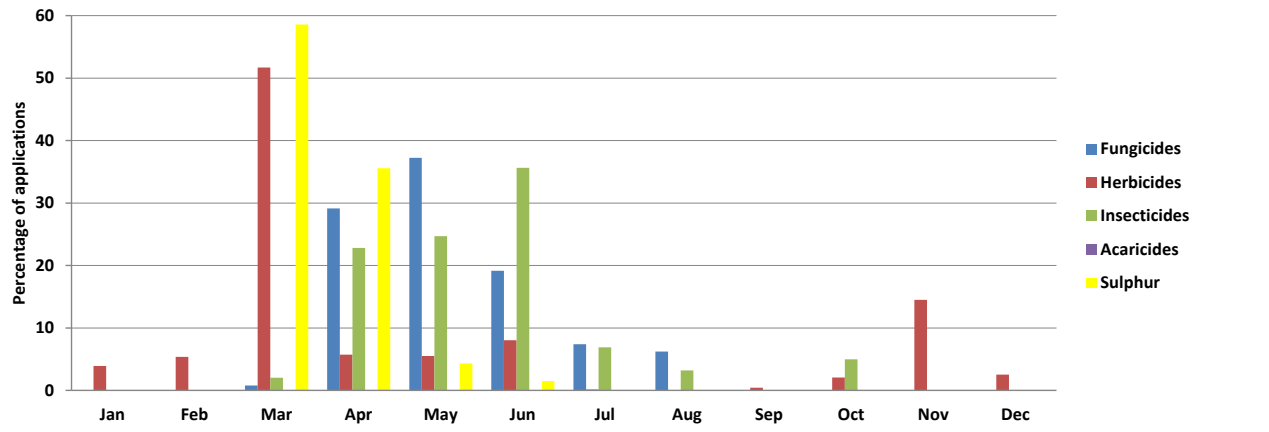


Figure 24 - Timing of pesticide applications on blackcurrants - processing - 2022

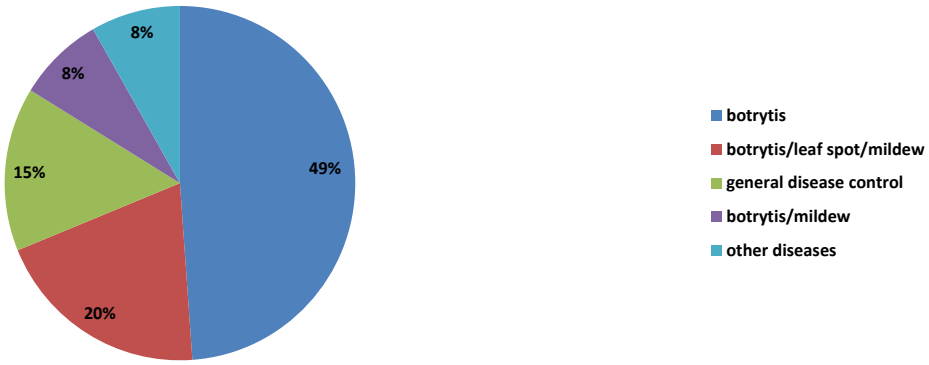


Blackcurrants – processing – Fungicides

- **Formulation area treated: 10,812 hectares**
- **Weight of formulations applied: 3.8 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Boscalid/pyraclostrobin	2,698	1,309	0.25	0.75	1.35	0.97
Myclobutanil	2,421	182	0.22	0.61	1.61	0.83
Kresoxim-methyl	1,933	193	0.18	0.60	1.38	1.00
Cyprodinil/fludioxonil	1,717	1,011	0.16	0.66	1.03	0.94
Pyrimethanil	910	634	0.08	0.33	1.11	0.87

Figure 25 - Blackcurrants - processing - Reasons for use of fungicides (where given)



Blackcurrants – processing – Sulphur

- **Formulation area treated: 4,790 hectares**
- **Weight of formulations applied: 32.9 tonnes**

Sulphur accounted for 15% of the pesticide treated area, but for 81% of the weight of pesticides applied. Control of blackcurrant big bud mite (blackcurrant gall mite, *Cecidophyopsis ribis*) was the only reason specified for sulphur usage on blackcurrants for processing.

Blackcurrants – processing – Herbicides

- **Formulation area treated: 9,845 hectares**
- **Weight of formulations applied: 3.7 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Glyphosate	2,875	1,393	0.29	0.74	1.63	0.63
Pendimethalin	1,819	898	0.18	0.72	1.00	0.94
Flufenacet/metribuzin	1,735	691	0.18	0.68	1.00	0.94
Carfentrazone-ethyl	1,502	18	0.15	0.59	1.01	0.65
Propyzamide	1,014	569	0.10	0.40	1.00	0.81

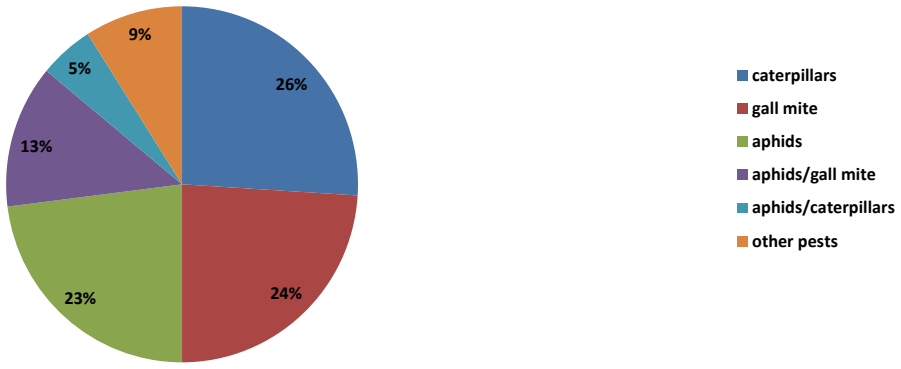
Ninety-seven percent of herbicide applications to blackcurrants for processing were used for general weed control, 2% for nettles and the remaining 1% for thistles and grass weeds.

Blackcurrants – processing – Insecticides

- **Formulation area treated: 5,862 hectares**
- **Weight of formulations applied: 0.3 tonnes**
- **The four formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Spirotetramat	2,752	201	0.47	0.72	1.58	0.94
Lambda-cyhalothrin	1,856	15	0.32	0.49	1.49	0.81
Spinosad	929	89	0.16	0.32	1.02	1.00
Deltamethrin	324	2	0.06	0.12	1.11	0.98

Figure 26 - Blackcurrants - processing - Reasons for use of insecticides (where given)



Blackcurrants – processing – Other pesticides

Molluscicides accounted for 3% of the total pesticide treated area of blackcurrants for processing. Ferric phosphate was the only molluscicide active substance encountered.

Honey bees situated on the farm were important for the pollination of 16% of the area of crops grown. No pollinators were specified for the remaining 84% of the area grown.

Redcurrants & whitecurrants

- **41 hectares of redcurrants & whitecurrants grown in the United Kingdom**
- **131 treated hectares**
- **0.1 tonnes of formulation applied**
- **45% of redcurrants & whitecurrants remained untreated**
- **Redcurrants & whitecurrants received on average 3 fungicide, 2 herbicide, 2 insecticide and 2 sulphur spray rounds**
- **12% of the crop was five years old or less, 14% was between six and ten years and 74% was over ten years old**
- **93% of the crop was grown in the soil with the remainder being grown in pots**
- **13% of the crop was grown under temporary tunnels**
- **38% of the harvested crop area was grown for the pick-your-own market, 36% for fresh market and 26% for processing (including freezing and jam making)**
- **Rovada and Jonkheer van Tets were the only redcurrant varieties encountered, and Blanka was the only whitecurrant variety encountered**

Figure 27 - Usage of pesticides on redcurrants & whitecurrants - 2022

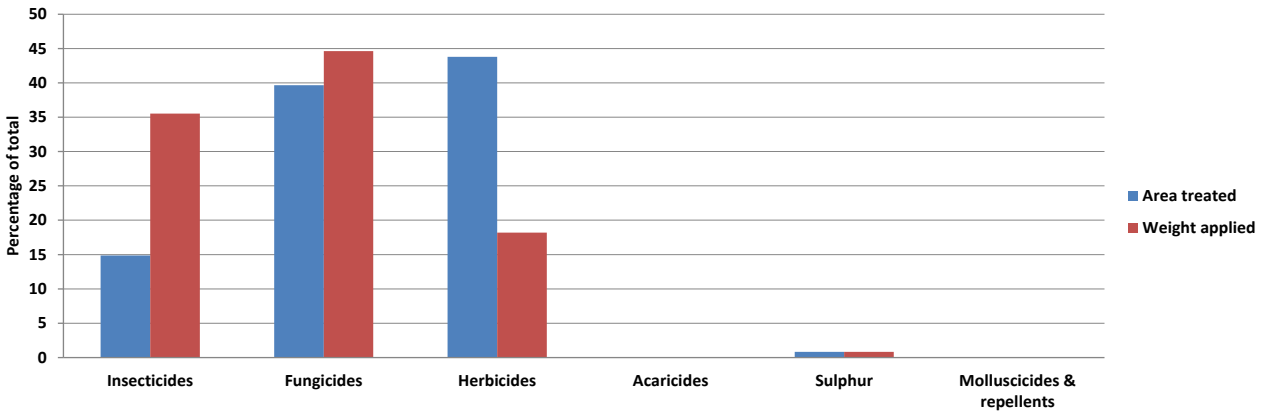
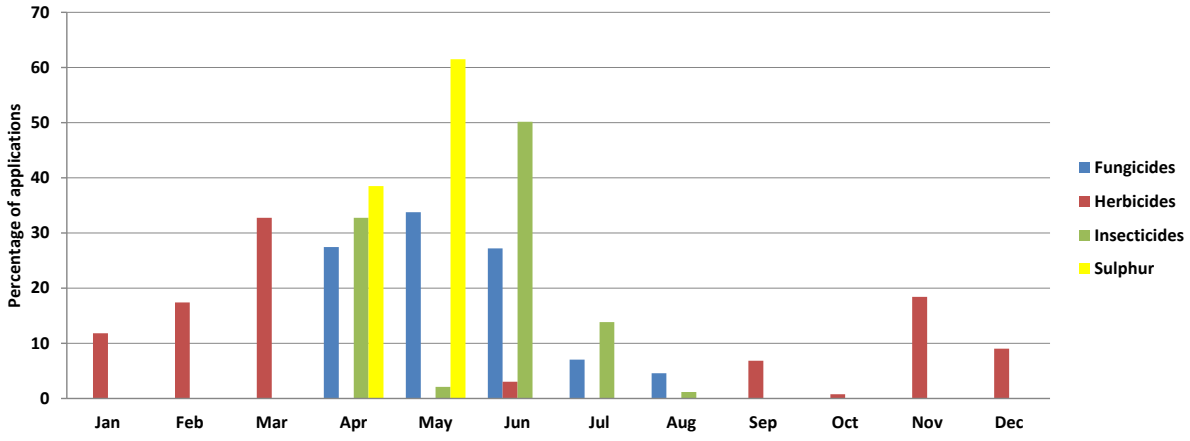


Figure 28 - Timing of pesticide applications on redcurrants & whitecurrants - 2022

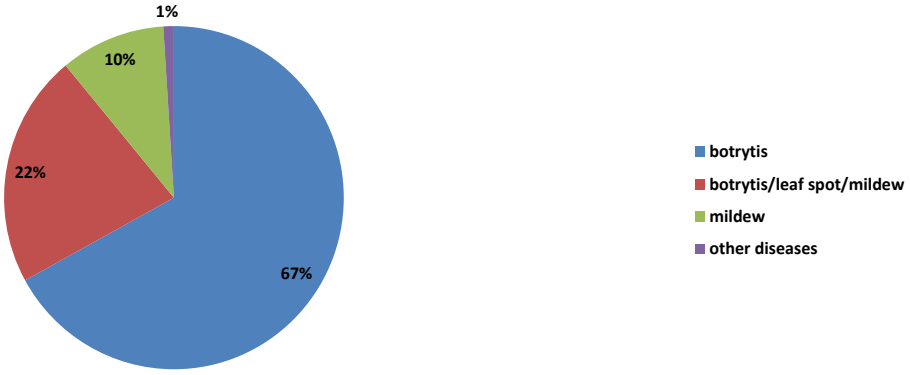


Redcurrants & whitecurrants – Fungicides

- **Formulation area treated: 48 hectares**
- **Weight of formulations applied: 0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Boscalid/pyraclostrobin	21	11	0.45	0.33	1.55	1.00
Cyprodinil/fludioxonil	13	8	0.27	0.20	1.73	1.00
Pyrimethanil	5	4	0.10	0.11	1.00	1.00
Fenhexamid	3	2	0.06	0.07	1.00	1.00
Bacillus pumilus strain QST 2808	3	29	0.06	0.07	1.00	1.00

Figure 29 - Redcurrants & whitecurrants - Reasons for use of fungicides (where given)



Redcurrants & whitecurrants – Herbicides

- **Formulation area treated: 53 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Propyzamide	12	6	0.23	0.30	1.00	0.77
Pendimethalin	12	5	0.22	0.29	1.00	0.89
Carfentrazone-ethyl	9	<1	0.17	0.16	1.34	0.65
Flufenacet/metribuzin	8	3	0.15	0.19	1.00	1.00
Glyphosate	5	4	0.09	0.11	1.00	0.98

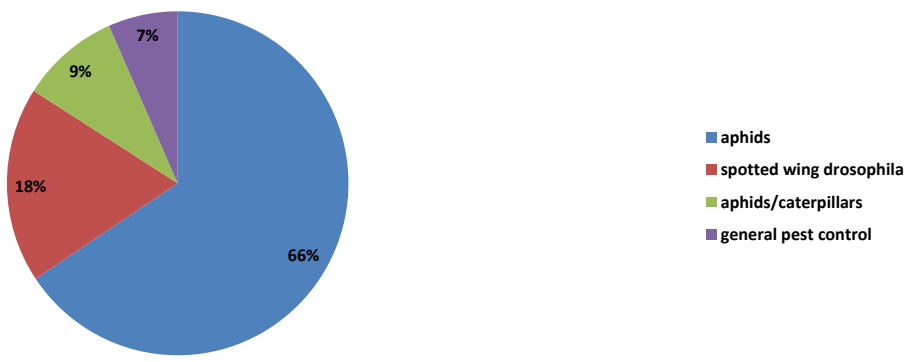
Seventy-six percent of the reasons given for herbicide use on redcurrants & whitecurrants were for general weed control; the remaining 24% was for cleavers.

Redcurrants & whitecurrants – Insecticides

- **Formulation area treated: 18 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The five formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Fatty acids C7-C20	9	42	0.49	0.07	3.00	1.00
Spinosad	3	<1	0.16	0.07	1.00	1.00
Deltamethrin	2	<1	0.14	0.06	1.00	1.00
Lambda-cyhalothrin	2	<1	0.12	0.04	1.00	0.83
Spirotetramat	2	<1	0.08	0.04	1.00	1.00

Figure 30 - Redcurrants & whitecurrants - Reasons for use of insecticides (where given)



Redcurrants & whitecurrants – Other pesticides

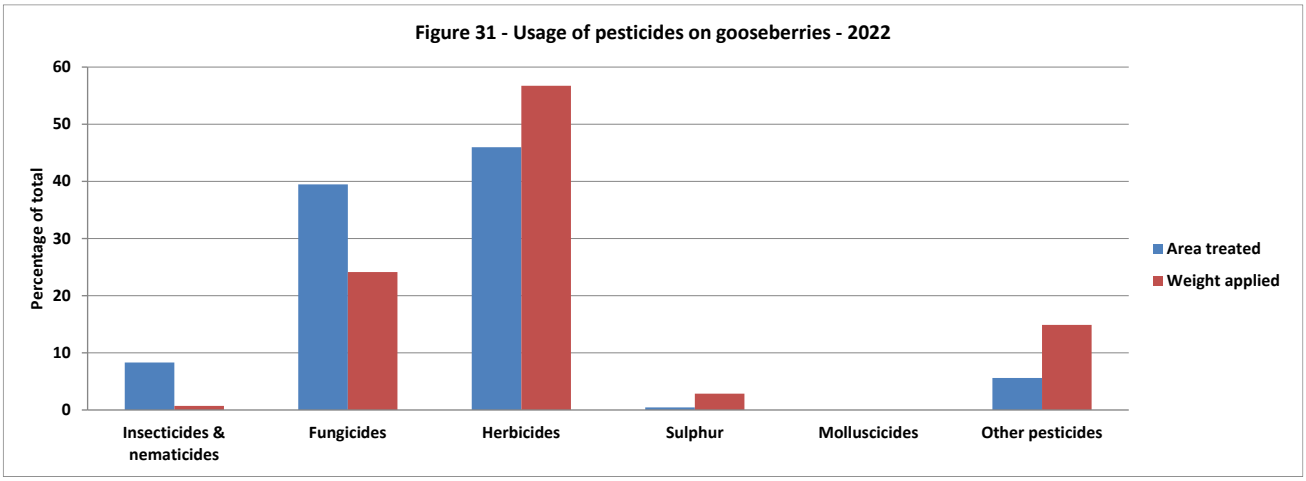
Physical control agents accounted for 9% of the pesticide treated area and weight of pesticides applied to redcurrants & whitecurrants.

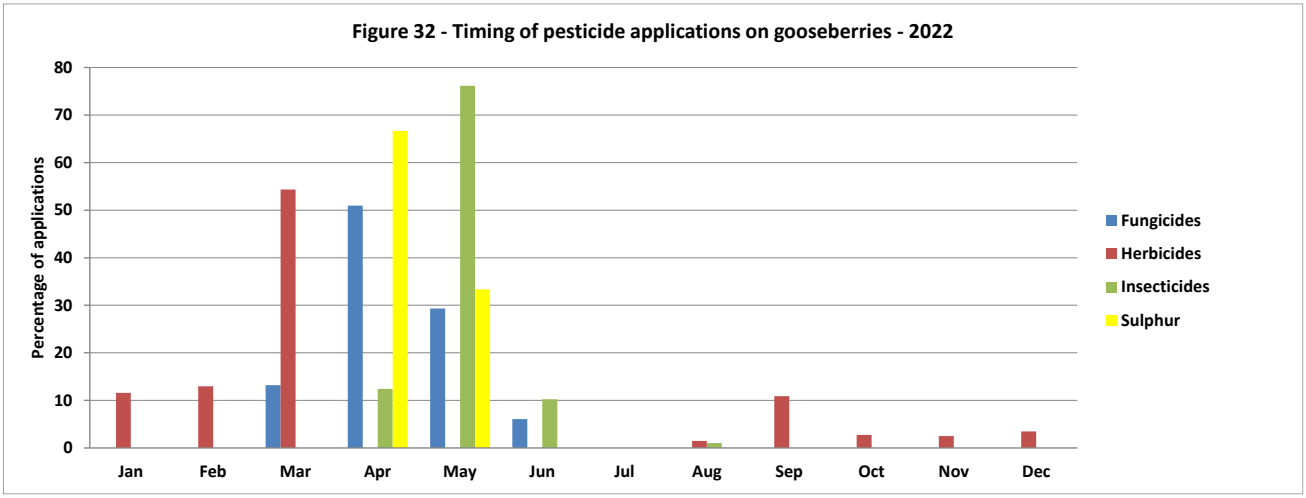
There was minimal usage of sulphur and molluscicides on redcurrants & whitecurrants.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 58% of the area of crops grown. No pollinators were specified for the remaining 42% of the area grown.

Gooseberries

- **101 hectares of gooseberries grown in the United Kingdom**
- **445 treated hectares**
- **0.1 tonnes of formulation applied**
- **25% of gooseberries remained untreated**
- **Gooseberries received on average 3 fungicide, 3 sulphur, 2 herbicide and 1 insecticide spray rounds**
- **62% of the crop was five years old or less, 10% was between six and ten years and 28% was over ten years old**
- **98% of the crop was grown in the soil with the remainder being grown in pots**
- **2% of the crop was grown in tunnels**
- **50% of the harvested crop area was grown for the fresh market, 45% for pick-your-own and 5% for processing**
- **The main varieties encountered were Invicta, Careless and Hinnonmaki Red**



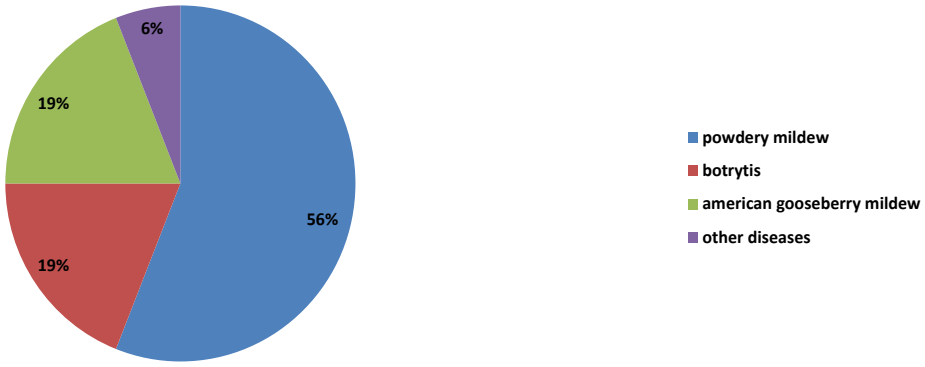


Gooseberries – Fungicides

- **Formulation area treated: 176 hectares**
- **Weight of formulations applied <0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Myclobutanil	76	7	0.43	0.28	2.70	0.98
Boscalid/pyraclostrobin	37	12	0.21	0.34	1.05	0.94
Kresoxim-methyl	24	2	0.14	0.24	1.00	1.00
Bupirimate	11	3	0.06	0.06	1.81	1.00
Cyprodinil/fludioxonil	11	7	0.06	0.11	1.00	1.00

Figure 33 - Gooseberries - Reasons for use of fungicides (where given)



Sulphur accounted for less than 1% of the total area treated and 3% of the weight of pesticides applied.

Gooseberries – Herbicides

- **Formulation area treated: 205 hectares**
- **Weight of formulations applied: 0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Glyphosate	50	37	0.24	0.47	1.06	0.89
Carfentrazone-ethyl	42	1	0.21	0.22	1.86	0.53
Pendimethalin	35	18	0.17	0.35	1.00	1.00
Flufenacet/metribuzin	28	11	0.13	0.27	1.00	1.00
Clopyralid	22	2	0.11	0.22	1.00	1.00

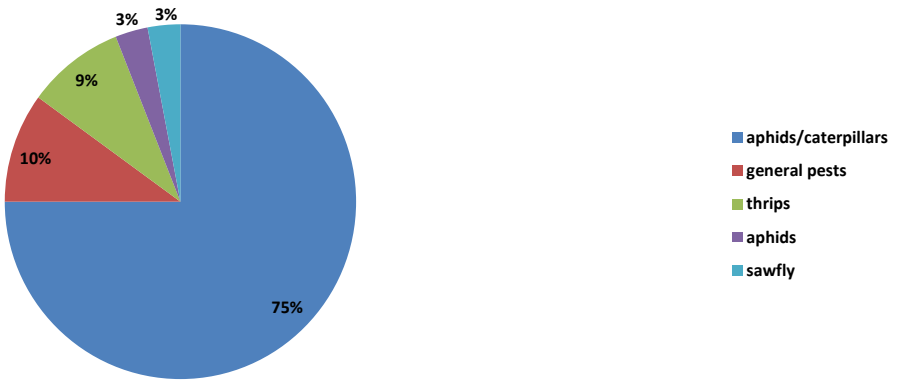
Seventy-six percent of the reasons given for herbicide use on gooseberries were for general weed control; 23% were for cleavers and the remaining 1% were for grass weeds.

Gooseberries – Insecticides

- **Formulation area treated: 37 hectares**
- **Weight of formulations applied: <0.001 tonnes**
- **The three formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Lambda-cyhalothrin	26	<1	0.70	0.25	1.00	0.91
Deltamethrin	7	<1	0.19	0.07	1.00	1.00
Spinosad	4	<1	0.11	0.04	1.00	1.00

Figure 34 - Gooseberries - Reasons for use of insecticides (where given)



Gooseberries – Other pesticides

Physical control agents accounted for 6% of the total pesticide treated area and 15% of the weight of pesticides applied to gooseberries.

There was minimal usage of molluscicides on gooseberries.

Honey bees, situated on the farm, were important for the pollination of 63% of the area of crops grown. No pollinators were specified for the remaining 37% of the area grown.

Blueberries

- **819 hectares of blueberries grown in the United Kingdom**
- **5,431 treated hectares**
- **1.9 tonnes of formulation applied**
- **23% of blueberries remained untreated**
- **Blueberries received on average 5 biological control agents, 5 fungicide, 3 insecticide, 2 sulphur and 1 herbicide spray rounds**
- **36% of the crop was five years old or less, 34% was between six and ten years and 30% was over ten years old**
- **45% of the crop was grown in pots, reflecting the acid conditions required by this crop; most of the remaining area was soil grown with a small area (1%) being grown in bags**
- **64% of the crop was grown under tunnels**
- **Almost all (95%) of the harvested crop area was grown for the fresh market with 3% for pick-your-own and 2% for processing**
- **The main varieties encountered were Liberty, Duke, Valor, Bluecrop and Last Call**

Figure 35 - Usage of pesticides on blueberries - 2022

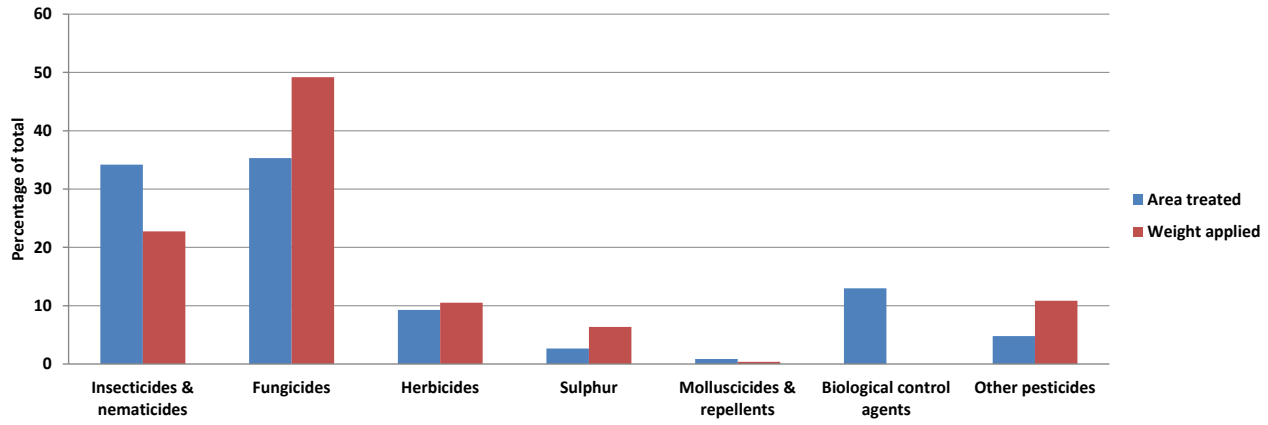
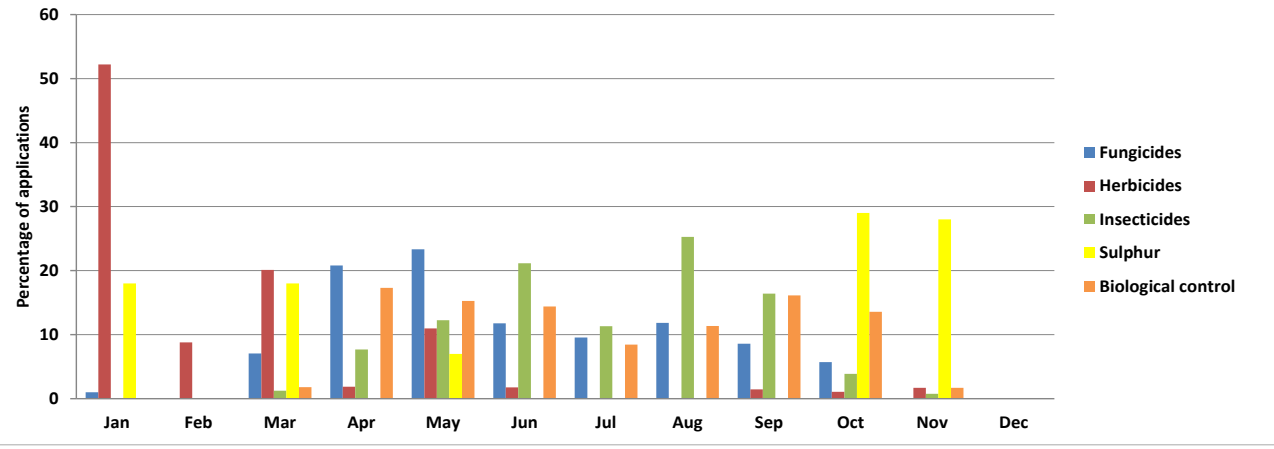


Figure 36 - Timing of pesticide applications on blueberries - 2022



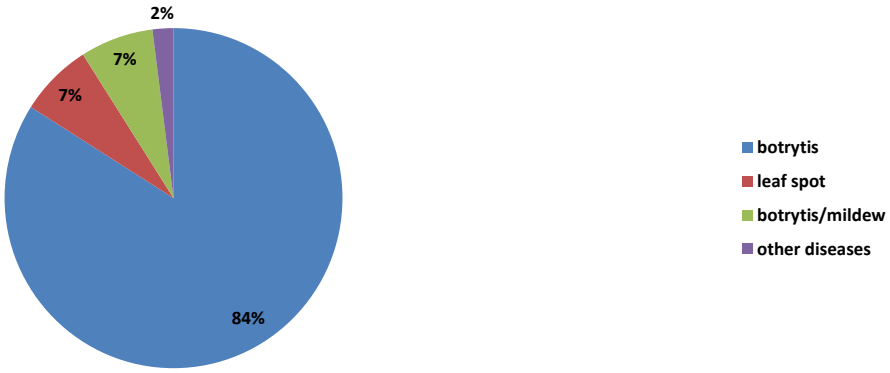
Blueberries – Fungicides

- **Formulation area treated: 1,917 hectares**
- **Weight of formulations applied: 1.0 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Cyprodinil/fludioxonil	485	263	0.25	0.48	1.27	0.87
Boscalid/pyraclostrobin	441	148	0.23	0.39	1.38	1.01
Fenhexamid	367	275	0.19	0.25	1.79	1.00
Bacillus subtilis strain QST 713	214	15	0.11	0.07	3.89	0.67
Copper oxychloride	172	119	0.09	0.08	2.56	volumetric

The high rate for boscalid/pyraclostrobin was due to a smaller number of applications at the higher recommended rate approved for other soft fruit crops.

Figure 37 - Blueberries - Reasons for use of fungicides (where given)



Sulphur accounted for 3% of the total pesticide treated area and 6% of the weight of pesticides applied to blueberries.

Blueberries – Herbicides

- **Formulation area treated: 504 hectares**
- **Weight of formulations applied: 0.2 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Carfentrazone-ethyl	153	2	0.30	0.19	1.00	0.85
Napropamide	122	96	0.24	0.15	1.00	0.53
Pendimethalin	106	39	0.21	0.13	1.00	0.50
Propyzamide	69	48	0.14	0.08	1.00	0.83
Glyphosate	30	15	0.06	0.03	1.22	0.62

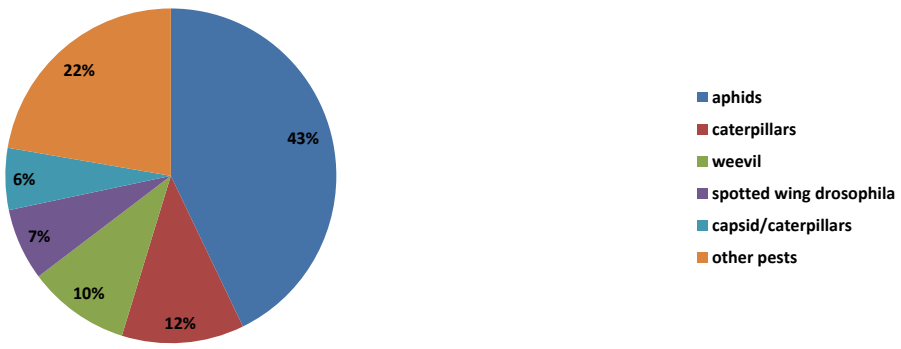
Over 99% of herbicide usage on blueberries was for general weed control, the remainder was for grass weed control.

Blueberries – Insecticides

- **Formulation area treated: 1,856 hectares**
- **Weight of formulations applied: 0.4 tonnes**
- **The five most common formulations recorded on blueberries were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Spinosad	576	52	0.31	0.55	1.35	0.95
Lambda-cyhalothrin	444	4	0.24	0.31	1.73	0.87
Spirotetramat	374	28	0.20	0.39	1.23	0.97
Cyantraniliprole	187	16	0.10	0.16	1.44	0.97
Indoxacarb	90	5	0.05	0.11	1.00	1.00

Figure 38 - Blueberries - Reasons for use of insecticides (where given)



Blueberries – Biological control

- **Formulation area treated: 704 hectares**
- **Weight of formulations applied: N/A**
- **The five biological control agents encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of biological control – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Steinernema kraussei	544	.	0.77	0.15	3.84	.
Heterorhabditis bacteriophora	115	.	0.16	0.06	2.20	.
Neoseiulus cucumeris	17	.	0.02	0.00	6.00	.
Aphidius colemani	17	.	0.02	0.01	2.00	.
Orius spp.	11	.	0.02	0.00	4.00	.

Steinernema kraussei and Heterorhabditis bacteriophora were used for vine weevil control; *Neoseiulus cucumeris* for two-spotted spider mite control; *Aphidius colemani* for aphid control and *Orius* Spp. for thrip control.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 59% of the area of crops grown. No pollinators were specified for the remaining 41% of the area grown.

Blueberries – Other pesticides

Physical control agents accounted for 4% of the treated area and 11% of the weight applied.

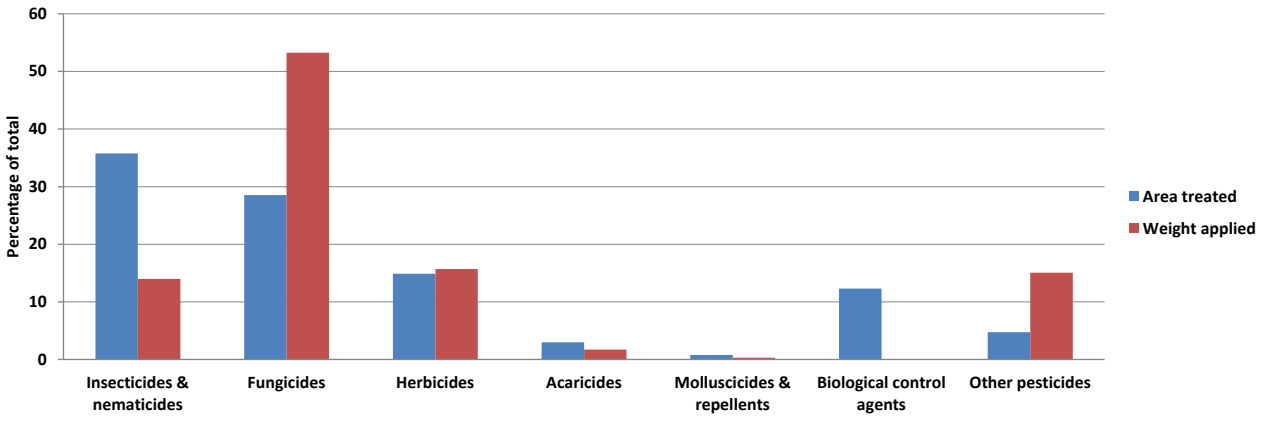
There was minimal usage of molluscicides, acaricides and growth stimulants on blueberries.

PESTICIDE USAGE ON CANE FRUIT

Raspberries

- **1,395 hectares of raspberries grown in the United Kingdom**
- **13,364 treated hectares**
- **4.6 tonnes of formulation applied**
- **4% of raspberries remained untreated**
- **Raspberries received on average 4 fungicide, 4 biological control agent, 4 insecticide, 2 herbicide and 2 acaricide spray rounds**
- **66% of the crop was one year old or less, 15% between two and five years, 12% between six and ten years and 7% over ten years old**
- **77% of the crop was grown in pots; most of the remaining area was soil grown with a small area (4%) being grown in troughs**
- **79% of the crop was grown under tunnels, the majority of which were Spanish tunnels**
- **85% of the harvested crop area was grown for the fresh market, 10% for pick-your-own and 5% for processing**
- **Maravilla, Glen Ample, Majestic and Lagorai were the principal varieties grown**

Figure 39 - Usage of pesticides on raspberries - 2022



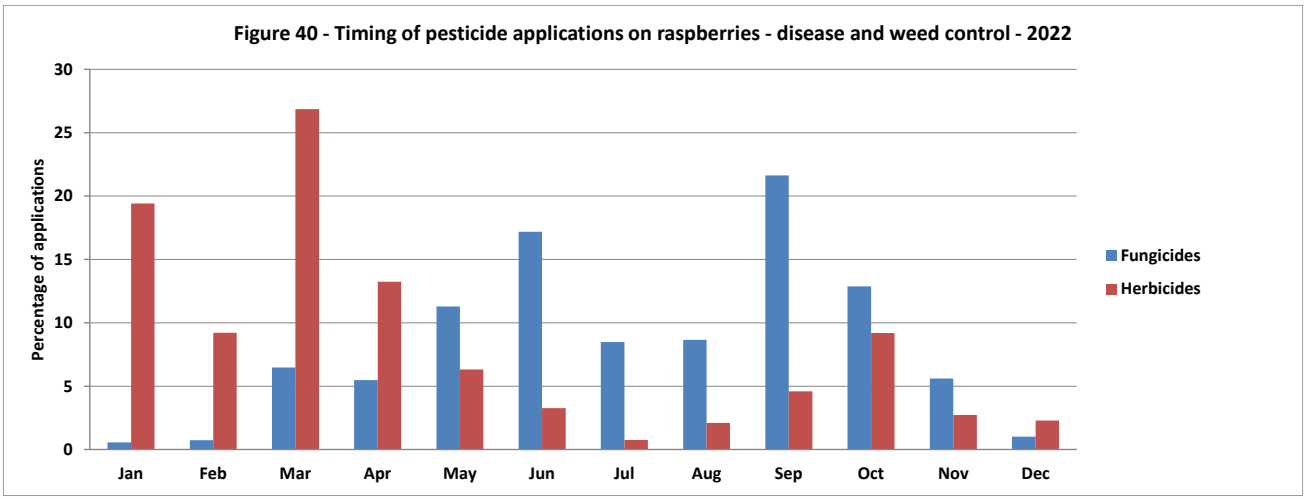


Figure 40 - Timing of pesticide applications on raspberries - disease and weed control - 2022
Percentage of applications
30
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Fungicides
Herbicides

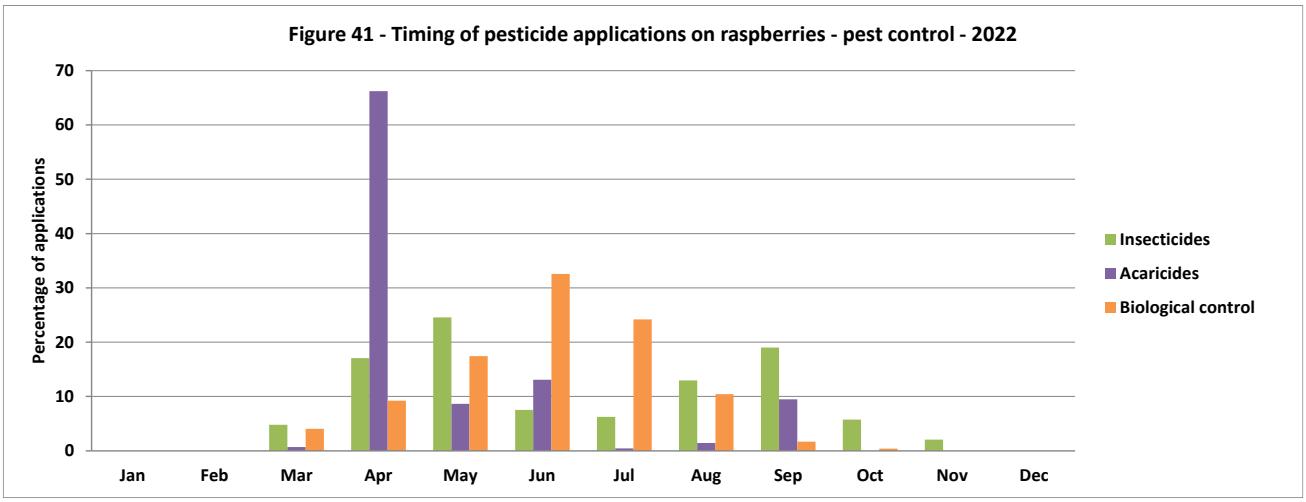


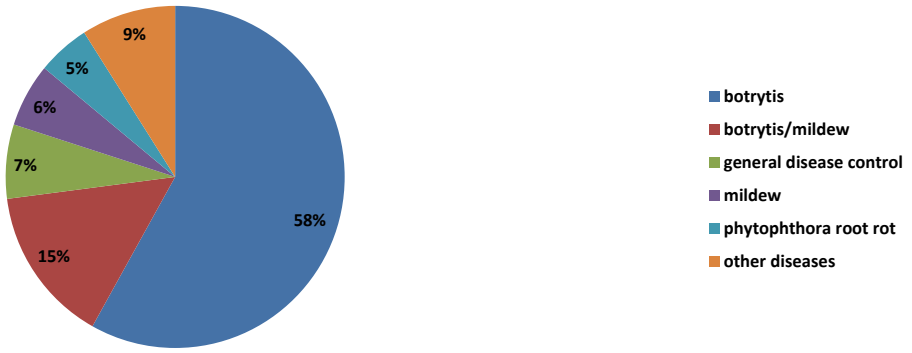
Figure 41 - Timing of pesticide applications on raspberries - pest control - 2022
Percentage of applications
70
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Insecticides
Acaricides
Biological control

Raspberries – Fungicides

- **Formulation area treated: 3,811 hectares**
- **Weight of formulations applied: 2.5 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Boscalid/pyraclostrobin	743	339	0.19	0.35	1.52	0.91
Fenhexamid	740	544	0.19	0.36	1.50	0.98
Dimethomorph	354	437	0.09	0.22	1.16	0.86
Cyprodinil/fludioxonil	340	207	0.09	0.22	1.05	0.98
Pyrimethanil	322	201	0.08	0.17	1.34	0.78

Figure 42 - Raspberries - Reasons for use of fungicides (where given)



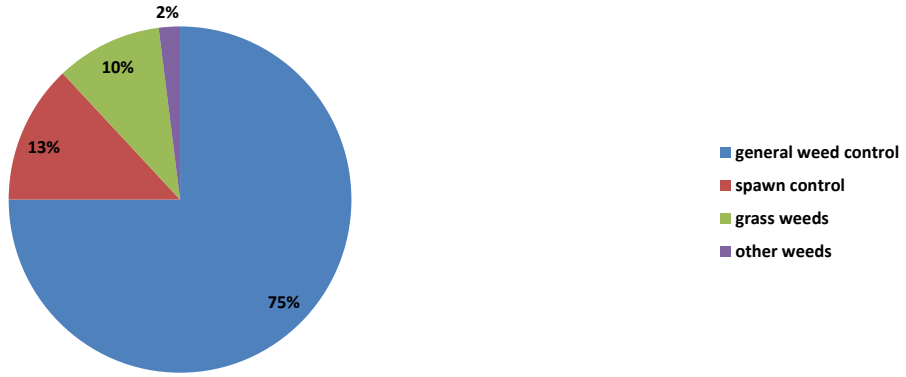
The increased use of pots standing on a woven ground cover material, particularly pots with “pot feet” where the pot is not in contact with the surface of the ground, has meant that there has been a reduction in the use of fungicides for soil-borne *Phytophthora* control.

Raspberries – Herbicides

- **Formulation area treated: 1,989 hectares**
- **Weight of formulations applied: 0.7 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Carfentrazone-ethyl	782	13	0.39	0.34	1.62	0.80
Glyphosate	501	383	0.25	0.31	1.15	0.87
Propyzamide	180	84	0.09	0.13	1.00	0.77
Clethodim	128	14	0.06	0.09	1.00	0.96
Pendimethalin	103	58	0.05	0.07	1.00	0.99

Figure 43 - Raspberries - Reasons for use of herbicides (where given)



Spawn control involves using herbicides to remove new shoots that appear at the base of the mature plants in soil grown crops.

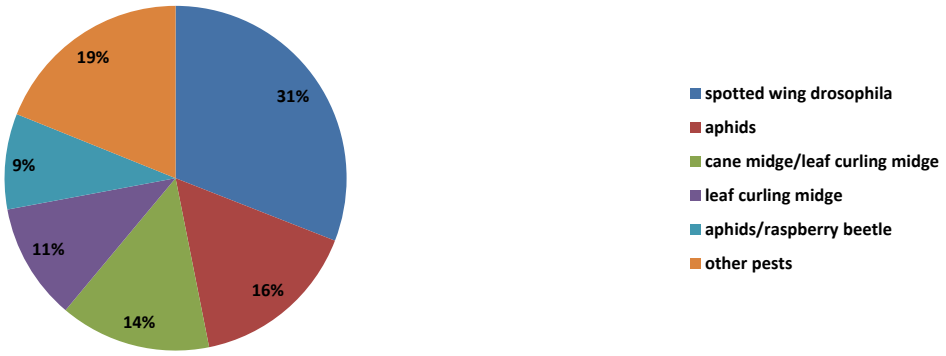
Raspberries – Insecticides

- **Formulation area treated: 4,779 hectares**
- **Weight of formulations applied: 0.6 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Deltamethrin	1,989	23	0.42	0.59	2.39	0.94
Spinosad	972	91	0.20	0.36	1.93	0.98
Lambda-cyhalothrin	924	7	0.19	0.48	1.36	1.00
Cyantraniliprole	549	49	0.11	0.32	1.24	0.99
Fatty acids C7-C20	99	441	0.02	0.05	1.57	0.93

Fatty acids C7-C20 accounted for 2% of the insecticide treated area, but for 68% of the weight of insecticides applied on raspberries, reflecting its relatively high rate of application.

Figure 44 - Raspberries - Reasons for use of insecticides (where given)



Spotted wing drosophila was a concern to many growers and accounted for 31% of the reasons given for insecticide use, in comparison to 25% in 2020 and 22% in 2018.

Raspberries – Biological control

- **Formulation area treated: 1,644 hectares**
- **Weight of formulations applied: N/A**
- **The five most common biological control agents were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of biological control – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Phytoseiulus persimilis	938	.	0.57	0.29	2.29	.
Amblyseius andersoni	191	.	0.12	0.08	1.80	.
Aphelinus abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Ephedrus cerasicola/Praon volucre	167	.	0.10	0.05	2.28	.
Aphidius abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Praon volucre	128	.	0.08	0.04	2.09	.
Heterorhabditis bacteriophora	54	.	0.03	0.04	1.00	.

Phytoseiulus persimilis and *Amblyseius andersoni* were used primarily for the control of two-spotted spider mite; *Aphidius* spp./*Ephedrus cerasicola* and *Praon volucre* for aphid control and *Heterorhabditis bacteriophora* for vine weevil control.

Both bumble bees and honey bees were important for the pollination of this crop, particularly those grown under Spanish tunnels with bees being used on 78% of the area of crops grown. No pollinators were specified for the remaining 22% of the area grown.

Raspberries – Acaricides

- **Formulation area treated: 400 hectares**
- **Weight of formulations applied: 0.1 tonnes**
- **The two formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of acaricide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Clofentezine	396	79	0.99	0.19	1.48	1.00
Abamectin	5	0	0.01	0.00	1.00	volumetric

Control of two-spotted spider mites was the only reason given for use of acaricides on raspberries.

Raspberries – Other pesticides

Physical control agents were used on 5% of the area treated and accounted for 15% of the weight applied.

Molluscicides accounted for 1% of the overall treated area. Ferric phosphate comprised 95% of molluscicide usage with metaldehyde accounting for the remaining 5%.

There was minimal use of the repellent calcium chloride.

Blackberries

- **319 hectares of blackberries grown in the United Kingdom**
- **3,404 treated hectares**
- **1.9 tonnes of formulation applied**
- **5% of blackberries remained untreated**
- **Blackberries received on average 4 biological control agent, 4 fungicide, 3 insecticide, 2 sulphur and 2 herbicide spray rounds**
- **85% of the crop was one year old or less, 5% between two and five years, 9% between six and ten years and 1% over 10 years old**
- **76% of the crop was grown in pots; most of the remaining area was soil grown with a small area (3%) being grown in troughs**
- **87% of the crop was grown under tunnels**
- **95% of the harvested crop area was grown for the fresh market, 3% for pick-your-own and 2% for processing**
- **Victoria, Loch Ness, Chester, Sweet Royalla and Von were the principal varieties grown**

Figure 45 - Usage of pesticides on blackberries - 2022

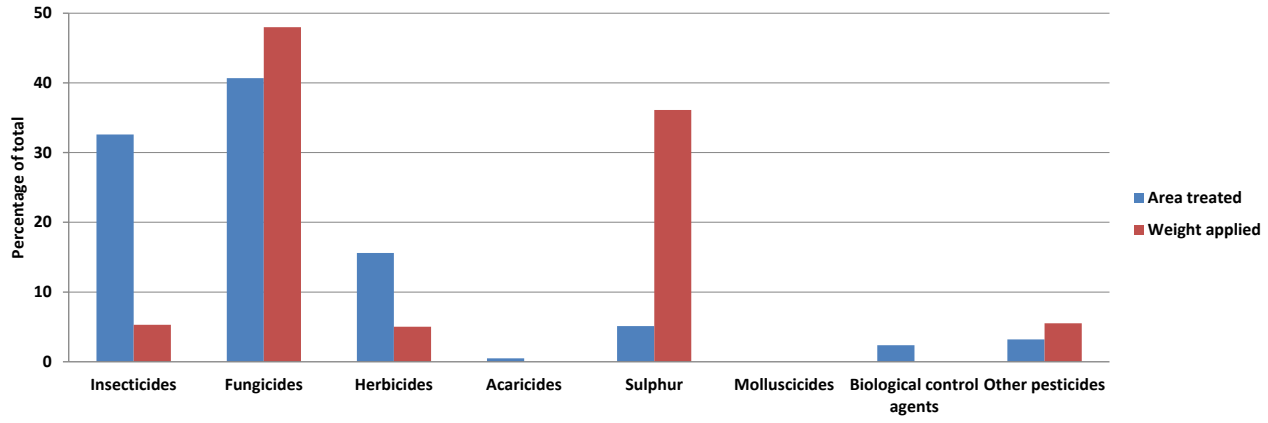
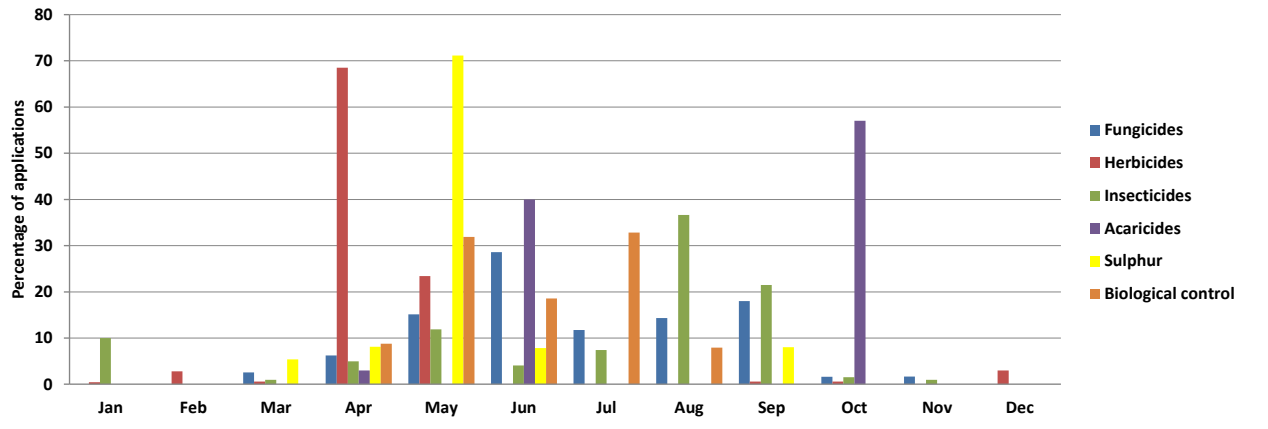


Figure 46 - Timing of pesticide applications on blackberries - 2022

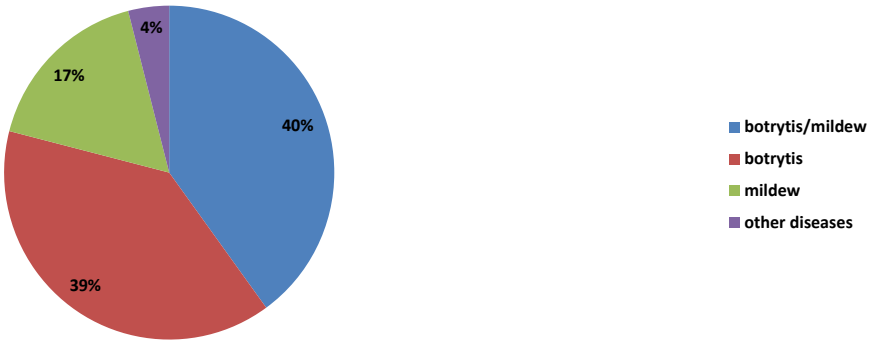


Blackberries – Fungicides

- **Formulation area treated: 1,385 hectares**
- **Weight of formulations applied: 0.9 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Boscalid/pyraclostrobin	456	195	0.33	0.86	1.61	0.85
Fenhexamid	282	203	0.20	0.55	1.59	0.96
Cyprodinil/fludioxonil	156	90	0.11	0.30	1.44	0.92
Pyrimethanil	112	84	0.08	0.27	1.18	0.93
Azoxystrobin	104	26	0.08	0.21	1.46	1.00

Figure 47 - Blackberries - Reasons for use of fungicides (where given)



Use of sulphur accounted for 5% of the treated area but comprised 36% of the weight of pesticides applied to blackberries. Red berry mite control was the only reason specified for sulphur usage on blackberries, although sulphur can also be used for disease control on blackberries.

Blackberries – Herbicides

- **Formulation area treated: 531 hectares**
- **Weight of formulations applied: 0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Carfentrazone-ethyl	263	5	0.49	0.45	1.81	0.84
Fluazifop-P-butyl	84	5	0.16	0.26	1.02	1.00
Clethodim	81	10	0.15	0.25	1.00	1.00
Glyphosate	72	64	0.14	0.23	1.00	1.00
Propyzamide	15	9	0.03	0.05	1.00	0.71

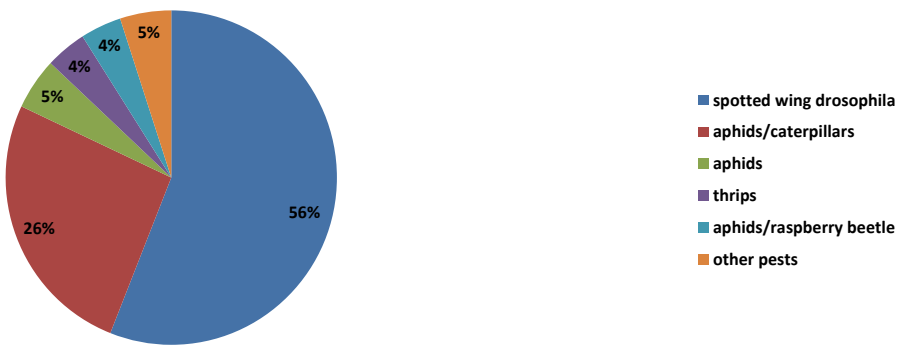
Eighty percent of the reasons given for herbicide use on blackberries were for general weed control, 19% were for grass weeds and 1% for sucker/spawn control.

Blackberries – Insecticides

- **Formulation area treated: 1,110 hectares**
- **Weight of formulations applied: 0.1 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Spinosad	408	38	0.37	0.65	1.97	0.96
Lambda-cyhalothrin	316	2	0.28	0.61	1.66	0.99
Cyantraniliprole	230	20	0.21	0.53	1.30	0.97
Deltamethrin	109	1	0.10	0.26	1.20	0.99
Beauveria bassiana ATCC-74040	37	8	0.03	0.08	1.50	0.97

Figure 48 - Blackberries - Reasons for use of insecticides (where given)



Blackberries – Biological control agents

- **Formulation area treated: 80 hectares**
- **Weight of formulations applied: N/A**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Neoseiulus cucumeris	28	.	0.35	0.04	2.34	.
Phytoseiulus persimilis	27	.	0.34	0.08	1.04	.
Steinernema carpocapsae	7	.	0.09	0.01	4.00	.
Amblyseius andersoni	7	.	0.08	0.02	1.37	.
Aphidius abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Praon volucre	4	.	0.05	0.01	2.00	.

Neoseiulus cucumeris were used primarily for the control of thrips; *Phytoseiulus persimilis* and *Amblyseius andersoni* were used primarily for the control of two-spotted spider mite; *Steinernema carpocapsae* were used for leaf midge and *Aphidius* spp./*Ephedrus cerasicola* and *Praon volucre* were for aphid control.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 90% of the area of crops grown. No pollinators were specified for the remaining 10% of the area grown.

Blackberries – Other pesticides

Physical control agents were used on 3% of the area treated and accounted for 5% of the weight applied.

There was minimal use of acaricides on blackberries (less than 1% of the total area treated), although sulphur, which can also be used for mite control accounted for 5% of the total area treated.

Hybrid berries

- **19 hectares of hybrid berries grown in the United Kingdom**
- **47 treated hectares**
- **<0.1 tonnes of formulation applied**
- **24% of hybrid berries remained untreated**
- **Hybrid berries received on average 4 herbicide and 3 fungicide spray rounds**
- **9% of the crop was five years old or less, 21% was between six and ten years and 70% was over ten years old**
- **All crops encountered were grown in the soil and there was no use of tunnels**
- **96% of the harvested crop area was grown for pick-your-own and 4% for fresh market**
- **Tayberry comprised 74% of the area of hybrid berries grown, Loganberry 21%, Tummelberry 3% and Boysenberry and Jostaberry 1% each**

Figure 49 - Usage of pesticides on hybridberries - 2022

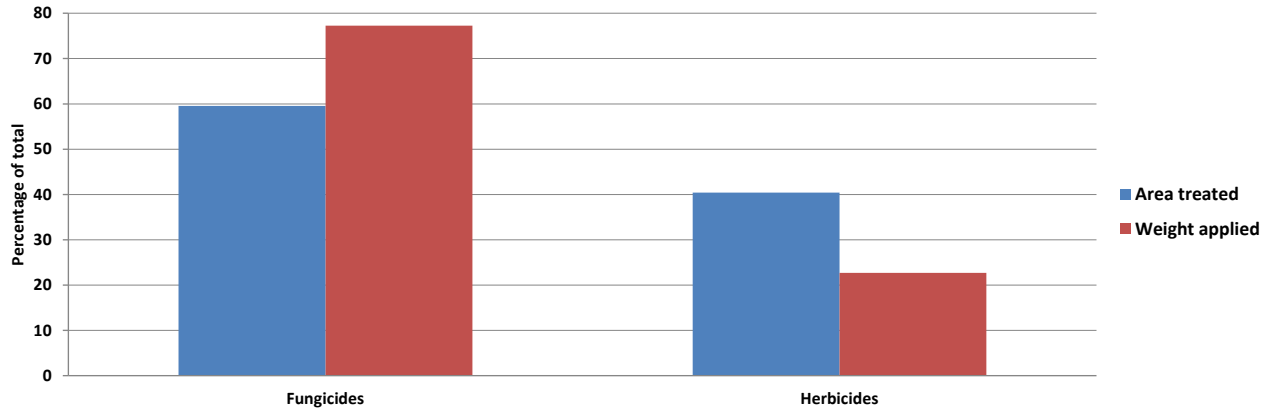
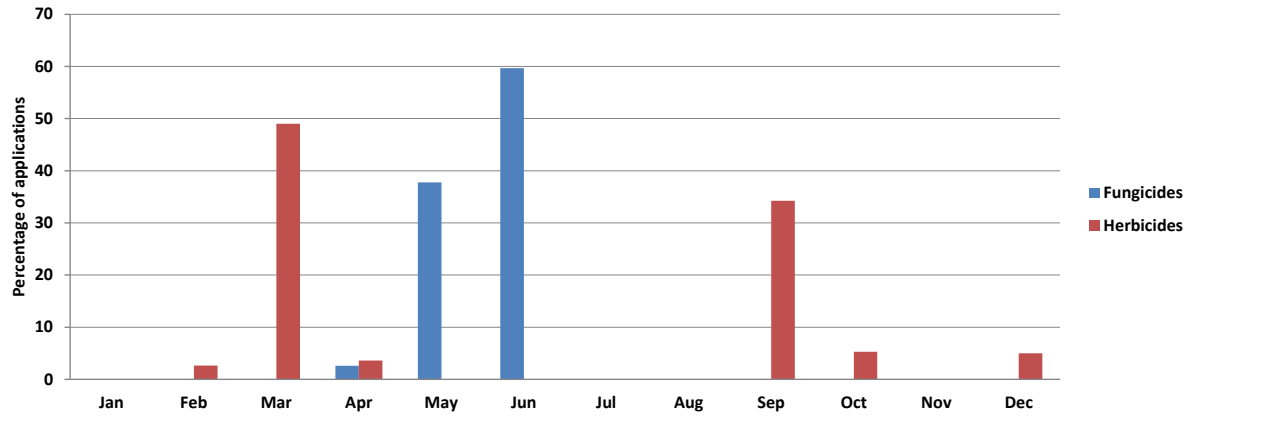


Figure 50 - Timing of pesticide applications on hybrid berries - 2022



Hybrid berries – Fungicides

- **Formulation area treated: 28 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The three formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Cyprodinil/fludioxonil	17	10	0.60	0.44	2.00	1.00
Boscalid/pyraclostrobin	9	5	0.33	0.46	1.04	0.83
Copper oxychloride	2	2	0.08	0.04	3.00	volumetric

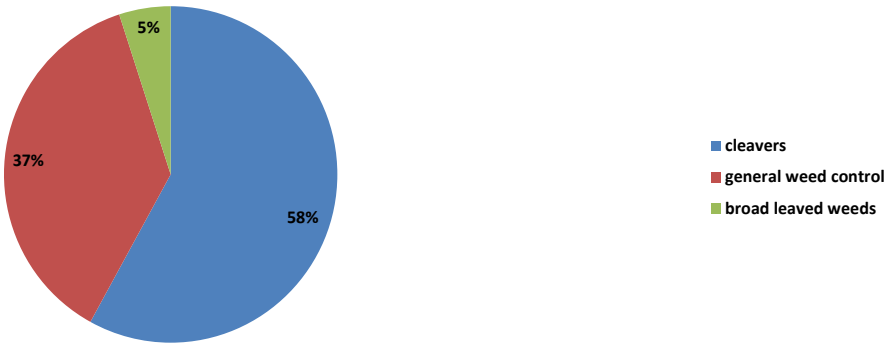
General disease control was the only reason specified for fungicide use on hybridberries.

Hybrid berries – Herbicides

- **Formulation area treated: 19 hectares**
- **Weight of formulations applied: 0.01 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Carfentrazone-ethyl	10	<1	0.51	0.25	2.08	0.49
Glyphosate	4	4	0.22	0.23	1.00	1.00
Isoxaben	1	<1	0.06	0.06	1.00	0.99
Pendimethalin	1	1	0.06	0.06	1.00	0.98
Fluazifop-P-butyl	1	<1	0.04	0.02	2.00	1.00

Figure 51 - Hybrid berries - Reasons for use of herbicides (where given)



Hybrid berries – Other pesticides

There was minimal use of the insecticide deltamethrin on hybrid berries (less than 1% of the total area treated).

Honey bees, situated on the farm, were important for the pollination of 29% of the area of crops grown. No pollinators were specified for the remaining 71% of the area grown.

PESTICIDE USAGE ON VINES

- **3,059 hectares of vines grown for wine production in the United Kingdom**
- **64,724 treated hectares**
- **57.1 tonnes of formulation applied**
- **16.8% of vines remained untreated**
- **Vines received on average 9 fungicide, 6 sulphur, 2 insecticide and 2 herbicide spray rounds**
- **41% of the crop was five years old or less, 32% was between six and ten years and 27% was over ten years old**
- **All crops were grown in the soil and there was minimal (1%) use of tunnels**
- **9% of the crop was not harvested either because of poor weather conditions or because the crop was not yet established**
- **Chardonnay, Pinot Noir, Pinot Meunier and Bacchus were the main varieties grown**

Figure 52 - Usage of pesticides on vines - 2022

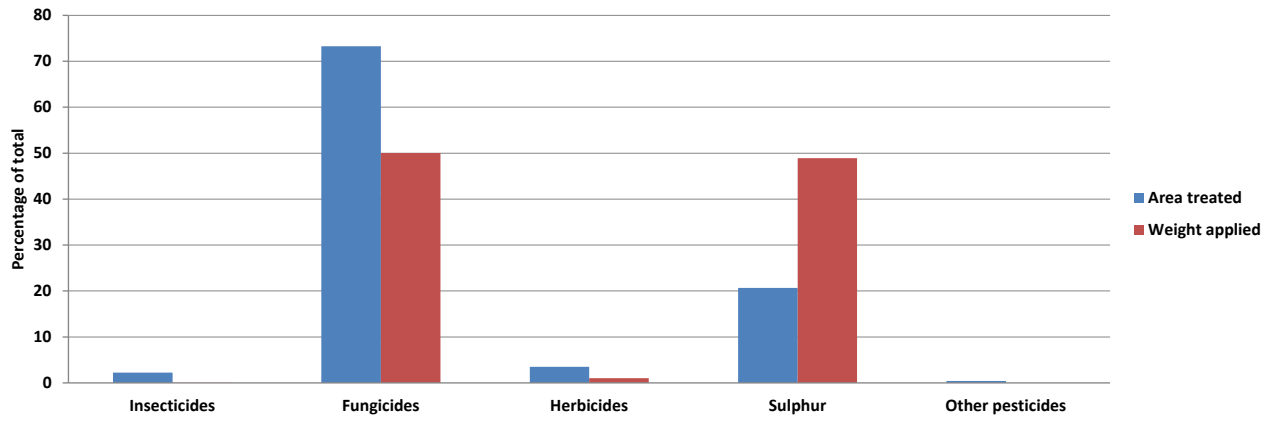
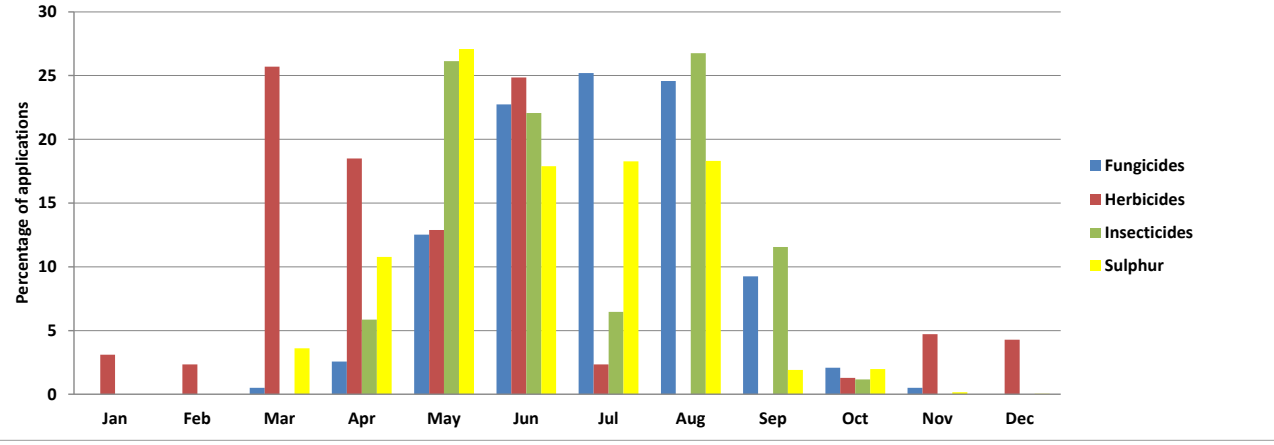


Figure 53 - Timing of pesticide applications on vines - 2022

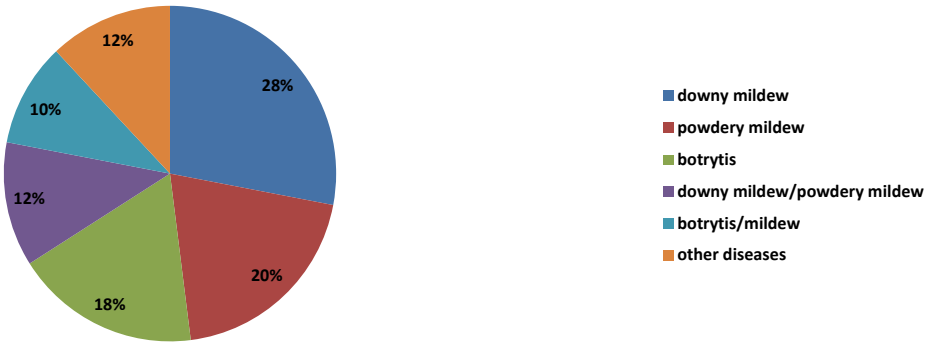


Vines – Fungicides

- **Formulation area treated: 47,409 hectares**
- **Weight of formulations applied: 28.6 tonnes**
- **The five most common formulations were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Mancozeb	3,847	3,220	0.08	0.60	1.89	0.54
Ametoctradin/dimethomorph	3,831	1,261	0.08	0.71	1.79	0.78
Copper oxychloride	3,697	2,765	0.08	0.56	2.23	0.81
Potassium hydrogen carbonate	3,425	13,201	0.07	0.43	2.53	0.52
Proquinazid	2,965	120	0.06	0.60	1.58	0.81

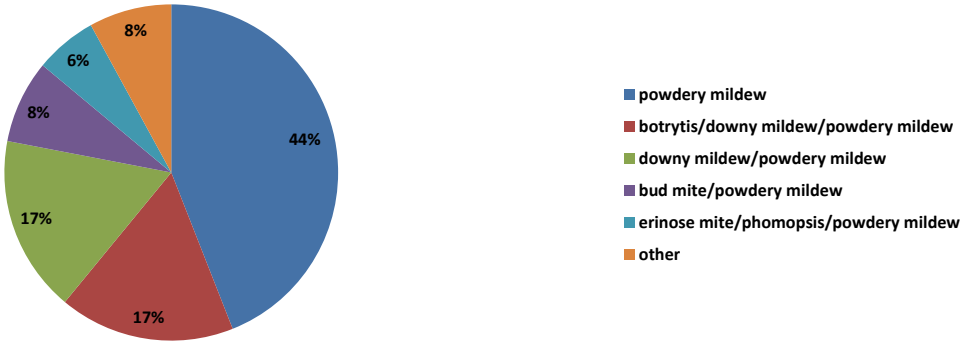
Figure 54 - Vines - Reasons for use of fungicides (where given)



Vines – Sulphur

- **Formulation area treated: 13,372 hectares**
- **Weight of formulations applied: 27.9 tonnes**

Figure 55 - Vines - Reasons for use of sulphur (where given)



Vines – Herbicides

- **Formulation area treated: 2,257 hectares**
- **Weight of formulations applied: 0.6 tonnes**
- **The four formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Glyphosate	1,384	509	0.61	0.35	1.44	0.65
Carfentrazone-ethyl	486	6	0.22	0.14	1.27	0.55
Fluazifop-P-butyl	267	1	0.12	0.09	1.00	0.05
Propyzamide	120	62	0.05	0.04	1.00	0.89

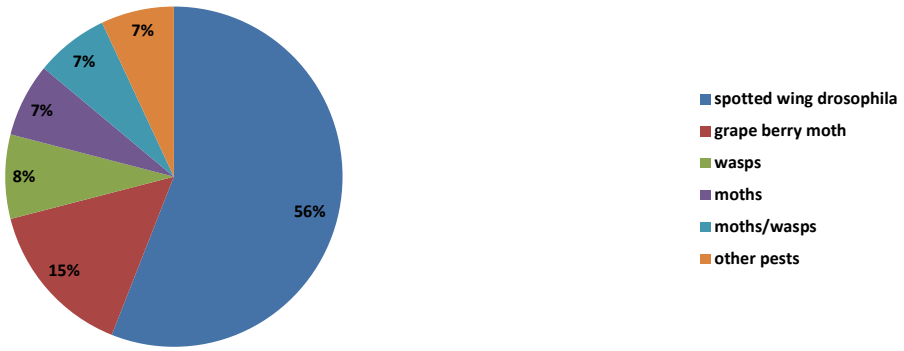
Ninety-two percent of the reasons given for herbicide use on vines were for general weed control and the remaining 8% were for broadleaved weeds.

Vines – Insecticides

- **Formulation area treated: 1,433 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The four formulations encountered were:**

	Formulation area treated (ha)	Weight of formulation applied (kg)	Proportion of insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Indoxacarb	785	6	0.55	0.16	1.41	0.20
Lambda-cyhalothrin	359	3	0.25	0.09	1.30	0.93
Spirotetramat	146	10	0.10	0.05	1.00	1.00
Spinosad	143	6	0.10	0.04	1.00	0.94

Figure 56 - Vines - Reasons for use of insecticides (where given)



Vines – Other pesticides

The growth stimulant harpin protein, used for frost protection, comprised less than 1% of the treated area and weight applied.

Although not important for the pollination of vines (vines are predominantly wind pollinated), honey bees were encountered on 31% of the area of crops grown. No pollinators were encountered on the remaining 69% of the area grown.

APPENDIX 1 – APPLICATION TABLES

Throughout all tables, "." indicates that there was no recorded area of crops grown or pesticides used.

Following statistical advice, it was recommended that regional cropping estimates were not presented in this report. The area of some individual soft fruit crops was estimated using a combination of the June Survey data and the sampled areas of these crops. The calculation is based upon the assumption that the June Survey data for each country and region are correct.

Table 1 Area of soft fruit crops grown in the United Kingdom 2022 (hectares)[1]	
	United Kingdom
Strawberry	3,297
Blackcurrant - fresh	44
Blackcurrant - processing	2,537
Redcurrant/ whitecurrant	41
Gooseberry	101
Blueberry	819
Raspberry	1,395
Blackberry	319
Hybrid berries	19
Vine	3,059
All soft fruit	**11,794**

Table 2a Treated area of soft fruit crops in the United Kingdom, 2022, by crop group (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All crops**
Insecticides & nematicides	11,572	12	5,862	18	37	1,856	4,779	1,110	<1	1,433	26,679
Fungicides	52,582	82	10,812	48	176	1,917	3,811	1,385	28	47,409	118,249
Herbicides	1,862	58	9,845	53	205	504	1,989	531	19	2,257	17,323
Molluscicides & repellents	461	<1	1,116	<1	<1	47	105	<1	.	.	1,731
Acaricides	2,283	3	.	.	.	<1	400	16	.	.	2,702
Biological control agents	19,711	.	.	.	.	704	1,644	80	.	.	22,139
Disinfectants	15	.	.	.	.	.	.	.	.	.	15
Sulphur	527	18	4,790	<1	2	143	.	174	.	13,372	19,027
Physical control agents	907	<1	.	12	25	216	636	109	.	.	1,905
Growth stimulant	21	.	.	.	.	43	.	.	.	253	317
Growth regulators	<1	.	.	.	.	.	.	.	.	.	<1
All pesticides	**89,943**	**174**	**32,424**	**131**	**445**	**5,431**	**13,364**	**3,404**	**47**	**64,724**	**210,087**

Table 2b Weight of pesticides applied to soft fruit crops in the United Kingdom, 2022, by crop group (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All crops**
Insecticides & nematicides	1,936	<1	307	43	<1	440	646	102	<1	25	3,500
Fungicides	37,365	33	3,792	54	34	951	2,461	925	17	28,550	74,182
Herbicides	1,322	24	3,671	22	80	203	726	97	5	578	6,729
Molluscicides & repellents	68	<1	81	<1	<1	7	14	<1	.	.	169
Acaricides	270	<1	.	.	.	<1	79	2	.	.	351
Biological control agents	.	.	.	.	.	.	.	.	.	.	.
Disinfectants	34	.	.	.	.	.	.	.	.	.	34
Sulphur	1,961	36	32,943	1	4	123	.	696	.	27,897	63,660
Physical control agents	712	<1	.	12	21	210	696	106	.	.	1,757
Growth stimulant	<1	.	.	.	.	<1	.	.	.	<1	<1
Growth regulators	<1	.	.	.	.	.	.	.	.	.	<1
All pesticides	**43,667**	**95**	**40,793**	**133**	**139**	**1,935**	**4,621**	**1,928**	**22**	**57,050**	**150,383**

Table 3 Usage of pesticides on soft fruit crops in the United Kingdom, 2022 - percentage area of crops treated with pesticides									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**Not treated**
Strawberry	88.4	93.5	7.4	28.2	40.3	9.1	56.2	17.5	1.7
Blackcurrant - fresh	20.8	49.9	21.3	37.4	3.5	<0.1	.	1.8	32.2
Blackcurrant - processing	84.6	90.5	84.6	96.2	.	37.1	.	.	3.2
Redcurrants & whitecurrants	18.2	31.3	1.1	39.8	.	0.3	.	7.5	44.9
Gooseberry	35.0	37.0	0.6	63.6	.	0.3	.	25.3	25.2
Blueberry	71.9	64.9	11.3	31.3	<0.1	6.2	14.0	16.0	23.1
Raspberry	86.2	76.6	.	59.9	20.4	4.3	35.2	20.0	3.8
Blackberry	92.5	94.7	39.6	66.8	3.7	0.1	9.8	21.6	4.5
Hybrid berries	3.7	50.1	.	28.4	.	.	.	.	23.7
Vine	24.8	77.6	73.8	34.8	.	.	.	.	16.8
All crops	**70.6**	**83.6**	**39.2**	**50.9**	**14.6**	**11.8**	**22.5**	**10.1**	**8.0**

Table 4a Usage of pesticides on soft fruit crops in the United Kingdom, 2022 - number of spray rounds applied to crops									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**All pesticides[1]**
Strawberry	4.2	14.5	2.6	1.3	1.7	1.1	8.9	1.8	21.4
Blackcurrant - fresh	1.3	3.1	1.7	1.8	2.0	1.0	.	1.0	3.6
Blackcurrant - processing	2.4	4.3	2.4	2.7	.	1.5	.	.	10.1
Redcurrants & whitecurrants	2.0	2.9	1.5	1.6	.	1.0	.	4.0	3.4
Gooseberry	1.0	3.3	3.0	1.6	.	1.0	.	1.0	3.3
Blueberry	3.2	4.5	1.8	1.2	1.0	1.1	5.0	1.6	7.4
Raspberry	3.9	3.8	.	2.0	1.5	2.2	4.1	2.8	9.5
Blackberry	2.9	4.0	1.6	1.9	1.0	1.0	4.1	2.0	7.9
Hybrid berries	1.0	2.7	.	3.8	.	.	.	.	3.6
Vine	1.9	9.1	5.8	1.7	.	.	.	.	10.6
All crops	**3.6**	**9.5**	**3.4**	**2**	**1.7**	**1.4**	**7.7**	**2.1**	**14.4**

[1] Includes information relating to all pesticides including growth stimulants, growth regulators and disinfectants. The number of spray rounds in the 'All pesticides' column takes account of tank mixing of different pesticide groups and therefore the figure may be less than the cumulative total number of spray rounds for the individual pesticide groups listed for each crop

Table 4b Usage of pesticides on soft fruit crops in the United Kingdom, 2022 - number of products applied to crops									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**All pesticides[1]**
Strawberry	4.4	19.0	2.6	1.8	1.8	1.1	8.9	1.8	29.6
Blackcurrant - fresh	1.3	3.8	1.7	2.8	2.0	1.0	.	1.0	5.2
Blackcurrant - processing	2.4	4.6	2.4	4.2	.	1.5	.	.	13.3
Redcurrants & whitecurrants	2.0	3.4	1.5	2.4	.	1.0	.	4.0	4.5
Gooseberry	1.0	4.1	3.0	2.5	.	1.0	.	1.0	4.7
Blueberry	3.3	4.7	1.8	2.0	1.0	1.1	5.0	1.6	9.2
Raspberry	4.0	4.1	.	2.6	1.5	2.2	4.1	2.9	11.2
Blackberry	3.0	4.3	1.6	2.8	1.3	1.0	4.1	2.0	9.7
Hybrid berries	1.0	2.7	.	5.0	.	.	.	.	4.3
Vine	1.9	14.8	5.8	2.0	.	.	.	.	20.6
All crops	**3.7**	**12.4**	**3.4**	**2.9**	**1.7**	**1.4**	**7.7**	**2.1**	**19.9**

[1]Includes information relating to all pesticides including growth stimulants, growth regulators and disinfectants

Table 4c Usage of pesticides on soft fruit crops in the United Kingdom, 2022 - number of active substances applied to crops									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**All pesticides[1]**
Strawberry	4.4	24.2	2.6	1.8	1.8	1.1	11.1	1.8	35.8
Blackcurrant - fresh	1.3	5.3	1.7	3.1	2.0	1.0	.	1.0	6.1
Blackcurrant - processing	2.4	6.4	2.4	5.0	.	1.5	.	.	15.7
Redcurrants & whitecurrants	2.0	5.3	1.5	2.6	.	1.0	.	4.0	5.6
Gooseberry	1.0	5.2	3.0	2.7	.	1.0	.	1.0	5.4
Blueberry	3.3	6.8	1.8	2.0	1.0	1.1	5.0	1.6	10.7
Raspberry	4.0	5.1	.	2.7	1.5	2.2	6.5	2.9	13.0
Blackberry	3.0	5.8	1.6	2.8	1.3	1.0	5.0	2.0	11.4
Hybrid berries	1.0	4.3	.	5.3	.	.	.	.	5.1
Vine	1.9	17.2	5.8	2.0	.	.	.	.	22.8
All crops	**3.7**	**15.7**	**3.4**	**3.2**	**1.7**	**1.4**	**9.8**	**2.1**	**23.7**

[1] Includes information relating to all pesticides including growth stimulants, growth regulators and disinfectants

Table 5 Usage of pesticides on soft fruit crops grown in the United Kingdom, 2022 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All crops**
Fungicides											
Ametoctradin/dimethomorph	.	.	.	.	.	.	.	.	.	3,831	3,831
Amisulbrom	.	.	.	.	.	.	.	.	.	2,296	2,296
Ampelomyces quisqualis strain AQ 10	264	.	.	.	.	.	.	.	.	.	264
Aureobasidium pullulans	228	.	.	.	.	108	53	2	.	2,704	3,095
Azoxystrobin	2,443	.	.	.	2	<1	282	104	.	.	2,830
Azoxystrobin/difenoconazole	518	.	.	.	.	.	.	.	.	.	518
Bacillus amyloliquefaciens strain MBI 600	1,852	.	.	.	.	.	.	.	.	.	1,852
Bacillus amyloliquefaciens subsp. *plantarum* strain D747	2,564	.	.	.	.	.	130	94	.	53	2,842
Bacillus pumilus strain QST 2808	776	.	.	3	.	.	21	<1	.	.	801
Bacillus subtilis	.	.	.	.	.	.	.	.	.	219	219
Bacillus subtilis strain QST 713	4,621	.	.	.	.	214	287	51	.	102	5,275
Benthiavalicarb-isopropyl/mancozeb	.	.	.	.	.	.	.	.	.	260	260
Boscalid	.	.	.	.	.	.	.	.	.	1,845	1,845
Boscalid/pyraclostrobin	2,682	24	2,698	21	37	441	743	456	9	.	7,112
Bupirimate	2,155	2	.	<1	11	<1	123	24	.	.	2,315
Cerevisane (S*accharomyces cerevisiae* strain LAS 117)	86	.	.	.	.	.	6	.	.	418	509
Copper oxychloride	4	.	.	.	.	172	8	1	2	3,697	3,884
Cyflufenamid	2,386	.	.	.	.	.	.	.	.	1,180	3,566
Cymoxanil	.	.	.	.	.	.	.	.	.	2,371	2,371
Cyprodinil/fludioxonil	3,236	25	1,717	13	11	485	340	156	17	2,256	8,255
Difenoconazole/fluxapyroxad	4,921	.	.	.	.	.	.	.	.	.	4,921
Dimethomorph	618	.	.	.	.	.	354	.	.	.	972
Fenhexamid	3,689	2	649	3	2	367	740	282	.	2,953	8,686
Fluopyram/trifloxystrobin	3,635	.	.	.	.	.	.	.	.	.	3,635
Fluxapyroxad	.	.	.	.	.	.	.	.	.	1,588	1,588
Kresoxim-methyl	1,499	.	1,933	.	24	.	.	.	.	1,656	5,112
Mancozeb	.	.	.	.	.	.	.	.	.	3,847	3,847
Mepanipyrim	1,117	.	.	.	.	.	.	.	.	.	1,117
Metalaxyl-M	.	.	.	.	.	.	74	.	.	1,602	1,676
Metrafenone	.	.	.	.	.	.	.	.	.	1,609	1,609
Myclobutanil	3,204	13	2,421	2	76	.	113	63	.	351	6,242
Penconazole	2,381	5	484	<1	4	.	.	.	.	260	3,135
Potassium hydrogen carbonate	2,661	.	.	.	.	.	79	37	.	3,425	6,202
Potassium phosphonate (phosphite)	.	.	.	.	.	.	.	.	.	2,733	2,733
Proquinazid	1,794	.	.	.	3	.	.	.	.	2,965	4,761

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2022 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Fungicides (cont.)											
Pyrimethanil	3,062	7	910	5	.	130	322	112	.	1,510	6,057
Tebuconazole/trifloxystrobin	.	.	.	.	.	.	.	.	.	1,300	1,300
Other fungicides[1,2]	189	5	.	<1	5	.	140	.	.	381	719
All fungicides	**52,582**	**82**	**10,812**	**46**	**176**	**1,917**	**3,811**	**1,384**	**28**	**47,410**	**118,250**
Sulphur	**527**	**18**	**4,790**	**<1**	**2**	**143**	**.**	**174**	**.**	**13,373**	**19,027**

[1] Throughout all tables, "Other" refers to chemicals grouped together because they were applied to less than 0.1% of the total area treated with pesticides

[2] Other fungicides include *Bacillus amyloliquefaciens* strain FZB24, COS-OGA, dodine, fenamidone/fosetyl-aluminium, fenpyrazamine, *Gliocladium catenulatum* strain J1446, mancozeb/zoxamide, sulphur/tebuconazole, tebuconazole, *Trichoderma atroviride* strain SC1 and *Trichoderma harzianum*

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2022 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Herbicides											
Carfentrazone-ethyl	326	5	1,502	9	42	153	782	263	10	486	3,578
Clethodim	153	.	15	.	3	.	128	81	.	.	380
Clopyralid	84	7	585	.	23	.	<1	.	.	.	698
Fluazifop-P-butyl	10	.	9	.	.	19	52	84	<1	267	441
Flufenacet/metribuzin	.	8	1,735	8	28	5	.	.	.	.	1,784
Glyphosate	459	13	2,875	5	50	30	501	72	4	1,384	5,394
Isoxaben	173	4	214	2	5	.	101	6	1	.	506
Napropamide	140	<1	20	2	3	122	94	3	.	.	384
Pendimethalin	161	12	1,819	12	35	106	103	3	1	.	2,250
Propyzamide	110	6	1,014	12	12	69	180	15	<1	120	1,538
Other herbicides[1]	247	3	56	4	5	0	47	3	<1	.	370
All herbicides	**1,862**	**58**	**9,845**	**53**	**205**	**504**	**1,988**	**530**	**19**	**2,257**	**17,324**

[1] Other herbicides include 2,4-D, 2,4-D/glyphosate, dimethenamid-P/pendimethalin, diquat, flazasulfuron, florasulam, imazamox/pendimethalin, lenacil, MCPB, metamitron, metamitron/quinmerac, phenmedipham and S-metolachlor

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2022 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Insecticides											
Bacillus thuringiensis var. kurstaki	941	.	.	.	.	53	31	<1	.	.	1,026
Beauveria bassiana ATCC-74040	195	.	.	.	.	.	75	37	.	.	308
Cyantraniliprole	2,012	.	.	.	.	187	550	230	.	.	2,978
Deltamethrin	655	.	324	3	7	<1	1,989	110	<1	.	3,088
Fatty acids C7-C20	241	.	.	9	.	66	99	7	.	.	421
Indoxacarb	50	.	.	.	.	91	80	4	.	785	1,009
Lambda-cyhalothrin	1,918	7	1,856	2	26	444	924	316	.	359	5,853
Spinosad	2,651	<1	929	3	4	576	972	408	.	143	5,687
Spirotetramat	2,820	3	2,752	2	.	374	6	.	.	146	6,103
Other insecticides[1]	89	2	.	.	.	65	52	.	.	.	208
All insecticides	**11,572**	**12**	**5,862**	**18**	**37**	**1,856**	**4,779**	**1,110**	**<1**	**1,433**	**26,679**
Acaricides											
Bifenazate	1,091	.	.	.	.	.	.	.	.	.	1,091
Clofentezine	559	.	.	.	.	<1	396	11	.	.	966
Cyflumetofen	223	.	.	.	.	.	.	.	.	.	223
Etoxazole	316	.	.	.	.	.	.	.	.	.	316
Other acaricides[2]	93	3	.	.	.	.	5	5	.	.	106
All acaricides	**2,282**	**3**	**.**	**.**	**.**	**<1**	**400**	**16**	**.**	**.**	**2,702**
Molluscicides & repellents											
Ferric phosphate	458	<1	1,116	<1	<1	47	83	<1	.	.	1,704
Other molluscicides & repellents[3]	4	.	.	.	.	.	22	.	.	.	26
All molluscicides & repellents	**461**	**<1**	**1,116**	**<1**	**<1**	**47**	**105**	**<1**	**.**	**.**	**1,731**

[1] Other insecticides include acetamiprid, chlorantraniliprole, chlorpyrifos, flonicamid, pirimicarb, pyrethrins, sugar, thiacloprid and unspecified insecticides

[2] Other acaricides include abamectin, spirodiclofen and tebufenpyrad

[3] Other molluscicides and repellents include calcium chloride and metaldehyde

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2022 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Biological controls											
Amblyseius spp.	293	.	.	.	.	.	4	.	.	.	296
Amblyseius andersoni	56	.	.	.	.	.	191	7	.	.	254
Aphelinus abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Ephedrus cerasicola/Praon volucre	1,201	.	.	.	.	.	167	<1	.	.	1,368
Heterorhabditis bacteriophora	271	.	.	.	.	115	54	.	.	.	439
Neoseiulus cucumeris	8,711	.	.	.	.	17	33	28	.	.	8,789
Orius spp.	1,626	.	.	.	.	11	40	.	.	.	1,677
Phytoseiulus persimilis	4,476	.	.	.	.	.	938	27	.	.	5,441
Steinernema kraussei	358	.	.	.	.	544	21	<1	.	.	923
Stratiolaelaps scimitus	249	.	.	.	.	.	.	2	.	.	251
Other biological control[1]	2,469	.	.	.	.	17	197	16	.	.	2,698
All biological controls	**19,710**	**.**	**.**	**.**	**.**	**704**	**1,644**	**79**	**.**	**.**	**22,138**

Other biological controls include *Adalia bipunctata, Amblyseius montdorensis, Amblyseius swirskii, Aphidius abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Praon volucre, Aphidius colemani, Aphidius colemani/Aphidius ervi, Aphidius ervi, Aphidius* spp*, Aphidoletes aphidimyza, Chrysoperla carnea, Eupeodes corollae, Feltiella acarisuga, Hypoaspis spp, Macrocheles robustulus, Micromus angulatus, Neoseiulus californicus, Orius insidiosus, Orius laevigatus, Phasmarhabditis hermaphrodita, Sphaerophoria rueppellii, Steinernema carpocapsae* and *Steinernema feltiae*

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2022 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Physical controls											
Unspecified physical controls	907	<1	.	12	25	216	619	109	.	.	1,888
Other physical control agents[1]	.	.	.	.	.	.	17	.	.	.	17
All physical controls	**907**	**<1**	**.**	**12**	**25**	**216**	**636**	**109**	**.**	**.**	**1,905**
Growth stimulants											
Harpin protein	21	.	.	.	.	43	.	.	.	253	317
Other disinfectants[2]	**15**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**15**
Other growth regulators[3]	**<1**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**<1**

[1] Other physical control agents include maltodextrin

[2] Other disinfectants include peroxyacetic acid

[3] Other growth regulators include prohexadione

Table 6 Usage of pesticides on soft fruit crops grown in the United Kingdom, 2022 (kg of active substance applied)											
	Strawberry	Blackcurrant fresh	Blackcurrant processing	Redcurrants & whitecurrants	Gooseberry	Blueberry	Raspberry	Blackberry	Hybrid berries	Vine	All crops
Fungicides											
Ametoctradin/dimethomorph	.	.	.	.	.	.	.	.	.	1,261	1,261
Amisulbrom	.	.	.	.	.	.	.	.	.	141	141
Ampelomyces quisqualis strain AQ 10	11	.	.	.	.	.	.	.	.	.	11
Aureobasidium pullulans	55	.	.	.	.	27	13	<1	.	341	437
Azoxystrobin	599	.	.	.	<1	<1	70	26	.	.	696
Azoxystrobin/difenoconazole	168	.	.	.	.	.	.	.	.	.	168
Bacillus amyloliquefaciens strain MBI 600	102	.	.	.	.	.	.	.	.	.	102
Bacillus amyloliquefaciens subsp. *plantarum* strain D747	1,462	.	.	.	.	.	79	59	.	26	1,626
Bacillus pumilus strain QST 2808	7,509	.	.	30	.	.	204	10	.	.	7,752
Bacillus subtilis	.	.	.	.	.	.	.	.	.	3	3
Bacillus subtilis strain QST 713	322	.	.	.	.	15	25	4	.	9	374
Benthiavalicarb-isopropyl/mancozeb	.	.	.	.	.	.	.	.	.	275	275
Boscalid	.	.	.	.	.	.	.	.	.	364	364
Boscalid/pyraclostrobin	1,361	10	1,309	11	12	148	339	195	5	.	3,390
Bupirimate	531	<1	.	<1	3	<1	30	6	.	.	571
Cerevisane (*Saccharomyces cerevisiae* strain LAS 117)	60	.	.	.	.	.	4	.	.	55	119
Copper oxychloride	<1	.	.	.	.	119	5	1	2	2,765	2,894
Cyflufenamid	35	.	.	.	.	.	.	.	.	22	57
Cymoxanil	.	.	.	.	.	.	.	.	.	165	165
Cyprodinil/fludioxonil	1,970	16	1,011	8	7	263	208	90	10	948	4,530
Difenoconazole/fluxapyroxad	360	.	.	.	.	.	.	.	.	.	360
Dimethomorph	926	.	.	.	.	.	437	.	.	.	1,363
Fenhexamid	2,288	1	457	2	2	275	544	203	.	1,433	5,205
Fluopyram/trifloxystrobin	1,437	.	.	.	.	.	.	.	.	.	1,437
Fluxapyroxad	.	.	.	.	.	.	.	.	.	65	65
Kresoxim-methyl	218	.	193	.	2	.	.	.	.	126	539
Mancozeb	.	.	.	.	.	.	.	.	.	3,220	3,220
Mepanipyrim	418	.	.	.	.	.	.	.	.	.	418
Metalaxyl-M	.	.	.	.	.	.	22	.	.	74	96
Metrafenone	.	.	.	.	.	.	.	.	.	200	200
Myclobutanil	191	1	182	<1	7	.	10	5	.	19	414
Penconazole	118	<1	7	<1	<1	.	.	.	.	8	133
Potassium hydrogen carbonate	14,662	.	.	.	.	.	253	242	.	13,201	28,359
Potassium phosphonate (phosphite)	.	.	.	.	.	.	.	.	.	2,588	2,588
Proquinazid	67	.	.	.	<1	.	.	.	.	120	187

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2022 (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Fungicides (cont.)											
Pyrimethanil	2,371	3	634	4	.	104	201	84	.	903	4,302
Tebuconazole/trifloxystrobin	.	.	.	.	.	.	.	.	.	123	123
Other fungicides[1,2]	127	<1	.	<1	<1	.	16	.	.	94	239
All fungicides	**37,365**	**31**	**3,792**	**54**	**32**	**951**	**2,461**	**925**	**17**	**28,549**	**74,181**
Sulphur	**1,961**	**36**	**32,943**	**2**	**4**	**123**	**.**	**696**	**.**	**27,897**	**63,660**

[1] Throughout all tables, "Other" refers to chemicals grouped together because they were applied to less than 0.1% of the total area treated with pesticides

[2] Other fungicides include *Bacillus amyloliquefaciens* strain FZB24, COS-OGA, dodine, fenamidone/fosetyl-aluminium, fenpyrazamine, *Gliocladium catenulatum* strain J1446, mancozeb/zoxamide, sulphur/tebuconazole, tebuconazole, *Trichoderma atroviride* strain SC1 and *Trichoderma harzianum*

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2022 (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Herbicides											
Carfentrazone-ethyl	7	<1	18	<1	<1	2	13	5	<1	6	53
Clethodim	20	.	<1	.	<1	.	14	10	.	.	45
Clopyralid	13	<1	42	.	2	.	<1	.	.	.	57
Fluazifop-P-butyl	2	.	<1	.	.	<1	3	5	<1	<1	12
Flufenacet/metribuzin	.	3	691	3	11	2	.	.	.	.	711
Glyphosate	569	9	1,393	4	37	15	383	64	4	509	2,987
Isoxaben	34	<1	18	<1	<1	.	10	<1	<1	.	64
Napropamide	248	<1	21	2	3	96	134	1	.	.	505
Pendimethalin	189	6	898	6	18	39	58	1	<1	.	1,215
Propyzamide	87	3	569	6	5	48	84	9	<1	62	873
Other herbicides[1]	153	<1	19	2	3	.	26	<1	<1	.	208
All herbicides	**1,322**	**22**	**3,670**	**21**	**79**	**203**	**726**	**95**	**4**	**577**	**6,729**

[1] Other herbicides include 2,4-D, 2,4-D/glyphosate, dimethenamid-P/pendimethalin, diquat, flazasulfuron, florasulam, imazamox/pendimethalin, lenacil, MCPB, metamitron, metamitron/quinmerac, phenmedipham and S-metolachlor

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2022 (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Insecticides											
Bacillus thuringiensis var. kurstaki	369	.	.	.	.	21	13	<1	.	.	403
Beauveria bassiana ATCC-74040	34	.	.	.	.	.	15	8	.	.	56
Cyantraniliprole	149	.	.	.	.	16	49	20	.	.	234
Deltamethrin	4	.	2	<1	<1	<1	23	1	<1	.	30
Fatty acids C7-C20	900	.	.	42	.	312	441	32	.	.	1,728
Indoxacarb	3	.	.	.	.	5	4	<1	.	6	17
Lambda-cyhalothrin	15	<1	15	<1	<1	4	7	2	.	3	47
Spinosad	178	<1	89	<1	<1	53	91	38	.	6	456
Spirotetramat	276	<1	201	<1	.	28	<1	.	.	10	517
Other insecticides[1]	8	<1	.	.	.	1	1	.	.	.	11
All insecticides	**1,935**	**<1**	**307**	**42**	**<1**	**440**	**645**	**101**	**<1**	**26**	**3,499**
Acaricides											
Bifenazate	107	.	.	.	.	.	.	.	.	.	107
Clofentezine	105	.	.	.	.	<1	79	2	.	.	187
Cyflumetofen	45	.	.	.	.	.	.	.	.	.	45
Etoxazole	12	.	.	.	.	.	.	.	.	.	12
Other acaricides[2]	<1	<1	.	.	.	.	<1	<1	.	.	<1
All acaricides	**269**	**<1**	**.**	**.**	**.**	**<1**	**79**	**2**	**.**	**.**	**350**
Molluscicides & repellents											
Ferric phosphate	67	<1	81	<1	<1	7	12	<1	.	.	167
Other molluscicides & repellents[3]	<1	.	.	.	.	.	<1	.	.	.	1
All molluscicides & repellents	**67**	**<1**	**81**	**<1**	**<1**	**7**	**12**	**<1**	**.**	**.**	**168**

[1] Other insecticides include acetamiprid, chlorantraniliprole, chlorpyrifos, flonicamid, pirimicarb, pyrethrins, sugar, thiacloprid and unspecified insecticides

[2] Other acaricides include abamectin, spirodiclofen and tebufenpyrad

[3] Other molluscicides and repellents include calcium chloride and metaldehyde

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2022 (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Biological controls											
Other biological controls[1]	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
All biological controls	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
Physical controls											
Unspecified physical controls	907	<1	.	12	25	216	619	109	.	.	1,888
Other physical control agents[2]	.	.	.	.	.	.	17	.	.	.	17
All physical controls	**907**	**<1**	**.**	**12**	**25**	**216**	**636**	**109**	**.**	**.**	**1,905**
Growth stimulants											
Harpin protein	21	.	.	.	.	43	.	.	.	253	317
Other disinfectants[3]	**15**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**15**
Other growth regulators[4]	**<1**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**<1**

[1] There is no weight associated with living biological control agents

[2] Other physical control agents include maltodextrin

[3] Other disinfectants include peroxyacetic acid

[4] Other growth regulators include prohexadione

Table 7 Estimated area (ha) of application of the fifty most extensively used active substances on all soft fruit crops surveyed in 2022 in the United Kingdom				
	Active substance	**Area treated 2022 (ha)**	**Area treated 2020 (ha)**	**% change on 2020**
1	Sulphur	19,045	17,754	7
2	Boscalid	8,956	10,140	-12
3	*Neoseiulus cucumeris*	8,789	17,123	-49
4	Fenhexamid	8,686	12,551	-31
5	Cyprodinil	8,255	8,687	-5
6	Fludioxonil	8,255	8,687	-5
7	Pyraclostrobin	7,112	8,840	-20
8	Fluxapyroxad	6,509	5,978	9
9	Myclobutanil	6,242	8,382	-26
10	Potassium hydrogen carbonate	6,202	5,371	15
11	Spirotetramat	6,103	3,679	66
12	Pyrimethanil	6,057	6,815	-11
13	Lambda-cyhalothrin	5,853	5,778	1
14	Spinosad	5,687	6,183	-8
15	*Phytoseiulus persimilis*	5,441	13,258	-59
16	Difenoconazole	5,439	6,071	-10
17	Glyphosate	5,428	5,871	-8
18	*Bacillus subtilis* strain QST 713	5,275	6,938	-24
19	Kresoxim-methyl	5,112	4,831	6
20	Trifloxystrobin	4,935	7,616	-35
21	Dimethomorph	4,802	4,184	15
22	Proquinazid	4,761	4,638	3
23	Mancozeb	4,192	6,812	-38
24	Copper oxychloride	3,884	3,863	1
25	Ametoctradin	3,831	2,891	33
26	Fluopyram	3,635	6,340	-43
27	Carfentrazone-ethyl	3,578	3,518	2
28	Cyflufenamid	3,566	4,738	-25
29	Azoxystrobin	3,348	5,596	-40
30	Penconazole	3,135	5,519	-43
31	*Aureobasidium pullulans*	3,095	798	288
32	Deltamethrin	3,088	1,325	133
33	Cyantraniliprole	2,978	1,084	175
34	*Bacillus amyloliquefaciens* subsp. *plantarum* strain D747	2,842	5,027	-43
35	Potassium phosphonate (phosphite)	2,733	355	670
36	Cymoxanil	2,371	1,390	71
37	Bupirimate	2,315	2,086	11
38	Pendimethalin	2,308	2,837	-19
39	Amisulbrom	2,296	227	910
40	Unspecified physical control agents	1,888	770	145
41	*Bacillus amyloliquefaciens* strain MBI 600	1,852	2,285	-19
42	Flufenacet	1,784	2,025	-12
43	Metribuzin	1,784	2,025	-12
44	*Orius laevigatus*	1,739	1,493	16
45	Ferric phosphate	1,704	1,651	3
46	*Orius* spp.	1,677	5,237	-68
47	Metalaxyl-M	1,676	851	97
48	Metrafenone	1,609	233	590
49	Propyzamide	1,538	2,243	-31
50	Tebuconazole	1,448	2,006	-28

Table 8 Estimated amount used (kg) of the fifty most extensively used active substances on all soft fruit crops surveyed in 2022 in the United Kingdom				
	Active substance	**Amount used 2022 (kg)**	**Amount used 2020 (kg)**	**% change on 2020**
1	Sulphur	63,685	57,667	10
2	Potassium hydrogen carbonate	28,359	27,800	2
3	*Bacillus pumilus* strain QST 2808	7,752	11,131	-30
4	Fenhexamid	5,205	7,909	-34
5	Pyrimethanil	4,302	4,826	-11
6	Mancozeb	3,540	7,337	-52
7	Boscalid	3,074	3,600	-15
8	Glyphosate	2,996	3,403	-12
9	Copper oxychloride	2,894	3,208	-10
10	Cyprodinil	2,718	2,864	-5
11	Potassium phosphonate (phosphite)	2,588	379	584
12	Dimethomorph	1,903	1,735	10
13	Fludioxonil	1,812	1,909	-5
14	Fatty acids C7-C20	1,728	4,598	-62
15	Unspecified physical control agents	1,628	429	279
16	*Bacillus amyloliquefaciens* subsp. *plantarum* strain D747	1,626	2,744	-41
17	Pendimethalin	1,245	1,432	-13
18	Propyzamide	873	1,228	-29
19	Azoxystrobin	799	1,316	-39
20	Trifloxystrobin	760	1,308	-42
21	Ametoctradin	720	623	16
22	Fluopyram	718	1,261	-43
23	Pyraclostrobin	680	828	-18
24	Bupirimate	570	513	11
25	Kresoxim-methyl	539	590	-9
26	Spirotetramat	517	319	62
27	Napropamide	505	815	-38
28	Spinosad	456	447	2
29	*Aureobasidium pullulans*	437	125	250
30	Mepanipyrim	418	663	-37
31	Myclobutanil	414	539	-23
32	Flufenacet	411	454	-10
33	*Bacillus thuringiensis* var. kurstaki	403	596	-32
34	*Bacillus subtilis* strain QST 713	374	471	-20
35	Metribuzin	300	331	-10
36	Fluxapyroxad	282	265	6
37	Cyantraniliprole	234	81	190
38	Difenoconazole	209	277	-25
39	Metrafenone	200	37	436
40	Clofentezine	187	122	53
41	Proquinazid	187	185	1
42	Ferric phosphate	167	219	-24
43	Cymoxanil	165	110	50
44	Amisulbrom	141	17	718
45	Penconazole	133	252	-47
46	Maltodextrin	129	124	4
47	Cerevisane (*Saccharomyces cerevisiae* strain LAS 117)	119	329	-64
48	Bifenazate	107	134	-20
49	*Bacillus amyloliquefaciens* strain MBI 600	102	125	-19
50	Tebuconazole	97	169	-43

Table 9 Active substances recorded at a significant level on soft fruit crops in the United Kingdom in 2022 but not			
	Active substance	**Area treated 2022 (ha)**	**Amount used 2022 (kg)**
1	*Trichoderma atroviride* strain SC1	187	.
2	*Aphidius abdominalis*	155	.
3	*Amblyseius swirskii*	111	.
4	*Eupeodes corollae*	48	.
5	*Amblyseius montdorensis*	34	.
6	*Sphaerophoria rueppellii*	30	.
7	Quinmerac	26	1
8	*Macrocheles robustulus*	22	.
9	Calcium chloride	18	1
10	*Phasmarhabditis hermaphrodita*	14	.

Table 10 Major increases in the use of individual active substances on soft fruit crops in the United Kingdom since 2020 (area treated)				
	Active substance	**Area treated 2022 (ha)**	**Area treated 2020 (ha)**	**% change on 2020**
1	*Stratiolaelaps scimitus*	251	12	2,067
2	Amisulbrom	2,296	227	910
3	Potassium phosphonate (phosphite)	2,733	355	670
4	Metrafenone	1,609	233	590
5	Fenamidone	91	16	459
6	Fosetyl-aluminium	91	16	459
7	*Aureobasidium pullulans*	3,095	798	288
8	Phenmedipham	23	7	229
9	Harpin protein	317	108	193
10	Cyantraniliprole	2,978	1,084	175
11	*Praon volucre*	1,196	449	166
12	*Beauveria bassiana ATCC-74040*	308	122	152
13	*Aphidius ervi*	1,251	505	148
14	*Aphidius matricariae*	1,196	508	136
15	Deltamethrin	3,088	1,325	133
16	*Aphelinus abdominalis*	1,040	449	132
17	*Ephedrus cerasicola*	1,040	449	132
18	Maltodextrin	17	8	108
19	Metalaxyl-M	1,676	851	97
20	COS-OGA	75	41	85

Table 11 Major decreases in the use of individual active substances on soft fruit crops in the United Kingdom since 2020 (area treated)				
	Active substance	**Area treated 2022 (ha)**	**Area treated 2020 (ha)**	**% change on 2020**
1	Thiacloprid	2	7,388	-100
2	Spirodiclofen	1	713	-100
3	Diquat	1	519	-100
4	Metaldehyde	8	881	-99
5	*Aphidius* spp.	1	44	-98
6	Fenpyrazamine	58	2,135	-97
7	Dodine	8	245	-97
8	Tebufenpyrad	3	59	-95
9	Zoxamide	85	1,603	-95
10	*Steinernema feltiae*	134	2,186	-94
11	Pyrethrins	72	1,122	-94
12	*Hypoaspis* spp.	107	1,454	-93
13	*Gliocladium catenulatum* strain J1446	60	452	-87
14	Benthiavalicarb-isopropyl	260	1,741	-85
15	Peroxyacetic acid	15	80	-81
16	*Amblyseius* spp.	296	1,462	-80
17	Dimethenamid-P	35	128	-73
18	*Orius* spp.	1,677	5,237	-68
19	*Aphidoletes aphidimyza*	53	162	-67
20	*Chrysoperla carnea*	129	392	-67

Table 12 Comparison of pesticide usage on soft fruit, 2014 - 2022, area treated (ha) and amount used (kg)										
	2014		2016		2018		2020		2022	
	ha	kg	ha	kg	ha	kg	ha	kg	ha	kg
Acaricides	10,610	853	8,313	718	7,599	530	3,827	401	2,702	351
Insecticides	29,183	6,015	30,881	3,229	34,900	3,371	30,578	7,146	26,679	3,499
Fungicides	120,892	98,930	129,285	92,079	127,245	83,829	135,620	88,164	118,249	74,182
Sulphur	19,730	52,980	17,670	54,783	15,394	45,800	17,616	57,514	19,027	63,660
Herbicides	26,112	13,229	27,576	12,294	28,039	11,290	20,246	8,307	17,323	6,728
Molluscicides & repellents	3,818	793	3,806	888	3,784	610	2,532	381	1,731	169
Soil sterilants	59	16,195	55	11,697	15	2,391	11	703	.	.
Total - all authorised pesticides[1]	210,404	188,995	217,586	175,690	216,976	147,821	210,430	162,616	185,711	148,589
Biological control agents	3,869	18	12,814	34	3,869	18	49,439	.	22,139	
Area grown	10,407		11,218		11,966		12,583		11,631	

[1] Excludes information relating to disinfectants, growth regulators, growth stimulants and physical control agents

APPENDIX 2 – BASIC SUBSTANCES ENCOUNTERED IN THE SURVEY BUT NOT PRESENTED ELSEWHERE IN THE REPORT

	Area Treated (ha)	Weight applied (kg)
Milk (used as a fungicide)	89	446
Sodium Chloride (used as a herbicide)	45	80
Vinegar (used as a herbicide)	45	1

APPENDIX 3 – METHODOLOGY

METHODS

The samples of holdings to be surveyed were selected using data from the Agricultural Census Returns, June 2021 for England & Wales (Anon., 2022a, 2022b) and for Northern Ireland (Anon, 2022d).

The samples were drawn from the census returns to represent the area of all soft fruit crops grown throughout England, Scotland, Northern Ireland and Wales. For England the sample was selected within each of the eight Government Office Regions (GORs). The Welsh Assembly Government provided a further sample, which represented the area grown in Wales. For Scotland, the country was divided into 11 land-use regions (Wood, 1931) and for Northern Ireland the sample represented the regions in this country.

For Scotland, the May 2022 Single Application Form (SAF) data was used to draw the sample. SAF data does not account for the majority of land area for soft fruit crops (smaller holdings are often excluded). The sample drawn is based on area of crop grown, rather than number of holdings. Therefore, to provide better pesticide usage estimates, the 2022 sample data was raised to the June 2021 Agricultural Census (Anon., 2022c) data rather than to SAF data. Using SAF data during the raising process would have underestimated total areas grown and therefore pesticide usage estimates. However, using 2021 census data during the raising process will also have impacted pesticide use estimates, though the magnitude of impact is unclear. The June Agricultural Census has been paused only for one year therefore up to date census areas will be available for future surveys (Wardlaw et. al., 2023).

The samples were stratified according to the total area of all soft fruit crops grown in each region and by size group based on the total area of soft fruit crops grown on each holding. The area of soft fruit crops sampled in each size group and each region was proportional to the total area of soft fruit crops grown on holdings of each size group in each region. All three survey teams followed the same methodology for data collection and used the same forms and instructions for their completion. The size groups, based on the total soft fruit area, are as follows: <2.5ha (A); >2.5-<=5 ha (B); >5-<=10 ha (C); >10-<=30 ha (D); and >30 ha (E).

For the purposes of this survey the total area of soft fruit crops was taken as the sum of the areas of the following crops: strawberries, blackcurrants (fresh market & processing), redcurrants and whitecurrants, gooseberries, blueberries, raspberries, blackberries, hybrid berries and grapevines.

An introductory letter was sent to the occupiers of the selected holdings explaining the purpose of the survey. Data were collected from a total of 297 UK holdings during the winter of 2022/23 either during a personal interview with the grower conducted by an experienced pesticide usage surveyor, over the phone or by email. Where a holding listed in the original sample was not able to provide data it was replaced with another from the same size group and region, held on a reserve list.

Within England and Wales a total of 453 holdings were contacted, of which 99 (22%) were not growing soft fruit crops commercially. Of the 354 premises growing soft fruit crops, 207 provided pesticide usage data , 45 (13%) were unwilling to help with the survey and the remaining 102 were unable to help when the surveyor phoned or provided data after the reporting deadline.

One of the requirements placed on growers by their customers is the membership of farm assurance schemes. These schemes require detailed pesticide records (computer based or handwritten) which ensure traceability and can be examined by crop assurance auditors at any time, but normally at least once each year. These records are used extensively by those collecting pesticide data.

Of the 288 holdings visited in Great Britain (no data were available from Northern Ireland) and where information was available (283 holdings), 48% were members of one or more crop assurance schemes. However, in terms of area grown, farms with a crop assurance scheme accounted for 83% of the total area surveyed. Thirteen of the holdings (5%) were registered organic on all or part of their farm.

Commercial farm management software and in-house electronic record keeping systems are now used extensively within many areas of agriculture and horticulture. Of the 207 holdings providing pesticide usage data in England & Wales, 53%

(109) used electronic record keeping, with these records accounting for 93% of the total area of soft fruit grown. Of those using electronic record keeping, 53% used commercial farm management software systems with the remaining 47% using in-house computer systems developed by the growers themselves.

Due to government restrictions surrounding the COVID-19 pandemic, we were unable to undertake any face-to-face visits for the 2020 survey and all data were collected via email, post and over the telephone. We continued this methodology for the 2022 survey as we feel that the impact in terms of participation and data quality has been minimal. An increasing number of soft fruit growers now use electronic record keeping and are therefore able to send their pesticide usage records via email. In most cases, where growers were using paper-based record keeping, they were happy to provide data over the telephone, by email (scanned records) or by post.

The Questionnaire

The questionnaire for the main part of the survey consisted of two forms, which were completed during a telephone interview with the grower.

Form 1 summarised the areas of soft fruit crops grown on the designated holding during the 2021/2022 season.

Form 2 dealt with all aspects of pesticide usage on the individual crops grown on the holding and harvested in 2022, a separate form being used for each field/crop combination, these included pesticides applied prior to planting. Certain agronomic details that may have influenced pesticide usage (including planting methods, growing medium, crop covers (such as tunnels), planting & harvest times, use of adjuvants and the volume of spray applied) were also recorded on form 2.

Raising factors

The pesticide usage data collected from each holding were raised by a ratio of two factors to give an estimate of regional usage using a standard ratio raising statistical technique; the first factor being dependent on farm size group and region (see Appendix 4) and the second dependent on crop area and region. The data were further adjusted by a third factor to compensate for regions in which specific crops were not sampled and to make estimates of total pesticide usage related to the national cropping areas in Great Britain (Thomas, 1999).

The raising factors were based on the areas of soft fruit crops grown and harvested in 2022 as recorded in the June Survey of Agriculture and Horticulture for England & Wales (Anon., 2023a, b) and Northern Ireland (Anon., 2023c).

To allow for the Agricultural Statistics Transformation Programme, the 2022 June Survey of Agriculture and Horticulture for Scotland was paused. This pause was agreed with the Office for Statistical Regulation and data users. The raising factors for Scotland are based on the areas of soft fruit crops grown and harvested in 2021 as recorded in the June Survey of Agriculture and Horticulture (Anon., 2022c). Please see methods on page 74 for more details.

Whilst we have confidence in the methodologies used for the pesticide usage surveys and the data collected from individual farmers and growers (Appendix 3), the raised estimates for individual crops will be subject to higher standard errors simply because available data on National and Regional areas for individual crops is much more limited. Where possible the survey team will use data collected as part of the June Survey to make estimates of national and regional pesticide usage as this survey is subject to the same strict methodologies as our own. However, where these estimates are not available then other sources of data such as the Defra Horticultural Statistics, information from industry experts or a combination of June Survey data and our own observations will be used, and these data may therefore be associated with a higher standard error. Estimates of the area of vines and blackcurrants in Wales were provided by WineGB and by industry experts.

Rounding

Due to rounding of figures, the sum of constituent items in the tables may not agree exactly with the totals shown.

Error checking

Extensive checks are made on the data before, at the time of and following data entry. Data checking routines are used to verify the authenticity of the data collected including: the authorisation and approval status of all crop/pesticide combinations; high and low rates of application; the methods of application used to apply pesticides; crop growth stages at the time of application; the timing of pesticide applications and consistency within a tank mix.

Further checks are made on the integrity of the relational database used to store the raw data collected ensuring that links to product databases are in place prior to the production of the report. The product databases used for the pesticide usage surveys are maintained alongside the commercial product database, *LIAISON*, which is used extensively by agronomists and the major farm management software companies.

Where inconsistencies are found, for example where there are high rates of application or non-approved product usage, these are checked first against the farm records and secondly with the grower and amended if necessary.

Reports are written and checked within the team after which they are sent to reviewers within the Working Party on Pesticide Usage Surveys for their comments and checking.

The final report is pre-announced and published via the Government statistics release calendar and the Fera Science Ltd. website in line with the Code of Practice for Statistics.

Data limitations and use of data

Our experience has shown that the proposed face to face interview and 'main contact plus reserves approach' delivers the highest quality data and minimises non response bias; no other approach is likely to yield fit for purpose data to meet the quality requirements of the UKSA Code of Practice for Statistics. Drawing a fresh stratified random sample each year is clearly an appropriate survey methodology. The population of horticultural growers sampled for the PUS is much smaller than the number of arable holdings in England, so that, especially in the strata of larger enterprises, the same growers come around frequently, so this sample is already closer to a panel than a sample from a larger population might be. These larger enterprises are vital to the statistical validity of the survey in that individually they can represent a significant proportion of the total area of soft fruit grown.

As part of this survey Fera Science Ltd. has implemented the UK Statistics Authority Code of Practice for Statistics, published in 2009 and revised in 2018. Whilst all three pillars and 14 principles apply, we acknowledge the following:

- Honesty and integrity: people in organisations that release statistics should be truthful, impartial and independent, and meet consistent standards of behaviour that reflect the wider public good.
- Data governance: organisations should look after people's information securely and manage data in ways that are consistent with relevant legislation and serve the public good.
- Efficiency and proportionality: statistics and data should be published in forms that enable their reuse. Producers should use existing data wherever possible and only ask for more where justified.
- Accessibility: statistics and data should be equally available to all, not given to some people before others. They should be published at a sufficient level of detail and remain publicly available.

In accordance with UKSA Code of Practice for Statistics, we work with Defra and HSE statisticians to build on our existing extensive and effective relationships with users of the surveys to further enhance user engagement. There is a broad spectrum of users and stakeholders across policy, research, agricultural supply industry (including consultancies), farming and horticultural businesses, civil society organisations and members of the public. Over the years we have an excellent record of listening to our users and incorporating their feedback into the way we collect and report our statistics.

APPENDIX 4 – STANDARD ERROR CALCULATIONS

The aim of the analysis of the results was to provide an estimate of the pesticide usage associated soft fruit crops by region and nationally.

Estimates are derived from pesticide usage survey data which are stratified by region and holding size. The survey information is combined with the total area grown within each stratum to provide an estimate of the total mass of pesticide used by region and nationally, and of the area sprayed. Each estimate (E) is provided with a standard error (SE). In general, we expect with approximately 95% confidence, that the true quantity of pesticide used will lie within the interval:

$$E \pm 1.96 \times se$$

Estimation method

We are provided with information about holdings in J regions. Holdings are assigned one of K size classes. L holdings are surveyed within each stratum (j, k). In addition, the total area cultivated with crop and number of holdings in each stratum from which samples have been taken is reported. Hence, we are given:

$H_{j,k}$: the total area of the stratum (in holdings of size class k, in region j)

$N_{j,k}$: the total number of holdings in the stratum

$L_{j,k}$: number of holdings surveyed within the stratum

$h_{j,k,l}$: area of each holding surveyed within the stratum

$a_{l,j,k,l}$: area of each holding sprayed within the surveyed stratum

$m_{j,k,l}$: mass of pesticide applied to each holding in the surveyed stratum

Then we estimate:

$r_{a_{j,k}}$: mean area sprayed per area surveyed within the stratum

$r_{m_{j,k}}$: mean mass applied per area surveyed within the stratum

$s_{a_{j,k}}$: the between-holding standard deviation of the area sprayed per area surveyed within the stratum

$s_{m_{j,k}}$: the between holding standard deviation of the mass sprayed per area surveyed within the stratum

A_j: estimated total area sprayed in a region

se_{A_j}: standard error of estimated total area sprayed in a region

M_j: estimated total mass applied in a region

se_{M_j}: standard error of estimated total mass applied in a region

A: estimated total area sprayed nationally

se_A: standard error of estimated total area sprayed nationally

M: estimated total mass applied nationally

se_M: standard error of estimated total mass applied nationally

Estimates are provided using the following formulae

Estimators

$r_{a_{j,k,l}} = \frac{a_{j,k,l}}{h_{j,k,l}}$	*Equation 1*
$r_{m_{j,k,l}} = \frac{m_{j,k,l}}{h_{j,k,l}}$	*Equation 2*
$r_{a_{j,k}} = mean\left(r_{a_{j,k,l}}\right), l = 1,2 \dots L_{j,k}$	*Equation 3*
$r_{m_{j,k}} = mean\left(r_{m_{j,k,l}}\right), l = 1,2 \dots L_{j,k}$	*Equation 4*
$s_{a_{j,k}} = sd\left(r_{a_{j,k,l}}\right), l = 1,2 \dots L_{j,k}$	*Equation 5*
$s_{m_{j,k}} = sd\left(r_{m_{j,k,l}}\right), l = 1,2 \dots L_{j,k}$	*Equation 6*
$A_j = \sum_{k=1}^{k=K} H_{j,k} \, . \, r_{a_{j,k}}$	*Equation 7*
$M_j = \sum_{k=1}^{k=K} H_{j,k} \, . \, r_{m_{j,k}}$	*Equation 8*
$se_{A_j} = \sqrt{\sum_{k=1}^{k=K} H_{j,k}^2 \, . \, \frac{s_{a_{j,k}}^2}{L_{j,k}} . \frac{N_{j,k} - L_{j,k}}{N_{j,k} - 1}}$	*Equation 9*
$se_{M_j} = \sqrt{\sum_{k=1}^{k=K} H_{j,k}^2 \, . \, \frac{s_{m_{j,k}}^2}{L_{j,k}} . \frac{N_{j,k} - L_{j,k}}{N_{j,k} - 1}}$	*Equation 10*
$A = \sum_{j=1}^{j=J} A_j$	*Equation 11*
$M = \sum_{j=1}^{j=J} M_j$	*Equation 12*

$se_A = \sqrt{\sum_{j=1}^{j=J} se_{A_j}^2}$	*Equation 13*
$se_M = \sqrt{\sum_{j=1}^{j=J} se_{M_j}^2}$	*Equation 14*

Standard errors se_A, se_M, se_{A_j} and se_{M_j} are estimated by a first order Taylor approximation[1] (Equations 9,10,13,14) with a finite population correction[2] (Equations 9 and 10).

95% confidence intervals for estimates A_j, M_j, A and M as estimated as mean±1.96×standard error.
Estimates of use derived from this survey were based on a stratification by region and size. Some size strata within regions and some regions were combined where there were fewer than five observations per stratum. Upper and lower confidence intervals were not reported where the relative standard error was estimated to be larger than 30%.

Estimates of area of application and mass applied by region are provided in Tables S1 and S3. Estimates of the total area of application and mass applied are given in Tables S2 and S4.

Assumptions

1) The survey is unbiased. This means that there is no correlation between the use of pesticides on the holding and the probability of any holdings in the UK being included or excluded from a survey. The simplest way of achieving this is to sample holdings at random from the population of holdings within a stratum.

2) Samples are not correlated between strata. This means that if by chance the holdings sampled from one stratum have a higher average pesticide use than the population within the stratum, then this provides no information about the relation between samples and populations in other strata.

3) The values of number of holdings per strata are correct.

4) The size of the potential error in estimates of the total area of holdings [se(H)] within each stratum is small compared with the standard error of the estimates for the ratios "mean area sprayed per area surveyed within the stratum" and "mean mass applied per area surveyed within the stratum" [se(R)]. For uncorrelated errors "small" might mean rse(H)<0.3×rse(R)[3]

5) The error associated with estimates A_j, M_j, A, and $M$is assumed to be described by a normal distribution

6) The areas reported in the June Survey give an estimate of the total area of crops grown on a holding within the year.

[1] BIPM, (2008). Evaluation of measurement data — Guide to the expression of uncertainty in measurement, JCGM 100:2008

[2] Isserlis, L. (1918). "On the value of a mean as calculated from a sample". Journal of the Royal Statistical Society. 81 (1): 75–81.

[3] If given estimates of relative standard errors (rse) rse(R)=1 and rse(H)=0.3 then rse (R.H) =1.04

Table S1: Estimates of area of application by region[1]

Crop	Region	Area	Number of holdings	Number of holdings surveyed	Estimate (Ha)	RSE area (%)	Lower end 95% CI (Ha)	Upper end 95% CI (Ha)
soft fruit	East Midlands	182.20	64	13	1,137.14	27.3	528.07	1,746.22
soft fruit	Eastern	1,328.02	185	38	22,543.72	7.4	19,294.66	25,792.79
soft fruit	London & South East	4,774.98	314	85	106,176.30	7.4	90,735.42	121,617.18
soft fruit	North East / North West	35.97	55	5	81.90	65.7	NA	NA
soft fruit	South West	868.57	222	27	5,131.90	50.0	NA	NA
soft fruit	West Midlands	1,756.75	116	19	38,746.39	12.5	29,246.22	48,246.57
soft fruit	Yorkshire & the Humber	97.03	63	11	1,389.24	35.0	NA	NA
soft fruit	Wales	82.13	364	9	0.00	NA	0.00	0.00
soft fruit	Scotland	2,159.339	785	81	34,302.20	4.3	31,425.14	37,179.27
soft fruit	Northern Ireland	10.44	21	9	77.51	18.6	49.18	105.84

[1]This table includes all crops including minor crops which are excluded elsewhere in the report

NA: Not estimated because the relative standard error is larger than 30%

Table S2: Estimates of total area of application in the United Kingdom[1]

Crop	Area treated (Ha)	SE area treated (Ha)	RSE area treated (%)	Lower end 95% CI (Ha)	Upper end 95% CI (Ha)
soft fruit	209,586.3	9,868.4	4.7	190,244.3	228,928.4

[1]This table includes all crops including minor crops which are excluded elsewhere in the report

Table S3: Estimates of mass applied by region[1]

Crop	Region	Area	Number of holdings	Number of holdings surveyed	Estimate (Kg)	RSE mass (%)	Lower end 95% CI (Kg)	Upper end 95% CI (Kg)
soft fruit	East Midlands	182.20	64	13	1,025.08	35.4	NA	NA
soft fruit	Eastern	1,328.02	185	38	19,043.96	9.4	15,534.37	22,553.56
soft fruit	London & South East	4,774.98	314	85	86,362.35	8.9	71,217.05	101,507.66
soft fruit	North East North West	35.97	55	5	61.31	74.4	NA	NA
soft fruit	South West	868.57	222	27	4,844.25	43.9	NA	NA
soft fruit	West Midlands	1,756.75	116	19	20,161.70	20.7	11,979.73	28,343.66
soft fruit	Yorkshire & the Humber	97.03	63	11	1,202.76	26.4	579.96	1,825.55
soft fruit	Wales	82.13	364	9	0.00	NA	0.00	0.00
soft fruit	Scotland	2,159.339	785	81	18,325.67	7.2	15,750.67	20,900.68
soft fruit	Northern Ireland	10.44	21	9	31.16	16.4	21.17	41.15

[1]This table includes all crops including minor crops which are excluded elsewhere in the report

NA: Not estimated because the relative standard error is larger than 30%

Table S4: Estimates of total mass applied in the United Kingdom[1]

Crop	Mass applied (Kg)	SE mass applied (Kg)	RSE mass applied (%)	Lower end 95% CI (Kg)	Upper end 95% CI (Kg)
soft fruit	151,058.2	9,318.4	6.2	132,794.2	169,322.3

[1]This table includes all crops including minor crops which are excluded elsewhere in the report

APPENDIX 5 – FIRST RAISING FACTORS FOR SOFT FRUIT CROPS

Region/Country	*Farm size group*	*rf1*	*Regional area (ha)*	*Area surveyed (ha)*	*Number of farms visited*
East Midlands	A	2.91	24	8	9
	B	9.59	39	4	*
	C	10.49	53	5	*
	D	1.90	66	35	*
Eastern	A	9.67	77	8	10
	B	2.49	67	27	8
	C	5.17	188	36	*
	D	1.65	214	130	7
	E	1.63	783	479	8
London & South East	A	4.80	112	23	19
	B	3.63	160	44	12
	C	2.96	338	114	17
	D	1.87	656	351	21
	E	3.01	3,509	1,167	16
North East	A	2.69	3	1	*
North West	A	10.43	19	2	*
	B	3.01	14	5	*
Northern Ireland	A	2.38	10	4	9
Scotland	A	3.59	74	21	30
	B	2.81	82	29	8
	C	1.52	119	79	10
	D	2.45	621	254	16
	E	1.33	1,263	947	17
South West	A	5.07	79	16	19
	B	7.50	95	13	*
	C	5.77	102	18	*
	D	10.10	202	20	*
	E	4.70	391	83	*
Wales	A	12.41	71	6	8
	D	1.10	11	10	*
West Midlands	A	8.81	62	7	10
	D	5.24	298	57	*
	E	3.77	1,396	370	6
Yorkshire & the Humber	A	5.57	35	6	8
	B	3.06	19	6	*
	C	7.16	43	6	*

For confidentiality reasons a * has been used where 5 or less holdings have been sampled.

The first raising factor (rf1) is the largest of the three raising factors and gives an indication of the robustness of the sample with smaller numbers indicating a larger area sampled within each size group and region.

ACKNOWLEDGEMENTS

Thanks are due to all growers who willingly participated in this survey, providing invaluable information upon which this report is based. Many thanks are also due to: Gillian Reay, Craig Davis, Johan Wardlaw, Calum MacLeod and Amy Robertson for their role in the collection and provision of data (including estimates of cropping areas) from Scotland; Stephen Jess, Michael Lavery, Joanna Kirbas, David Matthews and Amanda Browne for their role in the collection and provision of data (including estimates of cropping areas) from Northern Ireland; Yvonne Powell-Wainwright and Josephine Roberts for their role in maintaining the pesticides database; and Jayne Brigham and Sarah Thompson for their help with the frequency distributions of arable crops. Thanks also go to the members of the ECP Working Party on Pesticide Usage Surveys for their invaluable comments.

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LINKS TO JUNE SURVEY DATA

June Survey – England: https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june (last accessed 13.09.2023)

June Survey – Wales: https://gov.wales/survey-agriculture-and-horticulture (last accessed 13.09.2023)

June Survey – Scotland: https://www2.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/Publications/JuneAgriculturalCensus (last accessed 13.09.2023)

June Survey – Northern Ireland: https://www.daera-ni.gov.uk/articles/agricultural-census-northern-ireland - (last accessed 13.09.2023)