PESTICIDE USAGE SURVEY
REPORT 296

SOFT FRUIT
IN THE UNITED KINGDOM
2020

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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: 01904 465 712

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

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 2020. 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://secure.fera.defra.gov.uk/pusstats/surveys/index.cfm

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OVERVIEW OF MAIN FINDINGS

This report presents information on all aspects of pesticide usage during the 2019/2020 growing season on soft fruit crops comprising strawberries, blackcurrants, redcurrants & whitecurrants, gooseberries, blueberries, raspberries, blackberries, hybrid berries and grapevines. A total of 296 holdings growing soft fruit were visited throughout the United Kingdom and the area of soft fruit grown on these holdings represented 36% 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 25% since 2012 and by 5% since 2018. Four crops accounted for 85% of the total area of soft fruit grown; strawberries (33%), grapevines (21%), blackcurrants for processing (19%) and raspberries (12%). An estimated 41% of the total area of soft fruit crops was grown in London & South East Region, 17% in West Midlands, 17% in Scotland, 12% in Eastern Region, 6% in South West Region, 3% in East Midlands Region, 2% in Yorkshire & the Humber, 1% in Wales, 1% in the North West and less than 1% in the North East and Northern Ireland.

Approximately 56% of the total pesticide-treated (including macro-biological control agents) area was cropped with strawberries, 19% with vines, 12% with blackcurrants for processing and 6% with raspberries.

In 2020, 51% 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, 96% of the area grown was under protection, strawberries 95%, raspberries 88% and blueberries 69%.

Fungicides accounted for 52% of the total pesticide-treated area of soft fruit grown in the United Kingdom in 2020, biological control agents 19%, insecticides 12%, herbicides 8%, sulphur 7%, acaricides and molluscicides 1% each and physical control agents, growth stimulants, disinfectants and soil sterilants less than 1% each. In terms of weight of pesticides applied, fungicides accounted for 54% of the total, sulphur 35%, herbicides 5%, insecticides 4%, physical control agents 1%, and soil sterilants, acaricides, molluscicides, disinfectants and growth stimulants less than 1% each.

The most extensively used fungicide formulations applied were fenhexamid, boscalid/pyraclostrobin, cyprodinil/fludioxonil, myclobutanil and *Bacillus amyloliquefaciens* strain QST 713. Sulphur was used as a fungicide on almost all crops, but mainly on vines, blackcurrants for processing and strawberries.

The most extensively used herbicide formulations were glyphosate, carfentrazone-ethyl, pendimethalin and propyzamide, which together accounted for 71% of the herbicide-treated area in 2020.

Pyrethroids were the most extensively used insecticides, accounting for 27% of the insecticide-treated area, followed by neonicotinoids (24%) and the micro-organism derived spinosad (20%). Lambda-cyhalothrin was the principal pyrethroid recorded and thiacloprid the principal neonicotinoid encountered.

Neoseiulus cucumeris was the most extensively used biological control agent in 2020, accounting for 35% of the area treated with biological controls, followed by *Phytoseiulus persimilis* (27%) and *Orius spp.* (14%).

Three acaricides accounted for over 70% of usage - bifenazate (37%), spirodiclofen (19%) and clofentezine (18%). Only two molluscicide active substances were encountered - ferric phosphate (65% by area treated) and metaldehyde (35%). Dazomet was the only soil sterilant encountered in the survey.

OBSERVATIONS ON THE 2020 REPORT AND CHANGES SINCE 2018

The Covid pandemic has meant that all soft fruit data collected by each of the survey teams in England & Wales, Scotland and Northern Ireland has been either by phone, email or by post, and no face to face visits were conducted by any of the teams. However, we believe that the impact in terms of survey participation and data quality as a result of this change in methodology has been minimal (see page 72, Appendix 2 – methodology). Covid has caused problems for the June Survey teams in both England & Wales, and the full annual survey of farms that produces the comprehensive frequency distributions used for sample selection and raising factors was not conducted in 2020. Notes on page 72 show how the absence of regional 2020 data have been managed to produce this report. Estimates of the degree of uncertainty within the data are also available on page 74 (Appendix 3 – standard error calculations).

The total registered pesticide-treated area in the United Kingdom in 2020 was 3% less than in 2018. By contrast, the weight of pesticides applied increased by 10% since 2018 (mainly because of increases in the weight of sulphur, insecticides and fungicides applied). The UK cropping area has also increased by 5% since 2018 (cropping estimates are based on 2019 June Survey data for England & Wales and 2020 data for Scotland and Northern Ireland – see page 72) which is mainly due to an 18% increase in the area of grapevines and to a lesser extent, blackcurrants, which increased by 4%. The area of other soft fruit crops has remained largely unchanged since 2018, with a small increase in the area of raspberries and strawberries grown.

There has been 7% increase in the fungicide-treated area since 2018 and a 5% increase in weight applied. This in part could be due to the increase in the planted area of grapevines, which compared to other soft fruit crops are relatively intensively treated. There has also been a significant increase (78%) in the area treated with biological fungicides since 2018, with 10,580 treated-hectares recorded in 2018, in contrast to 18,854 in 2020. The weight of biological fungicides applied has also increased significantly from 955 kilograms in 2018 to 15,526 kilograms in 2020. There has also been an increase in the use of sulphur (14% by area treated and 26% by weight applied) over the same period.

The area treated with acaricides has decreased by almost a half, from 7,599 treated-hectares in 2018, to 3,827 treated-hectares in 2020. There has also been a 12% decrease in the insecticide area treated since 2018. However, the weight applied more than doubled, from 3,371 kilograms in 2018, to 7,146 kilograms in 2020. This is largely due to the increased use of fatty acids, which have very high rates of application compared to other insecticides. Fatty acids accounted for 300 kilograms of insecticide active substance use in 2018, in contrast to 4,601 kilograms in 2020.

There has been a decrease in herbicide use (28% by area-treated and 26% by weight applied) since 2018, possibly as a result of the use of mulches and a move to soil-less systems such as pots, bags and troughs.

The area treated with macro-biological control agents (living predators, parasites and nematodes) has increased almost four-fold since 2012 (12,814 treated hectares in 2012 compared to 49,439 treated hectares in 2020) and has almost doubled since 2018 (24,246 treated-hectares in 2018, 49,439 treated-hectares in 2020).

The use of soil sterilants, which accounted for 41% of the weight applied in 2012, has been excluded from Figures 4 and 5 (as in the 2018 report) in order not to mask the changes in other pesticide groups. Usage of soil sterilants has declined significantly since 2012 and was confined to recent plantings of strawberry and raspberry crops in 2014 and 2016 and raspberry crops in 2018 and 2020. In 2018 soil sterilants accounted for less than 0.1% (15 hectares) of the total area of all registered pesticides applied, but for 2% of the total weight applied. In 2020 soil sterilants accounted for less than 0.1% of the area treated (11 ha) and 0.4% of the total weight applied (please refer to Table 12 on page 72 for additional detail on soil sterilants).

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 2019/20 by visiting holdings throughout the United Kingdom during the winter of 2020/21.

This was the sixth survey of pesticide usage on soft fruit crops in the United Kingdom and the tenth 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 2020 covering pesticide usage on soft fruit crops in 2018 (Ridley et. al., 2020). Other reports for the United Kingdom covered harvest years 2010, 2012, 2014 and 2016. The 2018 UK soft fruit report can be found here: https://secure.fera.defra.gov.uk/pusstats/surveys/documents/softfruit2018.pdf

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: 01904 465 712
Or visit the website: https://secure.fera.defra.gov.uk/pusstats/surveys/index.cfm

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 Her 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://secure.fera.defra.gov.uk/pusstats/surveys/index.cfm

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://secure.fera.defra.gov.uk/pusstats/surveys/documents/uk_map.pdf

EXPLANATORY NOTES FOR THE 2020 REPORT

This report is based on over 46,000 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. However, 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://secure.fera.defra.gov.uk/phiw/riskRegister/plant-health/non-native-biocontrol-agents.cfm for information on non-native invertebrates which require a license.

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 rarely 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 36% 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 was taken in 2014 in order to reduce the burden on growers who grew both protected and outdoor soft fruit crops and were 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, desiccants, soil sterilants, nematicides 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 physical control agents, growth stimulants, soil sterilants and disinfectants.

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 the weight of biological control agents refers only to preparations of bacterial and fungal origin.

l) 'Non-authorised pesticides', including biological control agents, are those that do not require to be, and have not been put through, HSE's 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 11, 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

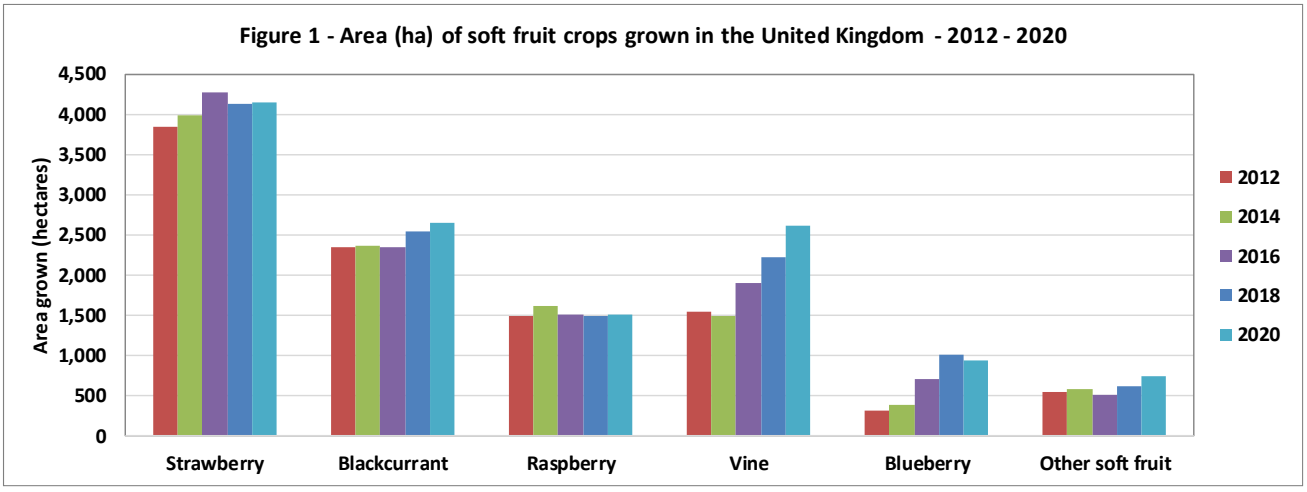


Figure 1 - Area (ha) of soft fruit crops grown in the United Kingdom - 2012 - 2020
Area grown (hectares)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Strawberry
Blackcurrant
Raspberry
Vine
Blueberry
Other soft fruit
2012
2014
2016
2018
2020

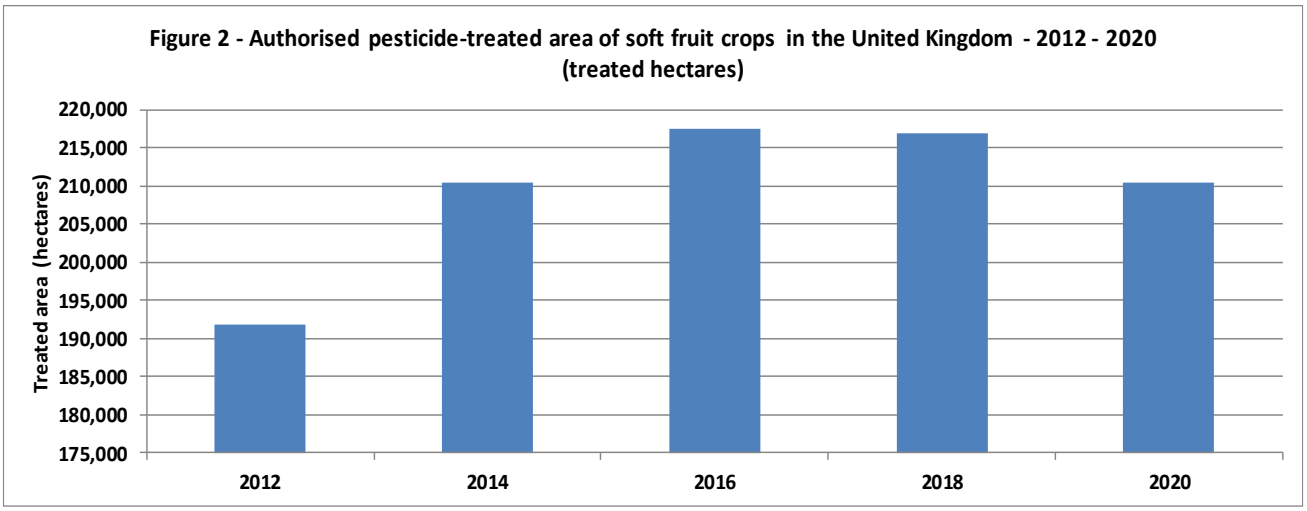


Figure 2 - Authorised pesticide-treated area of soft fruit crops in the United Kingdom - 2012 - 2020 (treated hectares)
Treated area (hectares)
220,000
215,000
210,000
205,000
200,000
195,000
190,000
185,000
180,000
175,000
2012
2014
2016
2018
2020

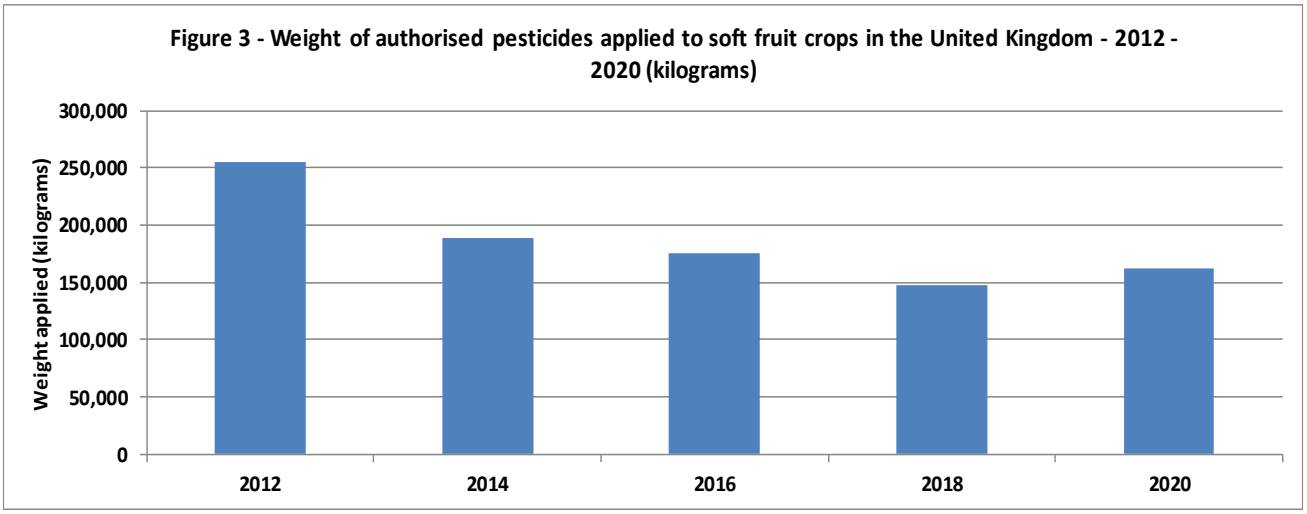


Figure 3 - Weight of authorised pesticides applied to soft fruit crops in the United Kingdom - 2012 - 2020 (kilograms)
Weight applied (kilograms)
300,000
250,000
200,000
150,000
100,000
50,000
0
2012
2014
2016
2018
2020

TRENDS (*cont.*)

Figure 4 - Area of soft fruit crops treated with the major pesticide groups in the United Kingdom - 2012 - 2020 (treated hectares)

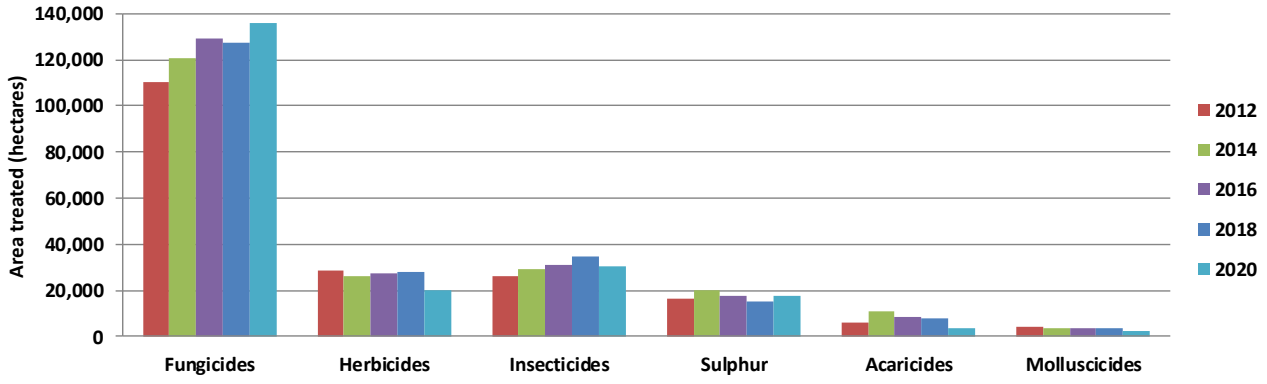
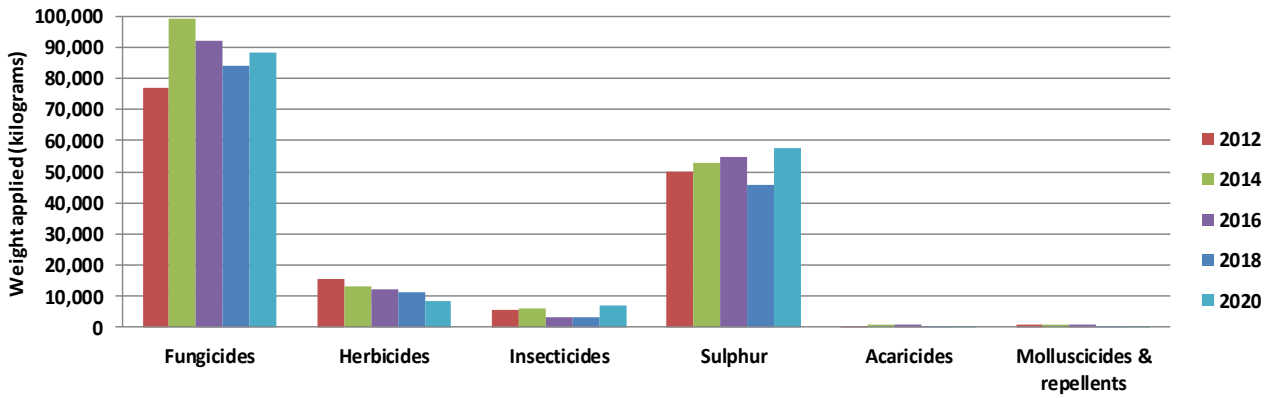


Figure 5 - Weight of the major pesticide groups applied to soft fruit crops in the United Kingdom - 2012 - 2020 (kilograms)



CROPS

Information concerning 10 main types of soft fruit crops and data on pesticide usage were collected from 2,263 fields/blocks, or groups of fields/blocks treated with the same pesticide applications, grown on 296 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, tummelberry and veitchberry); and grapevines. Small areas of chokeberry, elderberry, haskap berry, kiwi fruit, saskatoon and sea buckthorn were also recorded (0.4% of the sampled area), but not included in the survey for confidentiality reasons.

The sample accounted for 36% of the total area of soft fruit crops grown in the United Kingdom during the 2019/20 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 6a, show the regional distribution and relative area of crops grown in the United Kingdom. Figures are based on 2019 June Survey data for England & Wales and the 2020 June Survey data for Scotland and Northern Ireland. Due to the impact of the COVID-19 pandemic it was not possible for Defra or the Welsh Government to run the 2020 June Survey of Agriculture and Horticulture for England & Wales as planned and data on the area of soft fruit crops grown nationally and for each region were not available for 2020. 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) - 2020

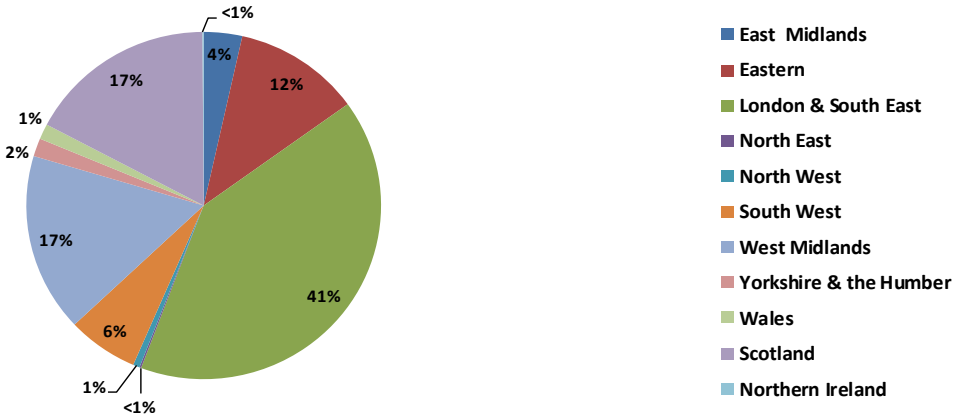
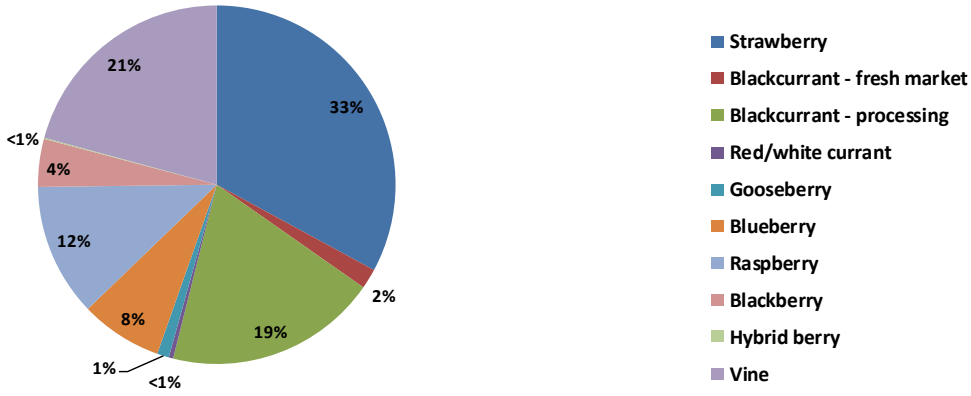


Figure 6a - Relative areas of the different soft fruit crops in the United Kingdom (June Survey data) - 2020



PESTICIDE USAGE

Figure 6b 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.

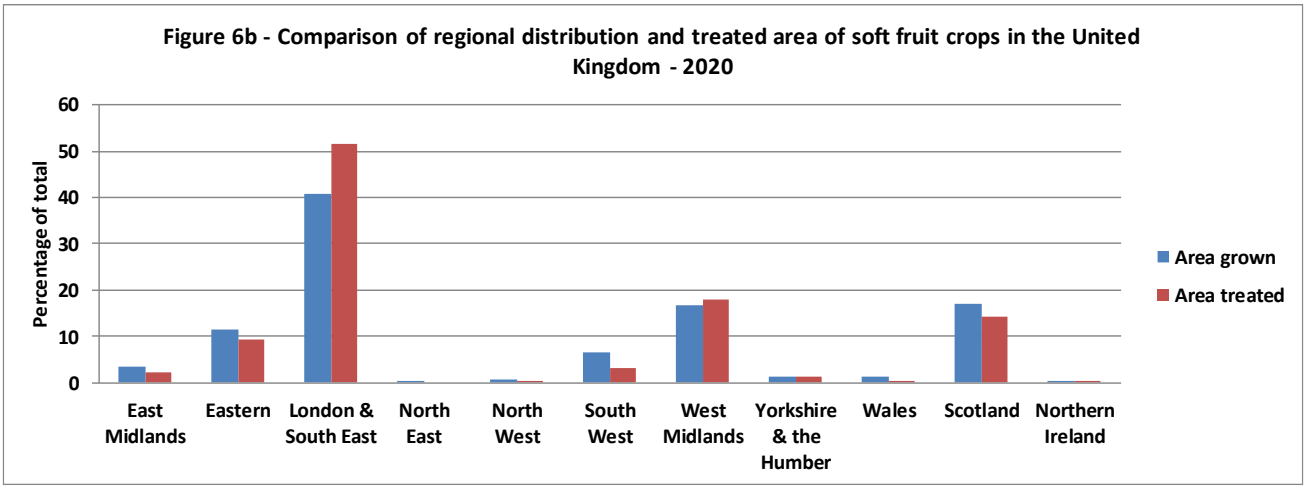
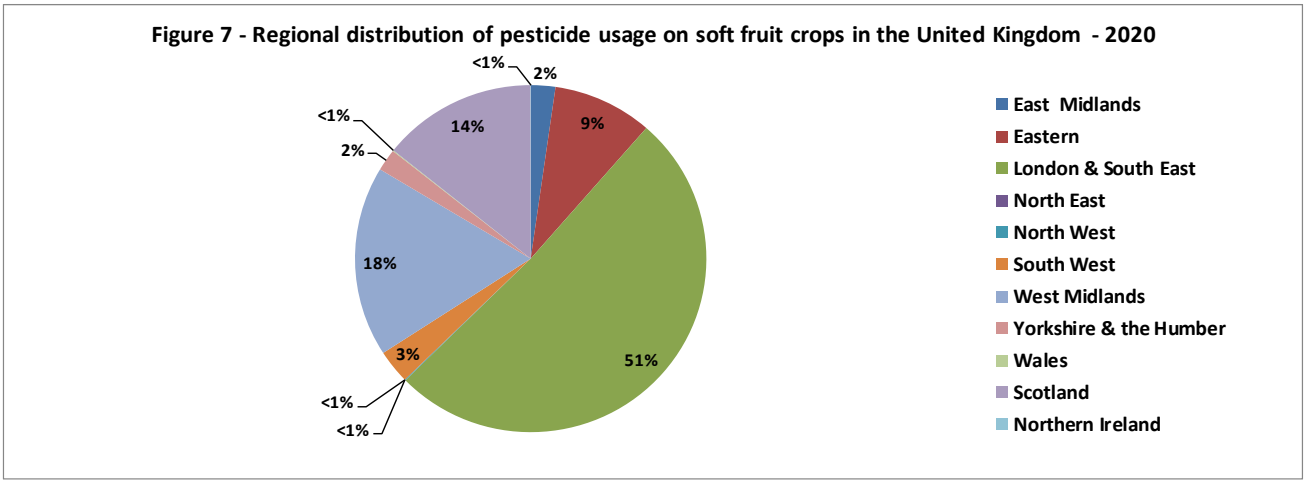


Figure 7 expresses the percentage (also found in Figure 6b) of the estimated total treated area in each region.



PESTICIDE USAGE (*cont*.)

Figure 8 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 physical control agents, growth stimulants, soil sterilants and disinfectants.

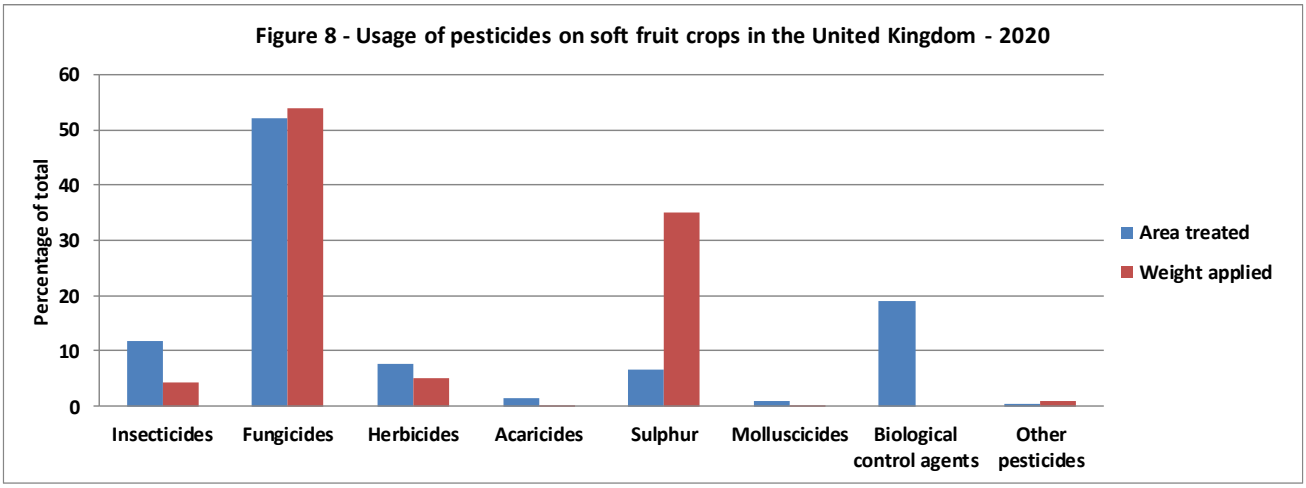
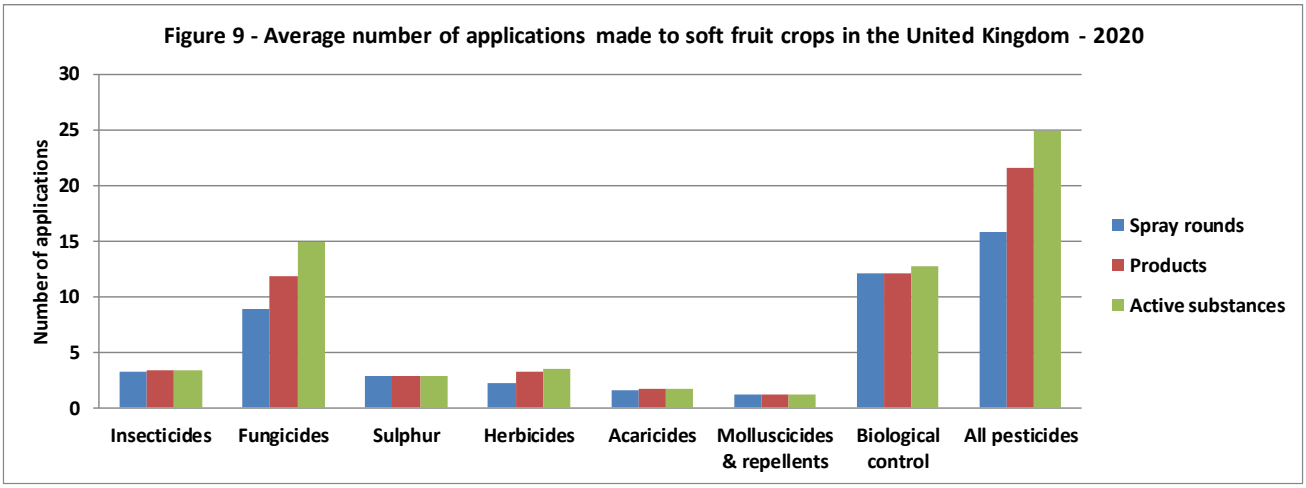


Figure 9 is based on Tables 4a, 4b and 4c (in Appendix 1 to this report) and shows the average number of spray rounds (number of passes of application machinery into a field), pesticide products and number of active substances used on each crop.

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

- **4,140 hectares of strawberries grown in the United Kingdom**
- **146,686 treated hectares**
- **66.5 tonnes of formulation applied**
- **1% of strawberries remained untreated**
- **Strawberries received on average 17 biological control agent, 15 fungicide, 4 insecticide, 2 herbicide, 2 sulphur, 2 acaricide and 1 molluscicide spray rounds**
- **72% of the crop was one year old or less, 23% was between 1 & 2 years and 5% was over 2 years old**
- **23% of the crop was grown directly in the soil with the remainder being grown in bags, pots or troughs. Approximately 75% of the crop was grown on a table-top system to ease picking and reduce pest pressure**
- **42% of the crop was either planted through a ground mulch (polythene or woven fabric), bags were placed on the mulch or a ground mulch was used beneath the table-tops**
- **95% of all crops by area grown was covered by tunnels**
- **94% of the harvested crop area was grown for the fresh-market, 4% for pick-your-own and 2% for processing. The main varieties encountered included Malling Centenary, Murano, Sonata, Sweet Eve 2 and Amesti.**

Figure 10 - Usage of pesticides on strawberries - 2020

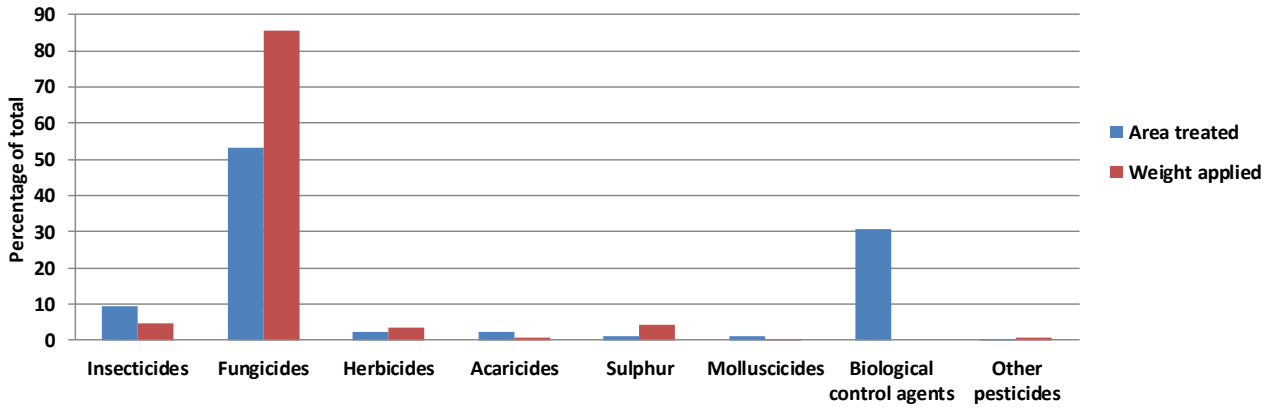
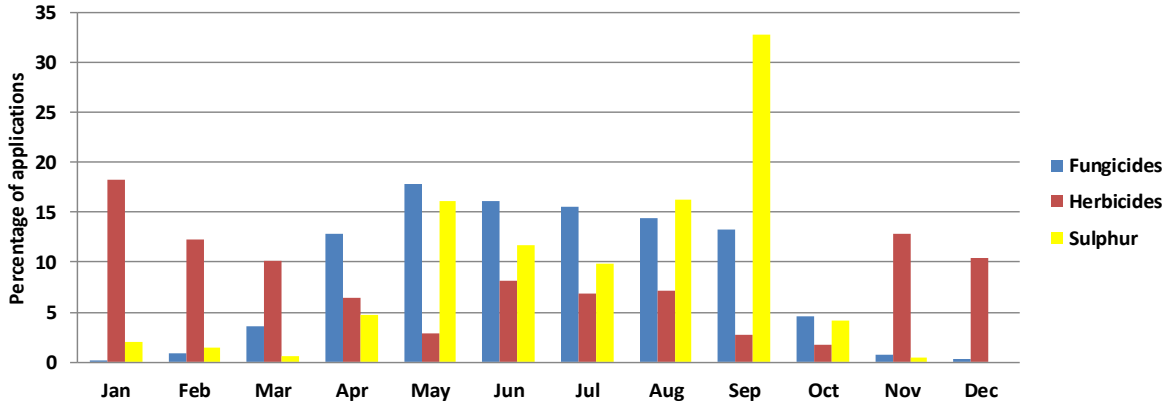
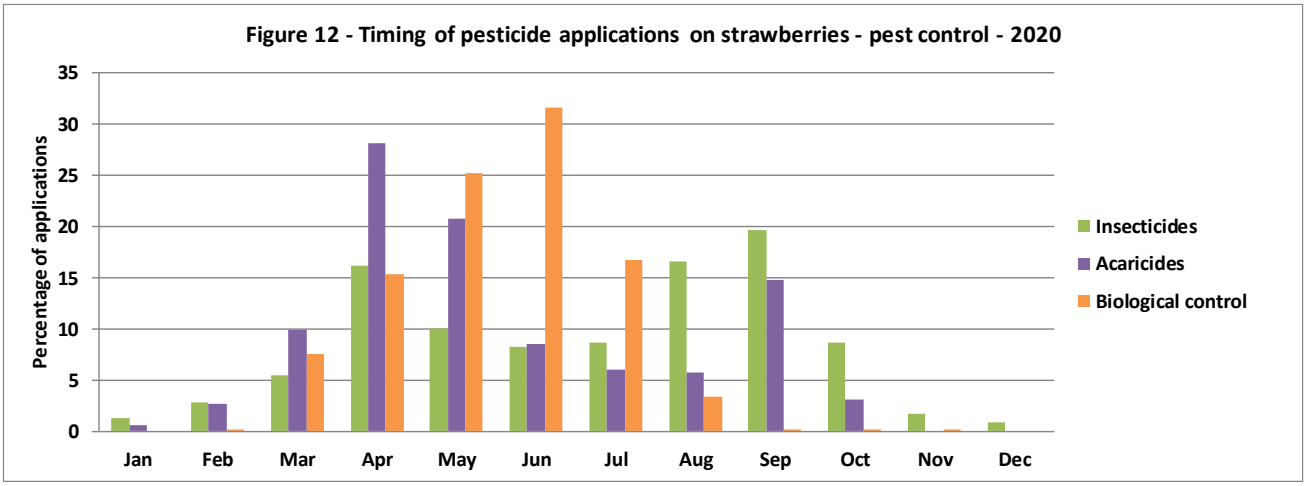


Figure 11 - Timing of pesticide applications on strawberries - disease and weed control - 2020



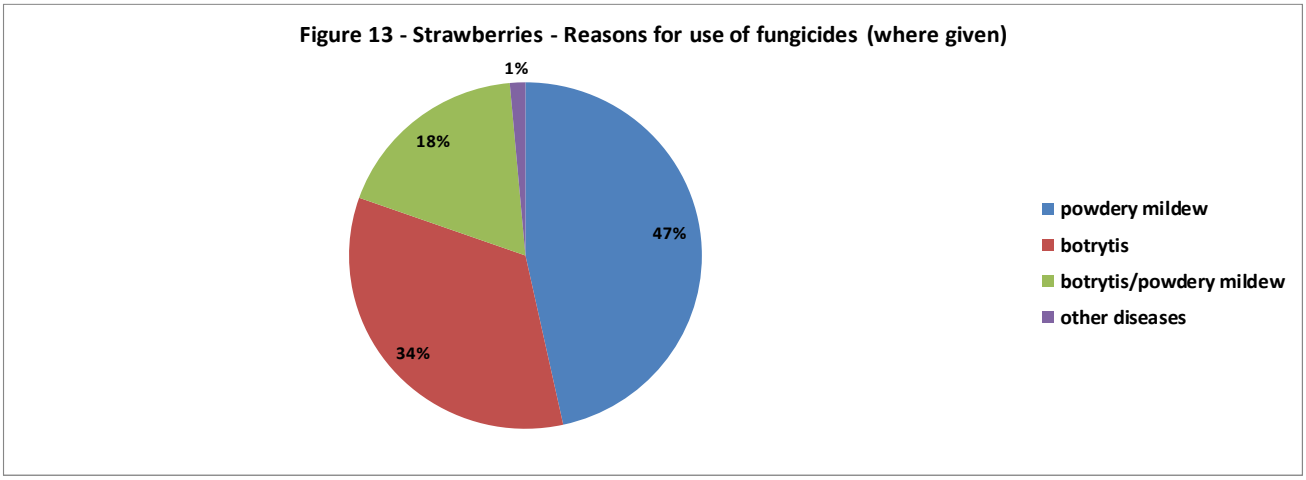


Strawberries – Fungicides

- **Formulation area treated: 78,145 hectares**
- **Weight of formulations applied: 57.0 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
Fenhexamid	7,027	4,409	0.09	0.78	2.25	0.84
Fluopyram/trifloxystrobin	6,340	2,523	0.08	0.81	1.92	0.99
Bacillus amyloliquefaciens strain QST 713	5,433	373	0.07	0.46	2.93	0.68
Myclobutanil	5,302	318	0.07	0.71	1.85	0.60
Difenoconazole/fluxapyroxad	5,044	376	0.06	0.69	1.79	0.99

Use of the commodity chemical potassium hydrogen bicarbonate (potassium bicarbonate) for powdery mildew control accounted for 6% of the fungicide treated area, but for 41% of the weight of fungicides applied, reflecting its relatively high rate of application.



Strawberries – Sulphur

- **Formulation area treated: 1,532 hectares**
- **Weight of formulations applied: 2.9 tonnes**

Usage of sulphur accounted for 1% of the area treated and 4% of the weight applied. The main usage, 98%, was for powdery mildew control alone, with a further 2% of applications made for botrytis (grey mould) and powdery mildew control.

Strawberries – Herbicides

- **Formulation area treated: 3,246 hectares**
- **Weight of formulations applied: 2.3 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	727	930	0.22	0.16	1.13	0.78
Carfentrazone-ethyl	575	13	0.18	0.11	1.24	0.62
Isoxaben	380	47	0.12	0.07	1.27	0.70
Propyzamide	309	222	0.10	0.07	1.04	0.77
Napropamide	272	538	0.08	0.06	1.00	0.80

Figure 14 - Strawberries - Reasons for use of herbicides (where given)

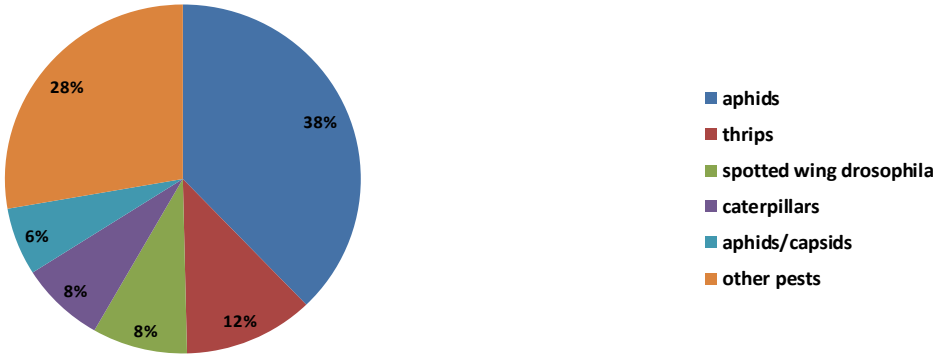
Strawberries – Insecticides

- **Formulation area treated: 13,550 hectares**
- **Weight of formulations applied: 3.2 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	3,857	253	0.28	0.52	1.79	volumetric
Spirotetramat	2,685	259	0.20	0.55	1.17	0.96
Lambda-cyhalothrin	2,079	17	0.15	0.36	1.38	0.65
Thiacloprid	1,968	229	0.15	0.39	1.23	0.97
Bacillus thuringiensis var. kurstaki	1,426	573	0.11	0.12	2.99	volumetric

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



Strawberries – Biological control

- **Formulation area treated: 45,142 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	16,807	.	0.37	0.53	8.05	.
Phytoseiulus persimilis	11,670	.	0.26	0.52	5.62	.
Orius spp.	5,237	.	0.12	0.23	5.62	.
Aphidius colemani	2,950	.	0.07	0.10	6.85	.
Steinernema feltiae	1,570	.	0.03	0.05	7.91	.

Neoseiulus cucumeris was used primarily for the control of thrips; *Phytoseiulus persimilis* for the control of two-spotted spider mite; *Orius* spp. for thrips control; *Aphidius colemani* for aphid control and *Steinernema feltiae* for vine weevil control.

The area of strawberries treated with biological control agents had more than doubled since 2018.

Bumble bees alone were important for pollination on 43% of farms. A further 36% of farms used either honey bees alone, a combination of both honey and bumble bees, or flies. The remaining 21% of farms did not use either bees or flies for the pollination of their strawberry crop.

Strawberries – Acaricides

- **Formulation area treated: 3,234 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	1,397	134	0.43	0.27	1.25	0.66
Clofentezine	603	106	0.19	0.14	1.01	0.88
Etoxazole	499	18	0.15	0.12	1.02	volumetric
Cyflumetofen	325	63	0.10	0.08	1.02	0.96
Spirodiclofen	323	27	0.10	0.08	1.02	volumetric

Eighty-eight percent of acaricide applications on strawberries were for the control of two-spotted spider mites, the remaining 12% was for general pest control.

Strawberries – Other pesticides

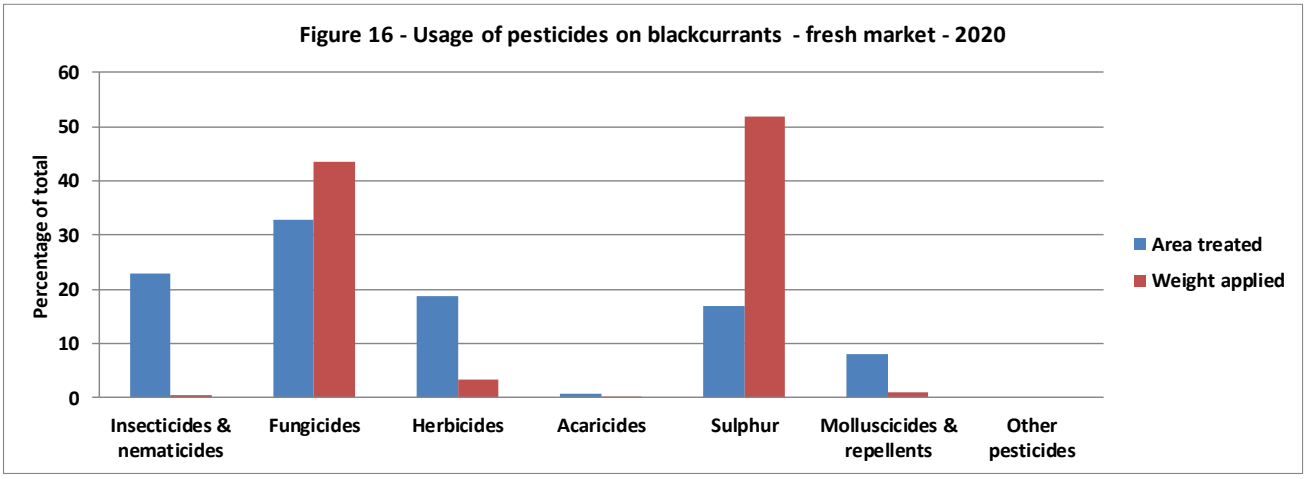
Molluscicide applications comprised 1% of the total treated area of strawberries. Ferric phosphate accounted for 61% of the molluscicide-treated area, metaldehyde the remaining 39%.

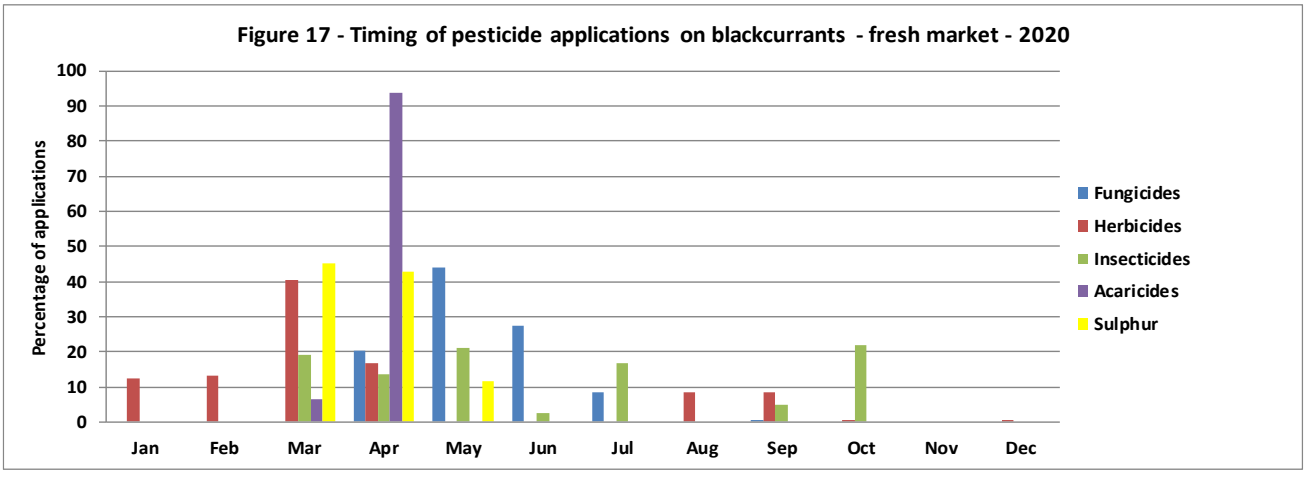
Other pesticides included unspecified physical control agents and maltodextrin for general pest control and the disinfectant peroxyacetic acid.

PESTICIDE USAGE ON BUSH FRUIT

Blackcurrants – fresh market

- **227 hectares of blackcurrants grown for the fresh market in the United Kingdom**
- **1,850 treated hectares**
- **2.5 tonnes of formulation applied**
- **16.6% of blackcurrants – fresh market remained untreated**
- **Blackcurrants grown for the fresh market received on average 3 fungicide, 2 insecticide, 2 sulphur, 2 herbicide, and 1 acaricide spray rounds**
- **7% of the crop was five years old or less, 50% was between six and ten years and 43% was over ten years old**
- **All crops encountered were grown in the soil**
- **1% of the crop, by area grown, was covered by tunnels**
- **Approximately 72% of the crop area was grown for the fresh market and 28% for the pick-your-own market. Less than 1% was used for processing (freezing, jams, preserves etc.)**
- **Ben Hope, Ben Conan, Ben Sarek and Ben Tirran were the four main varieties encountered**



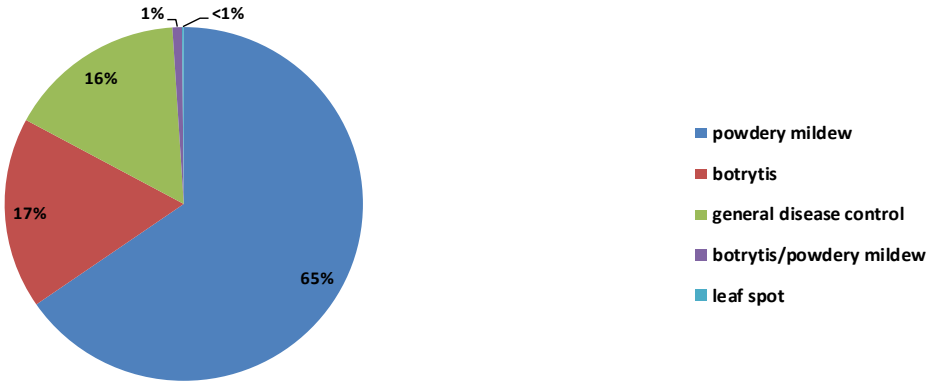


Blackcurrants – fresh market – Fungicides

- **Formulation area treated: 606 hectares**
- **Weight of formulations applied: 1.1 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
Bacillus amyloliquefaciens strain QST 713	221	11	0.36	0.35	2.74	0.50
Myclobutanil	122	11	0.20	0.24	2.22	0.95
Potassium hydrogen carbonate	71	972	0.12	0.08	4.00	Volumetric
Boscalid/pyraclostrobin	45	20	0.07	0.20	1.01	0.87
Fenhexamid	42	32	0.07	0.18	1.01	1.00

Figure 18 - Blackcurrants - fresh market - Reasons for use of fungicides (where given)



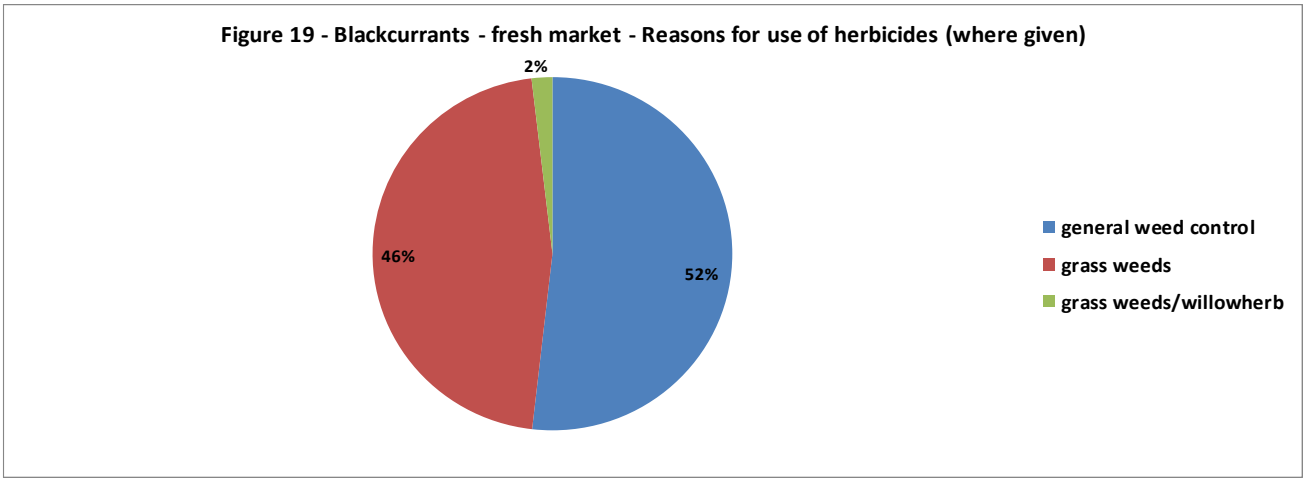
Sulphur accounted for 17% of the area treated and 52% of the weight of pesticides applied to blackcurrants for fresh market. Ninety-five percent of sulphur applications were used for blackcurrant big bud mite, the remaining 5% for botrytis.

Blackcurrants – fresh market – Herbicides

- **Formulation area treated: 348 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
Pendimethalin	92	32	0.26	0.41	1.00	1.00
Flufenacet/metribuzin	44	14	0.13	0.19	1.00	1.00
Propyzamide	36	18	0.10	0.16	1.00	0.97
Diquat	35	4	0.10	0.14	1.11	1.00
Carfentrazone-ethyl	29	<1	0.08	0.13	1.00	0.47

Figure 19 - Blackcurrants - fresh market - Reasons for use of herbicides (where given)



Blackcurrants – fresh market – Insecticides

- **Formulation area treated: 423 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
Pyrethrins	364	11	0.86	0.35	4.52	0.40
Deltamethrin	33	<1	0.08	0.14	1.00	1.00
Thiacloprid	14	2	0.03	0.06	1.03	1.00
Lambda-cyhalothrin	13	<1	0.03	0.05	1.04	1.00

Ninety-one percent of insecticide applications were used for aphid and capsid control, the remaining 9% was for aphids alone.

Blackcurrants – fresh market – Other pesticides

Molluscicide applications comprised 8% of the total treated area of blackcurrants – fresh market. Ferric phosphate accounted for over 99% of the molluscicide-treated area, metaldehyde less than 1%.

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

Honeybees situated on the farm were important for the pollination of 14% of crops.

Blackcurrants - processing

- **2,419 hectares of blackcurrants grown for processing in the United Kingdom**
- **32,086 treated hectares**
- **37.3 tonnes of formulation applied**
- **Almost all blackcurrants grown for processing received a pesticide application**
- **Blackcurrants grown for processing received on average 4 fungicide, 3 herbicide, 2 insecticide, 2 sulphur, 1 molluscicide and 1 acaricide spray rounds**
- **67% of the crop was five years old or less, 26% was between six and ten years and 7% was over ten years old**
- **All of the crop was grown in the soil and none was grown under tunnels**
- **10% of the crop was not harvested as it had either been recently planted or been pruned back in order to fruit in future years**
- **Ben Gairn, Ben Klibrek, Ben Starav and Ben Alder and were the four main varieties grown**

Figure 20 - Usage of pesticides on blackcurrants - processing - 2020

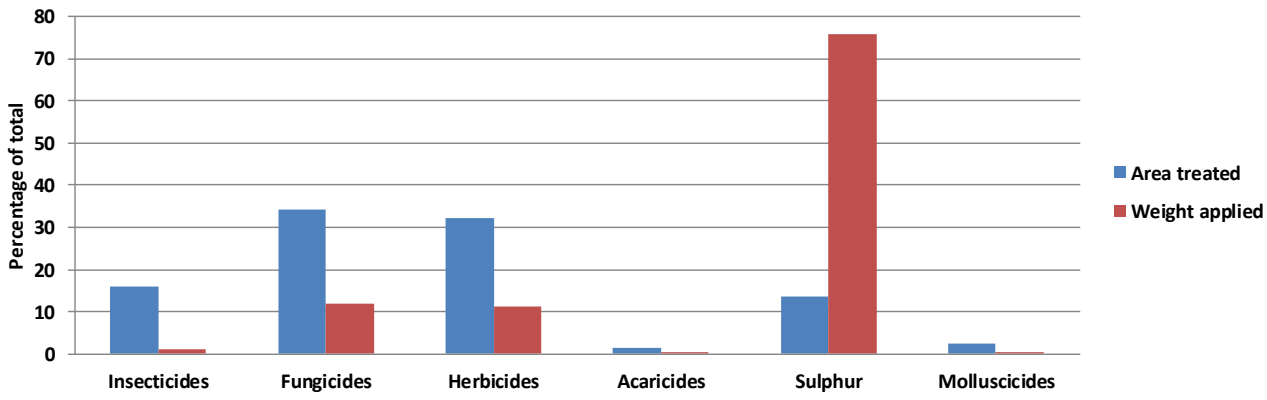
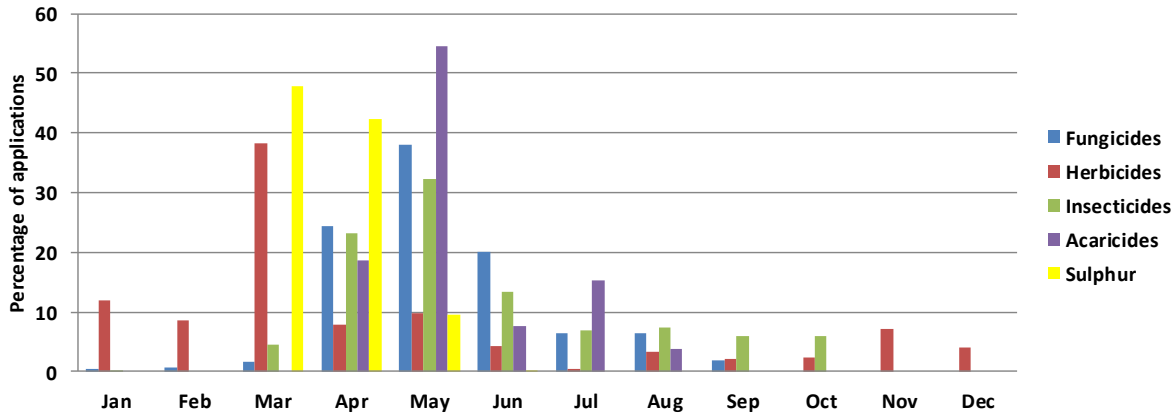


Figure 21 - Timing of pesticide applications on blackcurrants - processing - 2020

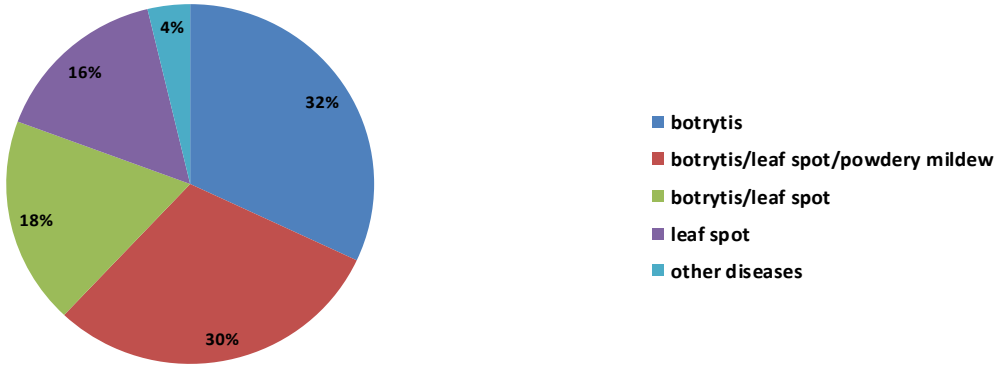


Blackcurrants – processing – Fungicides

- **Formulation area treated: 11,005 hectares**
- **Weight of formulations applied: 4.4 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
Boscalid/pyraclostrobin	2,954	1,370	0.27	0.85	1.42	0.93
Myclobutanil	2,144	168	0.19	0.55	1.60	0.87
Kresoxim-methyl	1,445	143	0.13	0.56	1.07	0.99
Pyrimethanil	1,322	976	0.12	0.48	1.16	0.92
Cyprodinil/fludioxonil	1,290	757	0.12	0.52	1.01	0.94

Figure 22 - Blackcurrants - processing - Reasons for use of fungicides (where given)



Blackcurrants – processing – Sulphur

- **Formulation area treated: 4,411 hectares**
- **Weight of formulations applied: 28.3 tonnes**

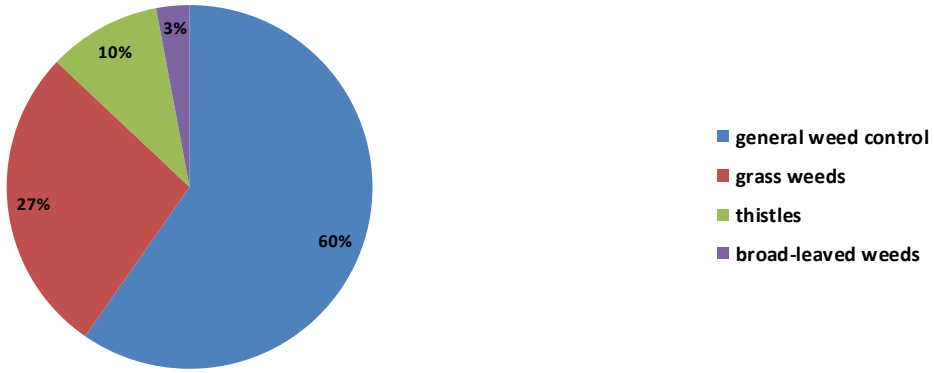
Sulphur accounted for 14% of the pesticide treated area, but for 76% of the weight of pesticides applied. Control of blackcurrant big bud mite was the only reason specified for sulphur usage on blackcurrants for processing.

Blackcurrants – processing – Herbicides

- **Formulation area treated: 10,367 hectares**
- **Weight of formulations applied: 4.1 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	2,941	1,474	0.28	0.71	1.61	0.71
Pendimethalin	2,019	1,004	0.19	0.83	1.00	0.93
Flufenacet/metribuzin	1,835	730	0.18	0.76	1.00	0.93
Propyzamide	1,415	810	0.14	0.58	1.00	0.82
Carfentrazone-ethyl	1,122	15	0.11	0.44	1.08	0.71

Figure 23 - Blackcurrants - processing - Reasons for use of herbicides (where given)

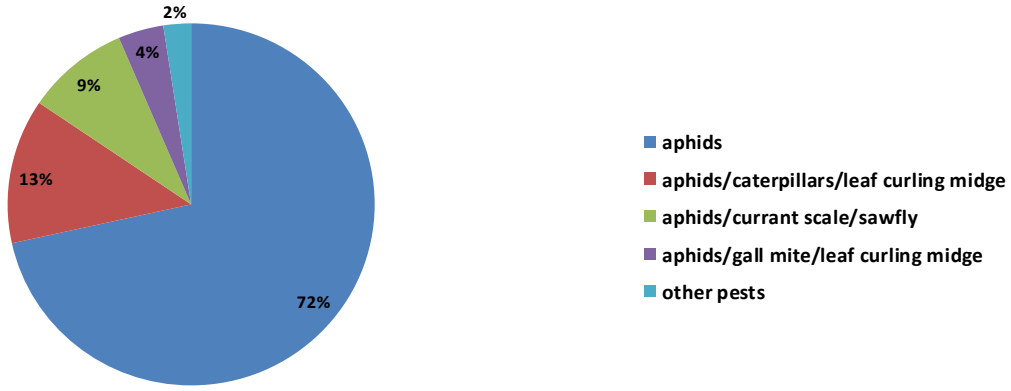


Blackcurrants – processing – Insecticides

- **Formulation area treated: 5,088 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 insecticide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Lambda-cyhalothrin	1,966	16	0.39	0.56	1.40	0.79
Thiacloprid	1,821	216	0.36	0.55	1.40	0.99
Spirotetramat	719	51	0.14	0.26	1.20	0.91
Spinosad	195	11	0.04	0.08	1.00	0.61
Pyrethrins	168	5	0.03	0.02	3.76	volumetric

Figure 24 - Blackcurrants - processing - Reasons for use of insecticides (where given)



Blackcurrants – processing – Acaricides

- **Formulation area treated: 435 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
Spirodiclofen	379	25	0.87	0.16	1.00	0.69
Tebufenpyrad	56	10	0.13	0.02	1.00	0.58

Control of two-spotted spider mite was the only reason specified for acaricide usage on blackcurrants for processing.

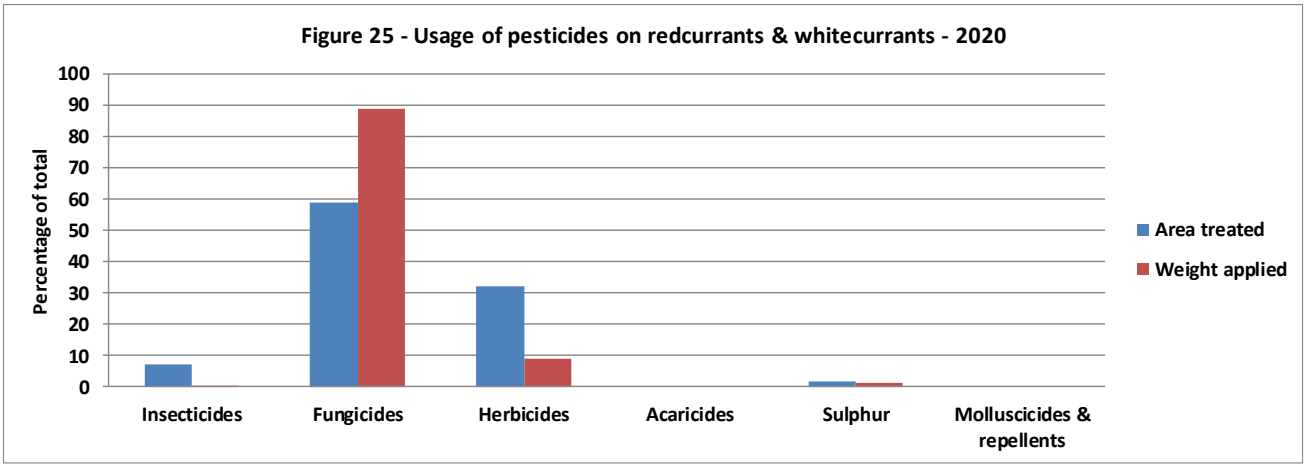
Blackcurrants – processing – Other pesticides

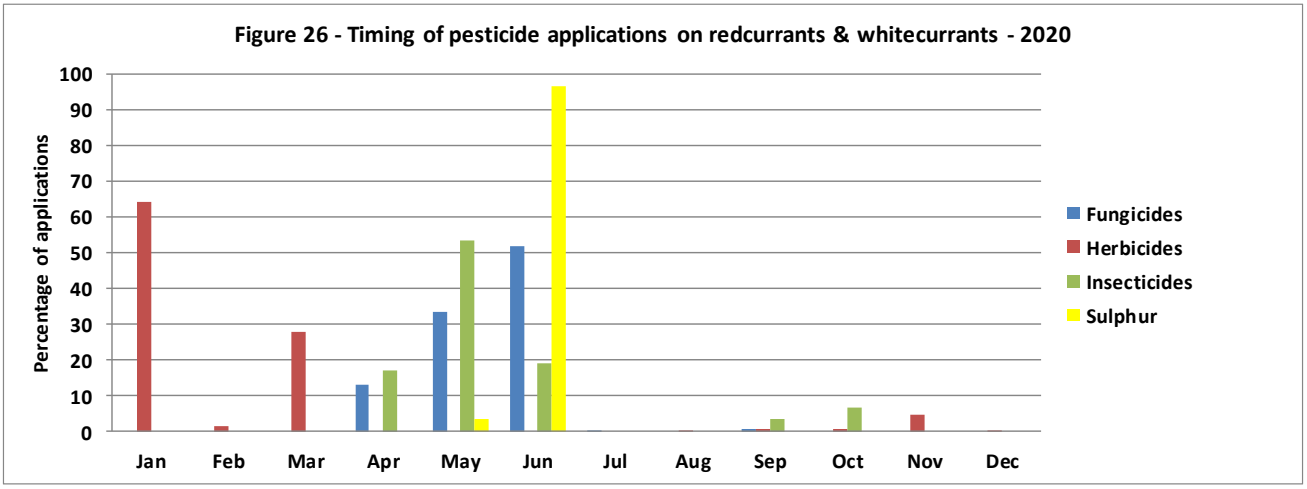
Molluscicides accounted for 2% of the total pesticide treated area of blackcurrants for processing with ferric phosphate comprising 59% of the molluscicide treated area. Metaldehyde accounted for the remaining 41%.

Honeybees situated on the farm were important for the pollination of 6% of crops.

Redcurrants & whitecurrants

- **50 hectares of redcurrants & whitecurrants grown in the United Kingdom**
- **189 treated hectares**
- **0.2 tonnes of formulation applied**
- **21.9% of redcurrants & whitecurrants remained untreated**
- **Redcurrants & whitecurrants received on average 3 fungicide, 2 herbicide and 2 insecticide spray rounds**
- **25% of the crop was five years old or less, 33% was between six and ten years and 42% was over ten years old**
- **95% of the crop was grown in the soil with the remainder being grown in pots**
- **14% of the crop was grown under temporary tunnels**
- **74% of the harvested crop area was grown for the fresh market, 13% for pick-your-own and 12% for processing (including freezing and jam making)**
- **Rovada, Jonkheer van Tets and Redstart were the only redcurrant varieties grown, no whitecurrants were encountered in this survey.**



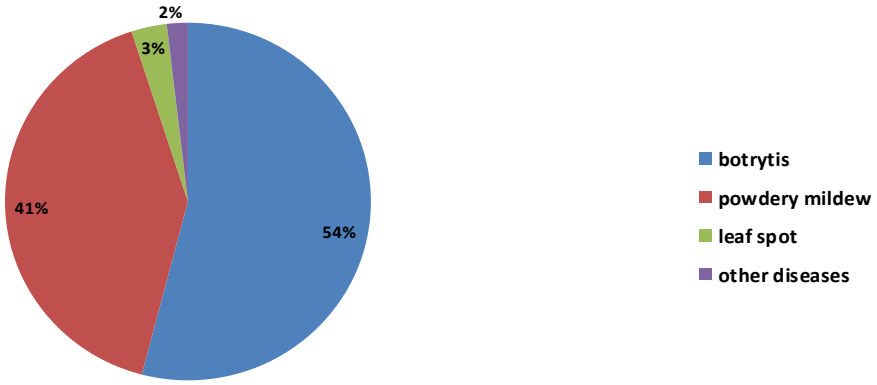


Redcurrants & whitecurrants – Fungicides

- **Formulation area treated: 111 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 fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Boscalid/pyraclostrobin	31	11	0.28	0.62	1.00	0.67
Fenhexamid	26	14	0.23	0.46	1.11	0.74
Myclobutanil	26	2	0.23	0.51	1.00	1.00
Potassium hydrogen carbonate	9	139	0.09	0.06	3.11	volumetric
Cyprodinil/fludioxonil	9	5	0.08	0.17	1.00	1.00

Figure 27 - Redcurrants & whitecurrants - Reasons for use of fungicides (where given)



Redcurrants & whitecurrants – Herbicides

- **Formulation area treated: 60 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	23	5	0.38	0.45	1.01	0.50
Propyzamide	9	5	0.16	0.19	1.00	0.94
Diquat	9	2	0.14	0.11	1.53	1.01
Flufenacet/metribuzin	8	3	0.14	0.16	1.00	1.00
Carfentrazone-ethyl	6	<1	0.10	0.11	1.00	0.75

The higher rate of diquat occurred because a single field had been treated with the 3l/ha rate (normally recommended before planting edible crops), rather than the inter-row rate (applied between the rows of currants) of 2l/ha.

Ninety-nine percent of the reasons given for herbicide use on redcurrants & whitecurrants were for general weed control; the remaining 1% was for grass weeds.

Redcurrants & whitecurrants – Insecticides

- **Formulation area treated: 15 hectares**
- **Weight of formulations applied: <0.01 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
Thiacloprid	5	1	0.35	0.05	1.98	1.00
Pyrethrins	4	<1	0.25	0.07	1.00	volumetric
Lambda-cyhalothrin	3	<1	0.21	0.06	1.00	1.00
Spinosad	3	<1	0.19	0.05	1.00	1.00

Fifty percent of the reasons given for insecticide use on redcurrants & whitecurrants were for control of spotted wing drosophila; the other 50% was for aphid control.

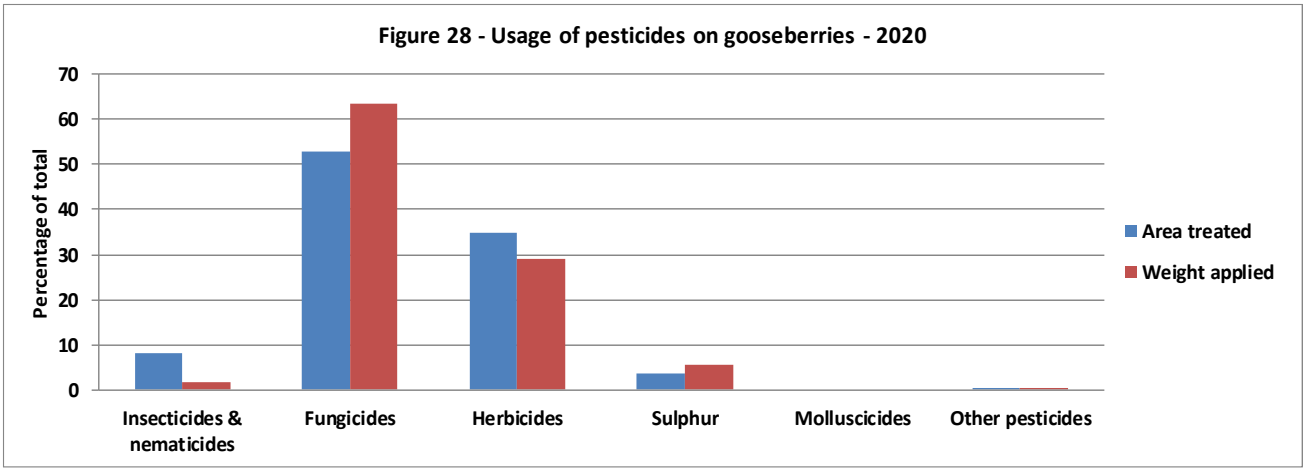
Redcurrants & whitecurrants – Other pesticides

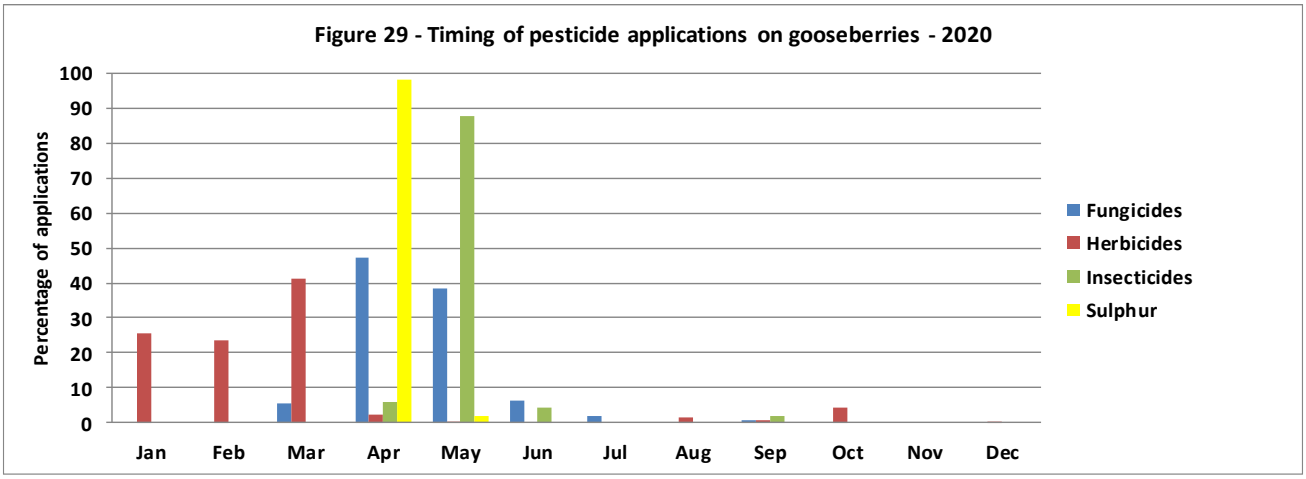
There was minimal usage of acaricides and molluscicides on redcurrants & whitecurrants.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 67% of the crop.

Gooseberries

- **135 hectares of gooseberries grown in the United Kingdom**
- **654 treated hectares**
- **0.4 tonnes of formulation applied**
- **29.7% of gooseberries remained untreated**
- **Gooseberries received on average 3 fungicide, 2 herbicide and 1 insecticide spray rounds**
- **39% of the crop was five years old or less, 54% was between six and ten years and 7% was over ten years old**
- **92% of the crop was grown in the soil with the remainder being grown in pots**
- **Less than 1% of the crop was grown in tunnels**
- **81% of the harvested crop area was grown for the fresh market, 17% for pick-your-own and 2% for processing**
- **The main varieties encountered were Invicta and Careless**



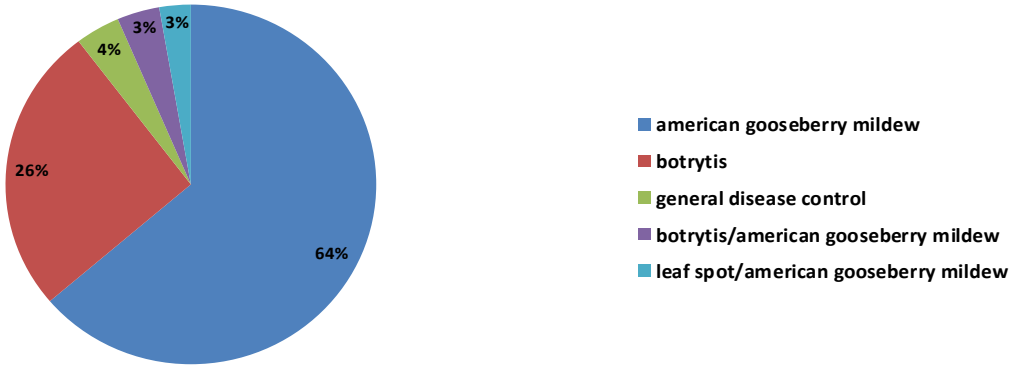


Gooseberries – Fungicides

- **Formulation area treated: 346 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 fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Myclobutanil	107	8	0.31	0.49	1.61	0.85
Fenhexamid	54	40	0.16	0.27	1.48	0.98
Boscalid/pyraclostrobin	46	13	0.13	0.32	1.07	0.83
Fenpropimorph	44	32	0.13	0.15	2.23	0.96
Pyrimethanil	23	9	0.07	0.17	1.00	0.50

Figure 30 - Gooseberries - Reasons for use of fungicides (where given)



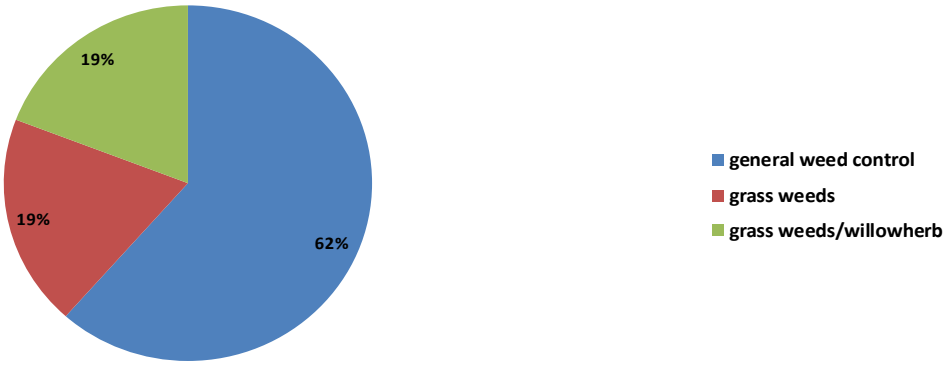
Sulphur accounted for 4% of the total area treated and 5% of the weight of pesticides applied.

Gooseberries – Herbicides

- **Formulation area treated: 229 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	47	24	0.21	0.34	1.02	0.72
Pendimethalin	44	24	0.19	0.33	1.00	0.97
Propyzamide	33	18	0.14	0.25	1.00	0.95
Flufenacet/metribuzin	30	10	0.13	0.22	1.00	1.00
Carfentrazone-ethyl	29	1	0.13	0.17	1.28	0.80

Figure 31 - Gooseberries - Reasons for use of herbicides (where given)



Gooseberries – Insecticides

- **Formulation area treated: 54 hectares**
- **Weight of formulations applied: <0.1 tonnes**
- **The two 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
Thiacloprid	47	6	0.87	0.35	1.00	1.00
Lambda-cyhalothrin	7	<1	0.13	0.04	1.39	1.00

Eighty-seven percent of the reasons given for insecticide use on gooseberries were for the control of scale insects. The remaining 13% was for sawfly control.

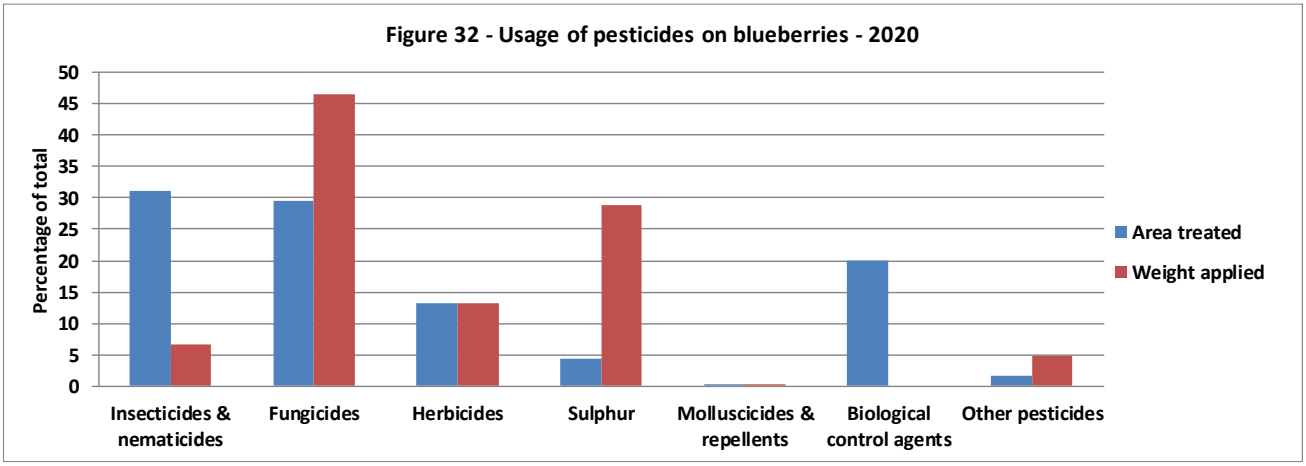
Gooseberries – Other pesticides

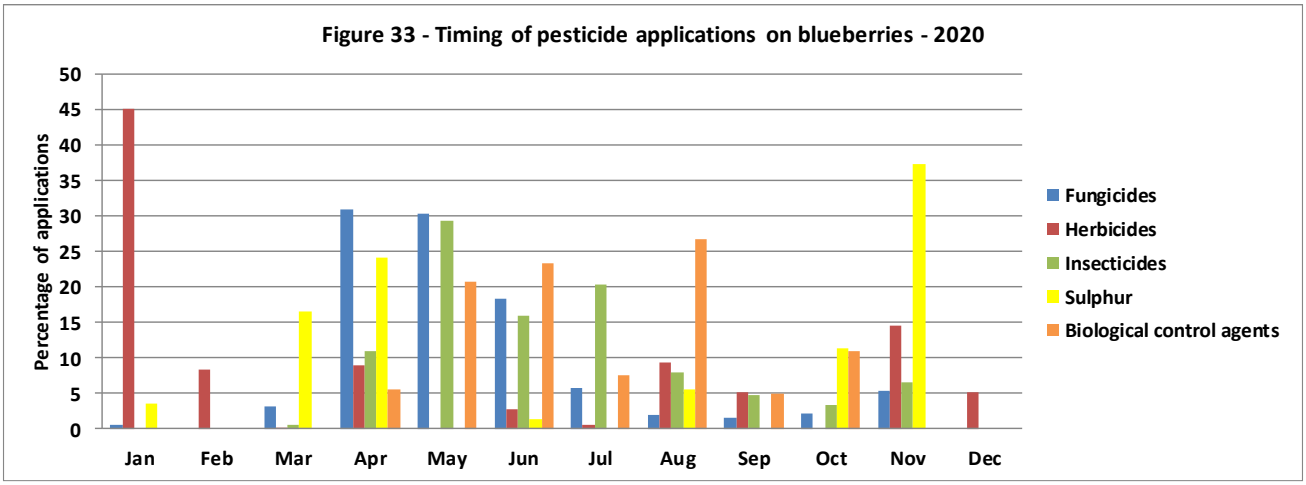
There was minimal usage of molluscicides and physical control agents on gooseberries.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 25% of the crop.

Blueberries

- **933 hectares of blueberries grown in the United Kingdom**
- **8,100 treated hectares**
- **2.7 tonnes of formulation applied**
- **13.8% of blueberries remained untreated**
- **Blueberries received on average 4 biological control agents, 3 fungicide, 3 insecticide, 2 herbicide and 1 sulphur spray rounds**
- **64% of the crop was five years old or less, 19% was between six and ten years and 17% was over ten years old**
- **60% 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 (2%) being grown in troughs or bags**
- **69% of the crop was grown under tunnels**
- **Almost all (92%) of the harvested crop area was grown for the fresh market with 5% for pick-your-own and 3% for processing**
- **The main varieties encountered were Liberty, Bluecrop, Duke, Last Call and Aurora**





Blueberries – Fungicides

- **Formulation area treated: 2,386 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 fungicide-treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Cyprodinil/fludioxonil	772	370	0.32	0.49	1.68	0.77
Boscalid/pyraclostrobin	529	154	0.22	0.45	1.26	0.87
Fenhexamid	388	275	0.16	0.36	1.15	0.95
Pyrimethanil	370	240	0.16	0.31	1.31	0.81
Copper oxychloride	262	231	0.11	0.21	1.32	0.24

Ninety-six percent of the reasons given for insecticide use on blueberries were for botrytis alone. The remaining 4% was for anthracnose and botrytis.

Sulphur accounted for 4% of the total pesticide treated area and 28% of the weight of pesticides applied to blueberries.

Blueberries – Herbicides

- **Formulation area treated: 1,063 hectares**
- **Weight of formulations applied: 0.4 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	222	112	0.21	0.14	1.65	0.96
Carfentrazone-ethyl	173	2	0.16	0.13	1.39	1.00
Pendimethalin	160	57	0.15	0.13	1.28	0.85
Flufenacet/metribuzin	108	29	0.10	0.12	1.00	0.79
Napropamide	101	106	0.09	0.07	1.53	0.91

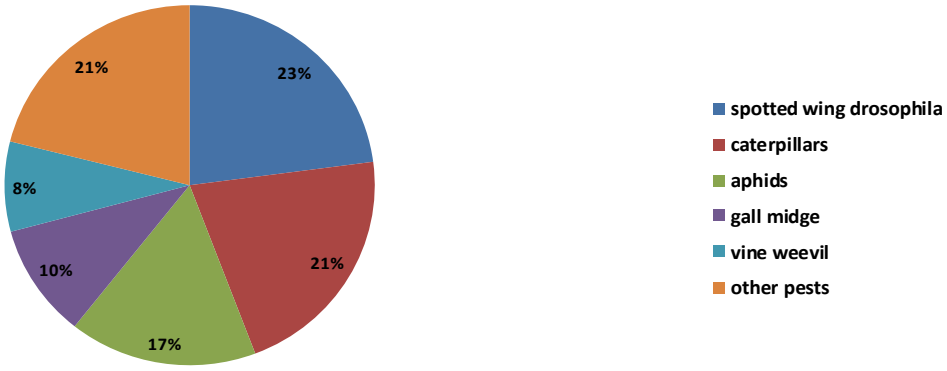
Over 99% of herbicide usage on blueberries was for general weed control, the remainder was for grass weed control.

Blueberries – Insecticides

- **Formulation area treated: 2,509 hectares**
- **Weight of formulations applied: 0.2 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
Thiacloprid	1,015	113	0.40	0.61	1.80	0.93
Lambda-cyhalothrin	672	6	0.27	0.49	1.46	0.96
Indoxacarb	306	15	0.12	0.32	1.04	0.99
Spinosad	304	28	0.12	0.27	1.21	0.97
Cyantraniliprole	147	13	0.06	0.15	1.06	0.98

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



Spotted wing drosophila was the reason given for 23% of insecticide use on blueberries, compared to 34% in 2018 and 44% in 2016.

Blueberries – Biological control

- **Formulation area treated: 1,646 hectares**
- **Weight of formulations applied: N/A**
- **The five most common 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
Heterorhabditis bacteriophora	1,168	.	0.71	0.20	6.25	.
Steinernema kraussei	264	.	0.16	0.15	1.81	.
Steinernema feltiae	110	.	0.07	0.09	1.34	.
Phytoseiulus persimilis	52	.	0.03	0.03	1.92	.
Neoseiulus cucumeris	48	.	0.03	0.02	2.30	.

Heterorhabditis bacteriophora, Steinernema kraussei and Steinernema feltiae were used for vine weevil control and *Phytoseiulus persimilis* and *Neoseiulus cucumeris* were used primarily for two-spotted spider mite control.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 68% of the crop.

Blueberries – Other pesticides

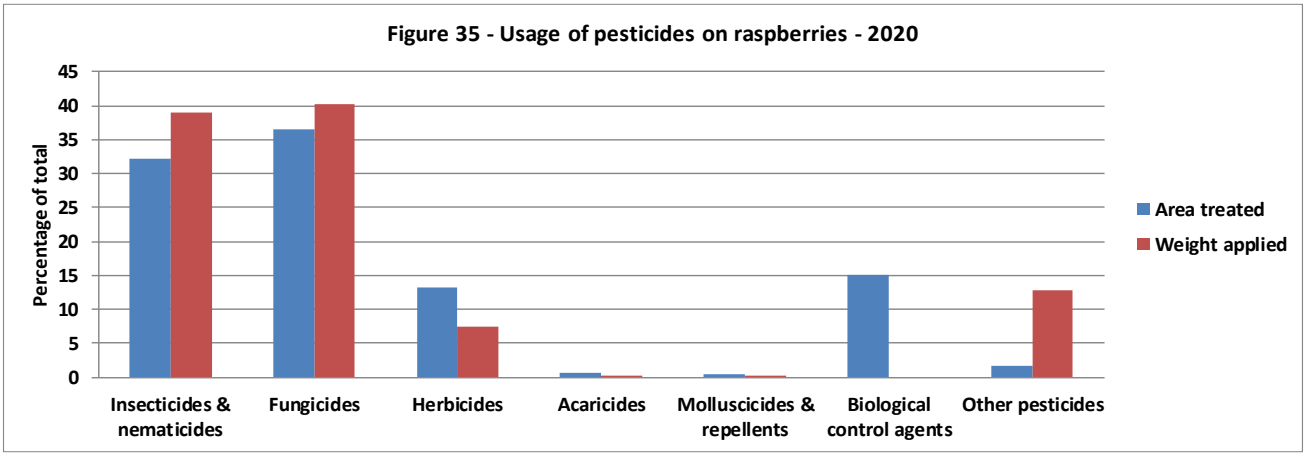
Physical control agents accounted for 2% of the treated area and 5% of the weight applied.

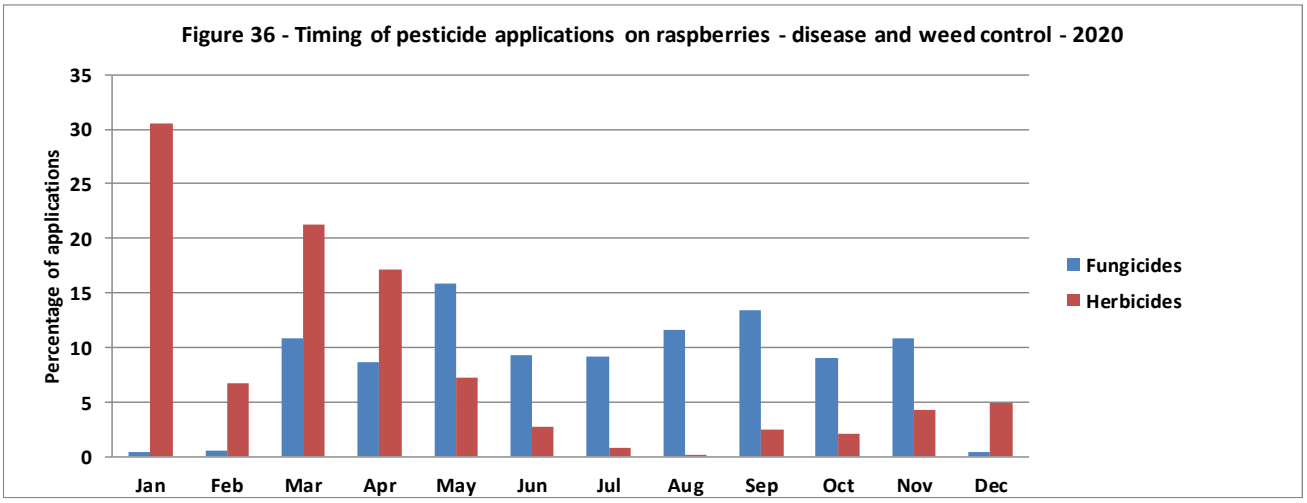
There was minimal usage of molluscicides on blueberries.

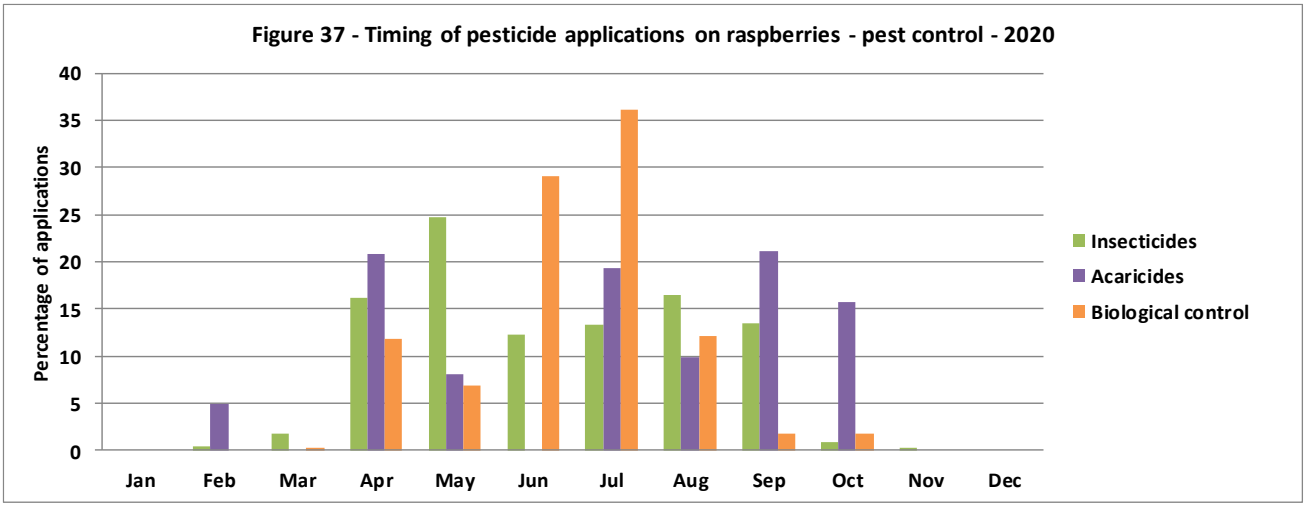
PESTICIDE USAGE ON CANE FRUIT

Raspberries

- 1,508 hectares of raspberries grown in the United Kingdom
- 15,607 treated hectares
- 7.7 tonnes of formulation applied of which soil sterilants accounted for 9%
- 2% of raspberries remained untreated
- Raspberries received on average 4 fungicide, 4 insecticide, 3 biological control agent and 2 herbicide spray rounds
- 56% of the crop was one year old or less, 39% between two and five years, 3% between six and ten years and 2% over ten years old
- 69% of the crop was grown in pots; most of the remaining area was soil grown with a small area (<1%) being grown in bags
- 88% of the crop was grown under tunnels, the majority of which were Spanish tunnels
- 94% of the harvested crop area was grown for the fresh market, 5% for pick-your-own and 1% for processing
- Maravilla, Kweli, Glen Ample, Grandeur, Kwanza and Sapphire were the principal varieties grown



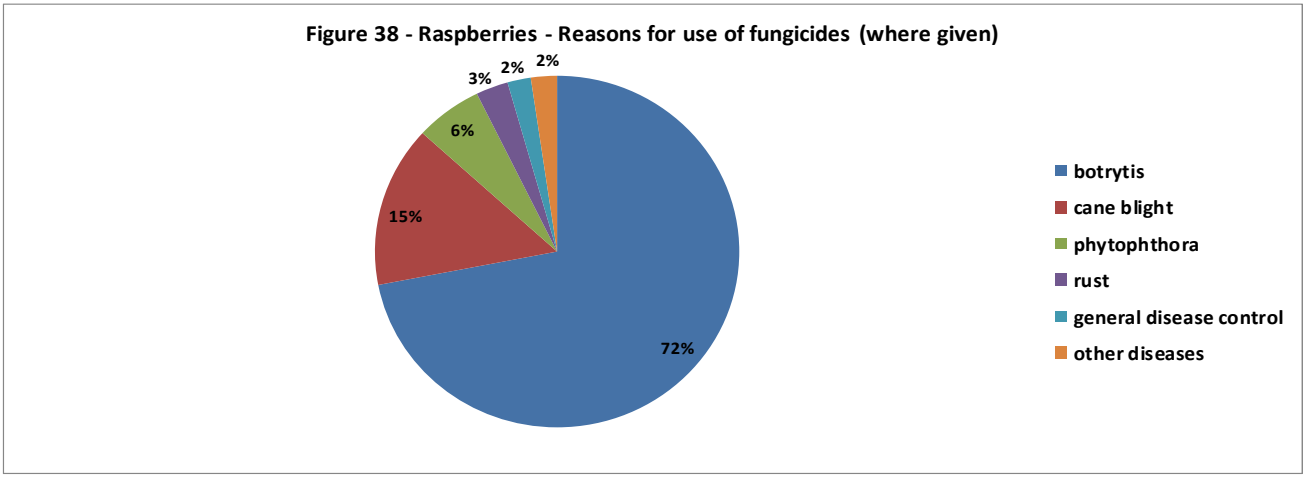




Raspberries – Fungicides

- **Formulation area treated: 5,710 hectares**
- **Weight of formulations applied: 3.1 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
Fenhexamid	1,504	924	0.26	0.60	1.66	0.82
Boscalid/pyraclostrobin	799	326	0.14	0.46	1.16	0.82
Cyprodinil/fludioxonil	738	450	0.13	0.44	1.12	0.98
Dimethomorph	583	299	0.10	0.36	1.09	0.62
Tebuconazole	561	58	0.10	0.35	1.05	0.97



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.

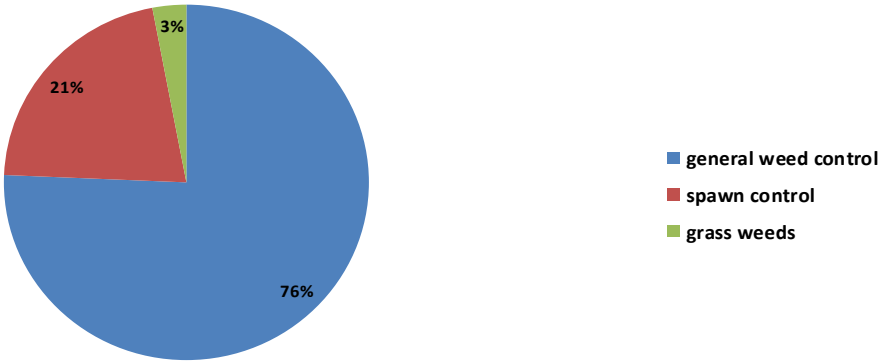
Raspberries – Herbicides

- **Formulation area treated: 2,073 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 herbicide – treated area	Proportion of June Survey area treated	Average number of applications (where applied)	Average proportion of full label rate
Carfentrazone-ethyl	735	8	0.35	0.32	1.53	0.66
Glyphosate	310	232	0.15	0.19	1.06	0.72
Propyzamide	192	62	0.09	0.12	1.00	0.51
Diquat	174	17	0.08	0.11	1.03	1.04
Pendimethalin	167	87	0.08	0.11	1.00	0.98

The higher rate of diquat occurred because a small number of fields had been treated at a rate of between 2.5l/ha and 4l/ha (normally recommended before planting edible crops), rather than the inter-row rate (applied between the rows of raspberries) of 2l/ha.

Figure 39 - 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.

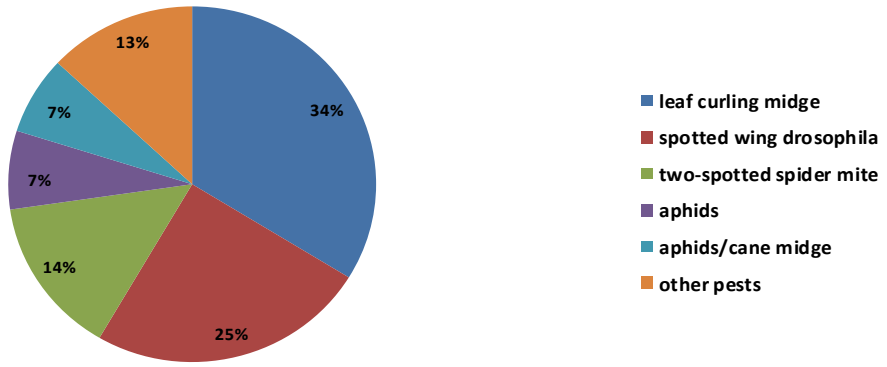
Raspberries – Insecticides

- **Formulation area treated: 5,008 hectares**
- **Weight of formulations applied: 3.0 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
Thiacloprid	1,582	188	0.32	0.66	1.58	0.99
Spinosad	1,124	104	0.22	0.53	1.40	0.96
Deltamethrin	687	6	0.14	0.23	1.95	0.76
Fatty acids C7-C20	564	2,630	0.11	0.28	1.31	0.97
Lambda-cyhalothrin	433	3	0.09	0.23	1.25	1.00

Fatty acids C7-C20 accounted for 11% of the insecticide treated area, but for 87% of the weight of insecticides applied on raspberries, reflecting its relatively high rate of application.

Figure 40 - Raspberries - Reasons for use of insecticides (where given)



Spotted wing drosophila was a concern to many growers and accounted for 25% of the reasons given for insecticide use, in comparison to 22% in 2018 and 40% in 2016.

Raspberries – Biological control

- **Formulation area treated: 2,353 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	1,450	.	0.62	0.33	2.91	.
Steinernema feltiae	507	.	0.22	0.11	3.00	.
Neoseiulus cucumeris	131	.	0.06	0.06	1.38	.
Unspecified nematodes	83	.	0.04	0.03	1.70	.
Steinernema kraussei	48	.	0.02	0.03	1.00	.

Phytoseiulus persimilis was used primarily for the control of two-spotted spider mite, *Steinernema feltiae* for thrips and vine weevil control, *Neoseiulus cucumeris* for thrips control under Spanish tunnels, and *Steinernema kraussei* 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 84% of all crops grown.

Raspberries – Acaricides

- **Formulation area treated: 116 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	82	16	0.71	0.05	1.00	0.99
Abamectin	34	0	0.29	0.02	1.50	volumetric

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

Raspberries – Other pesticides

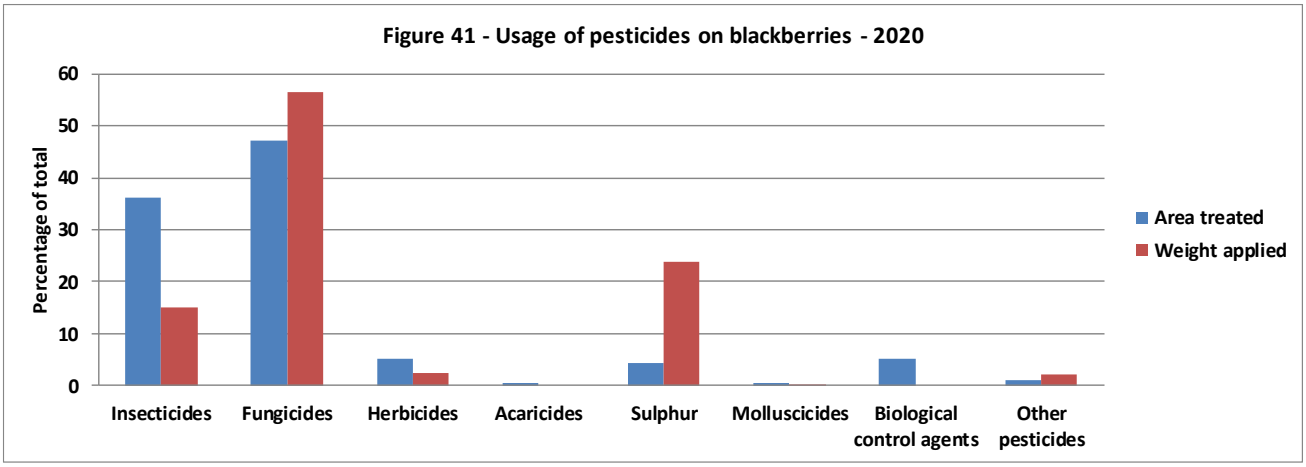
Physical control agents were used on 2% of the area treated and 4% of the weight applied.

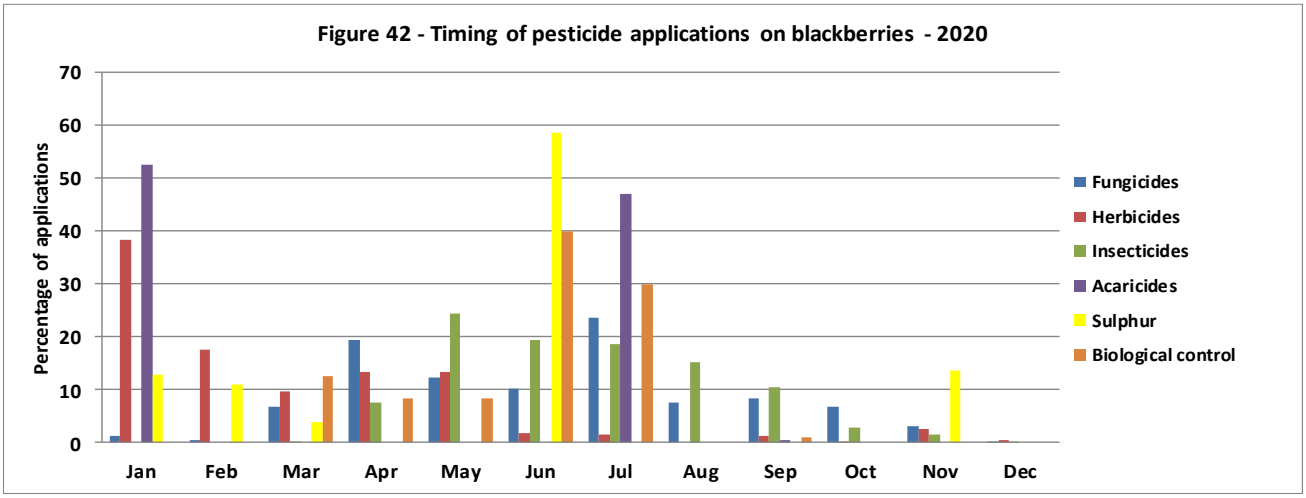
Molluscicides accounted for less than 1% of the overall treated area. Ferric phosphate comprised over 99% of molluscicide usage with metaldehyde accounting for less than 1%.

The soil sterilant dazomet was used on less than 1% of the area treated but accounted for 9% of the weight of all pesticides applied to raspberries. It was applied prior to planting 11 hectares of the raspberry crop.

Blackberries

- **543 hectares of blackberries grown in the United Kingdom**
- **5,662 treated hectares**
- **2.4 tonnes of formulation applied**
- **2.4% of blackberries remained untreated**
- **Blackberries received on average 5 fungicide, 4 insecticide, 2 biological control agent, 2 sulphur and 2 herbicide and spray rounds**
- **4% of the crop was one year old or less, 51% between two and five years, 25% between six and ten years and 20% over 10 years old**
- **29% of the crop was grown in pots, with the remaining 71% in the soil**
- **96% of the crop was grown under tunnels**
- **98% of the harvested crop area was grown for the fresh market, 1% for processing and 1% for pick-your-own**
- **Victoria, Loch Ness, Karaka Black and Loch Tay were the principal varieties grown**



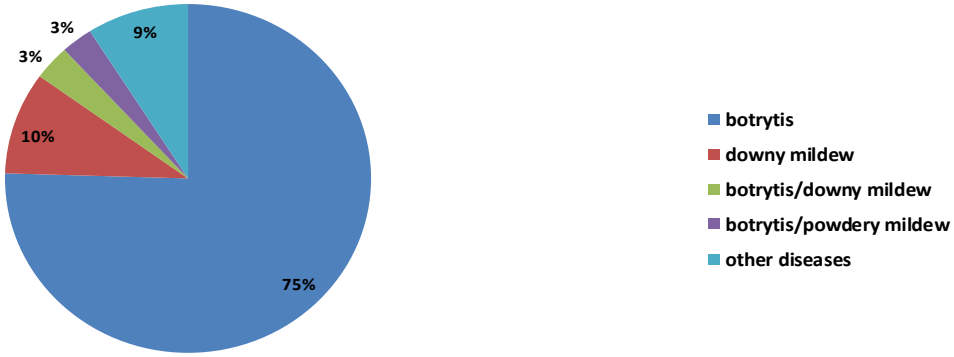


Blackberries – Fungicides

- **Formulation area treated: 2,671 hectares**
- **Weight of formulations applied: 1.4 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
Fenhexamid	789	528	0.30	0.87	1.64	0.89
Boscalid/pyraclostrobin	571	242	0.21	0.80	1.29	0.85
Cyprodinil/fludioxonil	304	183	0.11	0.49	1.15	0.97
Copper oxychloride	278	174	0.10	0.29	1.77	0.80
Azoxystrobin	275	68	0.10	0.44	1.08	0.98

Figure 43 - Blackberries - Reasons for use of fungicides (where given)



Use of sulphur accounted for less than 4% of the treated area but comprised 24% of the weight of pesticides applied to blackberries. Ninety percent of the reasons given for sulphur usage where for downy mildew control; the remaining 10% was used for red berry mite control.

Blackberries – Herbicides

- **Formulation area treated: 292 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	75	1	0.26	0.08	1.55	0.71
Propyzamide	57	19	0.19	0.09	1.14	0.62
Fluazifop-P-butyl	45	1	0.15	0.08	1.00	1.00
Isoxaben	35	2	0.12	0.06	1.00	1.00
Pendimethalin	33	12	0.11	0.06	1.00	0.78

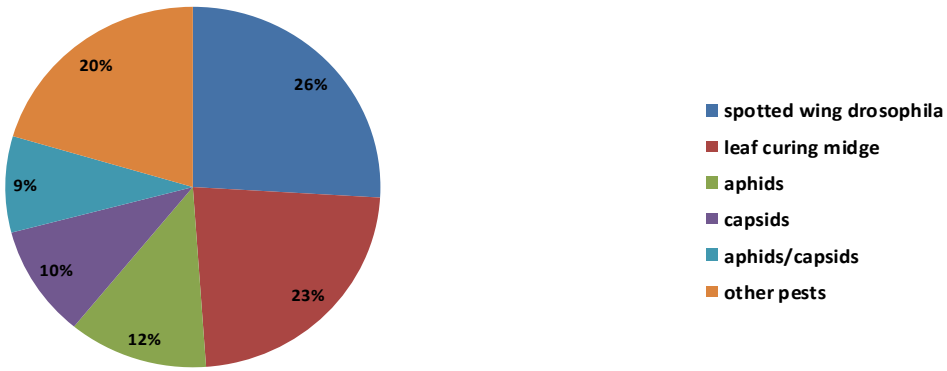
Over 99% of the reasons given for herbicide use on blackberries where for general weed control; the remainder for broad-leaved weed or grass weed control.

Blackberries – Insecticides

- **Formulation area treated: 2,052 hectares**
- **Weight of formulations applied: 0.4 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
Thiacloprid	935	112	0.46	0.89	1.98	0.99
Spinosad	355	34	0.17	0.41	1.64	0.99
Lambda-cyhalothrin	295	2	0.14	0.48	1.14	1.00
Cyantraniliprole	175	16	0.09	0.24	1.34	1.00
Deltamethrin	134	2	0.07	0.10	2.43	0.96

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



Blackberries – Acaricides

- **Formulation area treated: 29 hectares**
- **Weight of formulations applied: <0.01 tonnes**
- **The single formulation encountered was:**

	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
Abamectin	29	<1	1.00	0.05	1.15	1.46

Sixty-two percent of the reasons given for acaricide use on blackberries were for control of two-spotted spider mites; the remaining 38% were for control of two-spotted spider mites and red berry mites.

Blackberries – Biological control agents

- **Formulation area treated: 299 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	137	.	0.46	0.22	1.13	.
Phytoseiulus persimilis	86	.	0.29	0.06	2.76	.
Steinernema kraussei	19	.	0.06	0.03	1.00	.
Orius laevigatus	18	.	0.06	0.03	1.00	.
Amblyseius andersoni	18	.	0.06	0.03	1.00	.

Neoseiulus cucumeris and *Orius laevigatus* were used primarily for the control of thrips under Spanish tunnels. *Phytoseiulus persimilis* and *Amblyseius andersoni* were used primarily for the control of two-spotted spider mite and *Steinernema kraussei was used* for vine weevil control.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 85% of the crop.

Blackberries – Other pesticides

There was minimal use of physical control agents.

Hybrid berries

- **13 hectares of hybrid berries grown in the United Kingdom**
- **18 treated hectares**
- **<0.1 tonnes of formulation applied**
- **62.7% of hybrid berries remained untreated**
- **Hybrid berries received on average 2 herbicide and 1 fungicide spray rounds**
- **47% of the crop was five years old or less, 26% was between six and ten years and 27% was over ten years old**
- **97% of the crop was grown in the soil with the rest being grown in pots**
- **3% of the crop by area grown was covered by tunnels**
- **56% of the harvested crop area was grown for fresh market, 25% for pick-your-own and 19% for processing**
- **Tayberry comprised 34% of the area of hybrid berries grown, Loganberry 32%, Tummelberry and Jostaberry 16% each and Veitchberry and Boysenberry less than 1% each**

Figure 45 - Usage of pesticides on hybrid berries - 2020

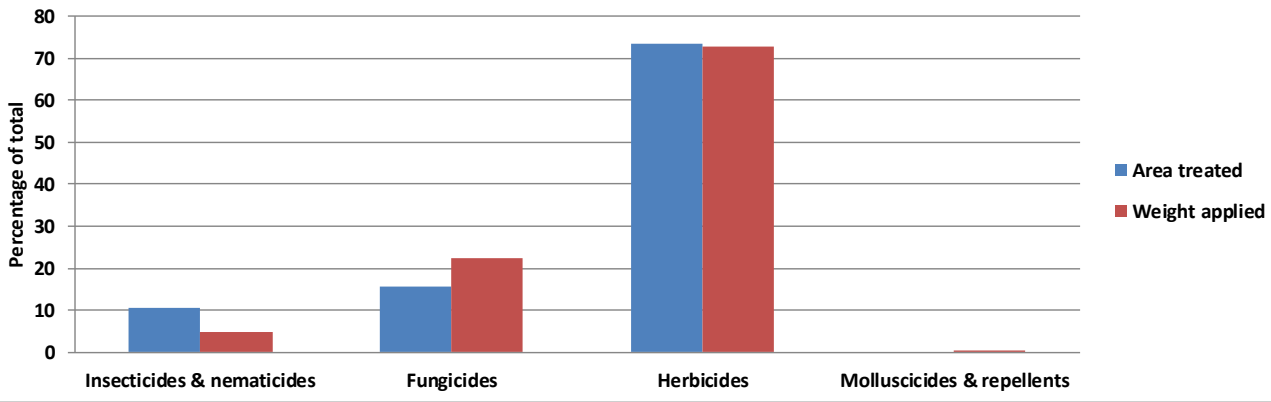
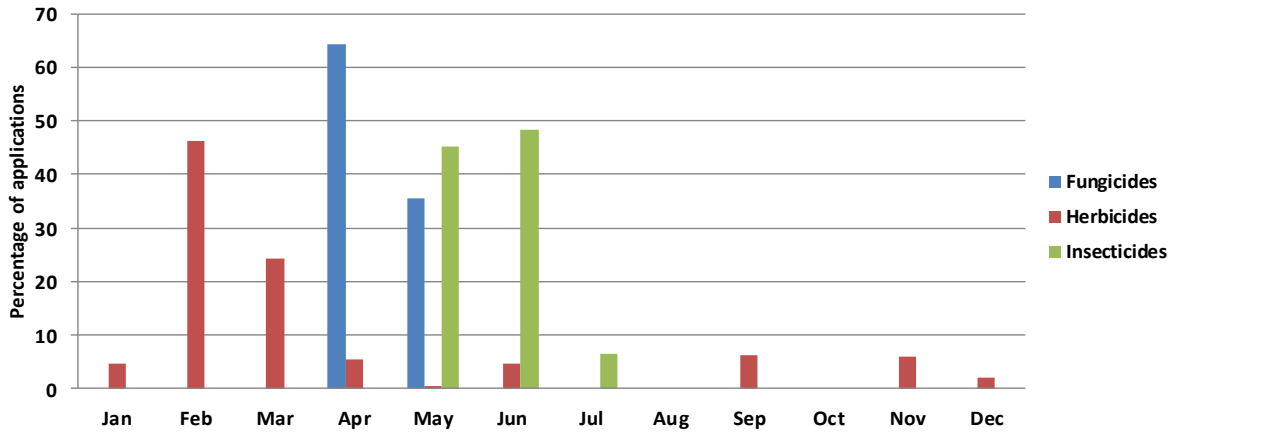


Figure 46 - Timing of pesticide applications on hybrid berries - 2020



Hybrid berries – Fungicides

- **Formulation area treated: 3 hectares**
- **Weight of formulations applied: <0.01 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
Copper oxychloride	2	1	0.64	0.06	2.00	0.75
Boscalid/pyraclostrobin	1	<1	0.35	0.07	1.00	0.64
Fenhexamid	<1	<1	0.01	0.00	1.00	1.00

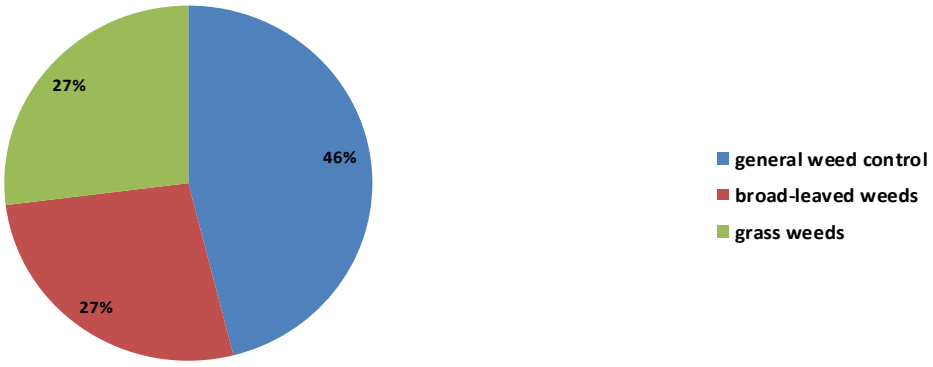
Ninety-nine percent of the reasons given for fungicide use on hybrid berries were for general disease control; the remaining 1% was for botrytis control.

Hybrid berries – Herbicides

- **Formulation area treated: 13 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
Isoxaben	4	<1	0.31	0.32	1.00	1.00
Pendimethalin	4	1	0.31	0.32	1.00	0.52
Diquat	1	<1	0.10	0.08	1.25	0.94
Carfentrazone-ethyl	1	<1	0.09	0.05	2.00	0.37
Propyzamide	1	1	0.08	0.08	1.00	0.64

Figure 47 - Hybrid berries - reasons for use of herbicides (where given)

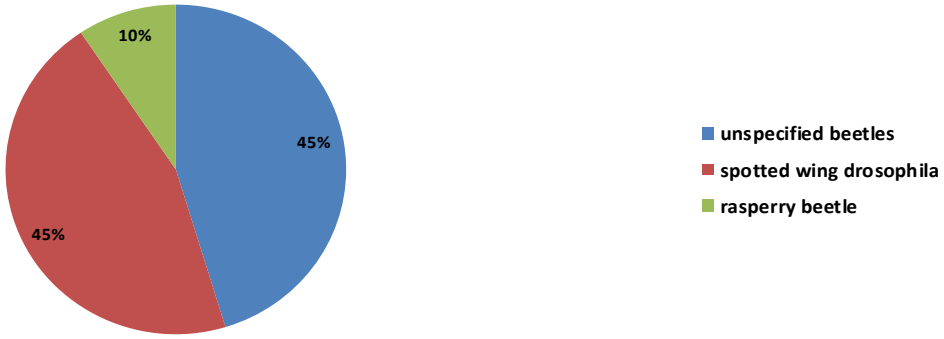


Hybrid berries – Insecticides

- **Formulation area treated: 2 hectares**
- **Weight of formulations applied: <0.01 tonnes**
- **The two 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
Thiacloprid	1	<1	0.55	0.07	1.13	0.99
Spinosad	1	<1	0.45	0.06	1.00	1.00

Figure 48 - Hybrid berries - reasons for use of insecticides (where given)



In Figure 48 it is most likely that unspecified “beetles” are also raspberry beetles, resulting in this pest accounting for 55% of all insecticide usage.

Hybrid berries – Other pesticides

No use of other pesticides was recorded in the 2020 survey.

Both bumble bees and honey bees, situated on the farm, were important for the pollination of 26% of the crop.

PESTICIDE USAGE ON VINES

- **2,614 hectares of vines grown for wine production in the United Kingdom**
- **49,987 treated hectares**
- **43.9 tonnes of formulation applied**
- **12.8% of vines remained untreated**
- **Vines received on average 10 fungicide, 5 sulphur, 2 insecticide and 2 herbicide spray rounds**
- **27% of the crop was five years old or less, 36% 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**
- **12% of the crop was not harvested either because of poor weather conditions or because the crop was not yet established**
- **Chardonnay, Pinot Noir and Pinot Meunier were the three main varieties grown**

Figure 49 - Usage of pesticides on vines - 2020

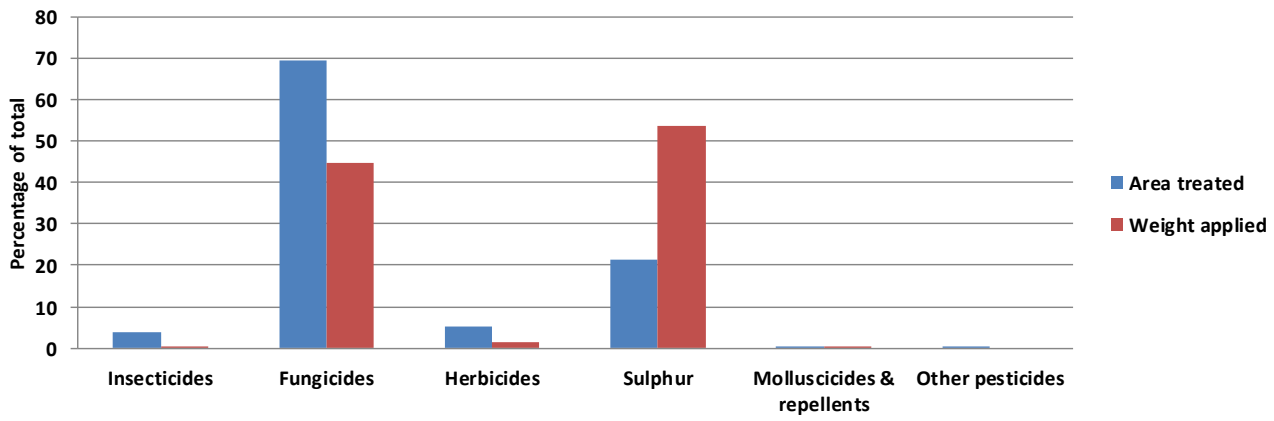
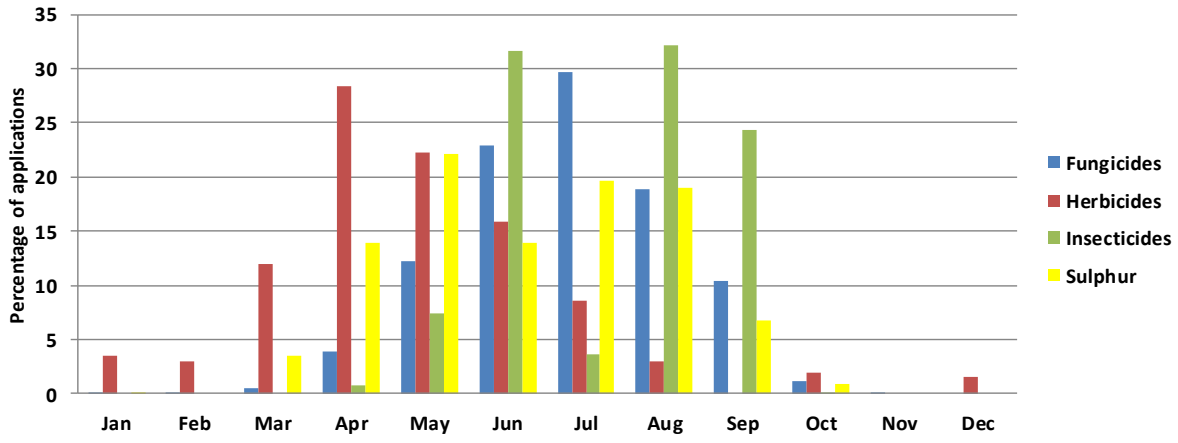


Figure 50 - Timing of pesticide applications on vines - 2020

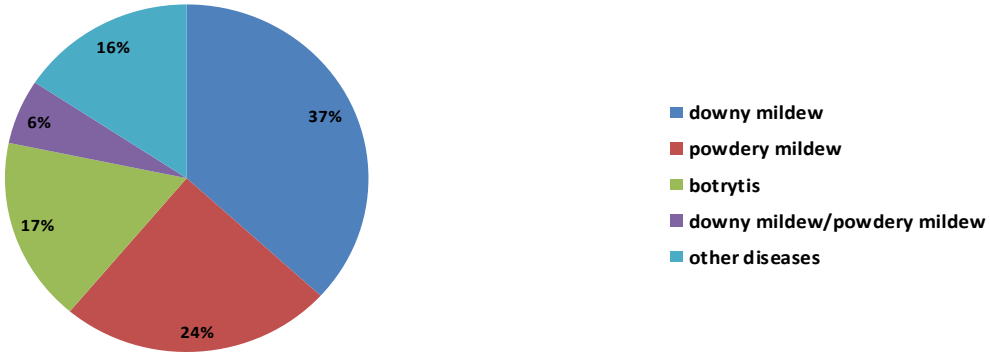


Vines – Fungicides

- **Formulation area treated: 34,637 hectares**
- **Weight of formulations applied: 19.6 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	3,468	4,087	0.10	0.65	2.10	0.69
Copper oxychloride	2,929	2,634	0.08	0.43	2.69	0.40
Ametoctradin/dimethomorph	2,891	1,090	0.08	0.66	1.73	0.90
Proquinazid	2,480	106	0.07	0.60	1.63	0.86
Benthiavalicarb-isopropyl/mancozeb	1,741	1,773	0.05	0.44	1.51	0.89

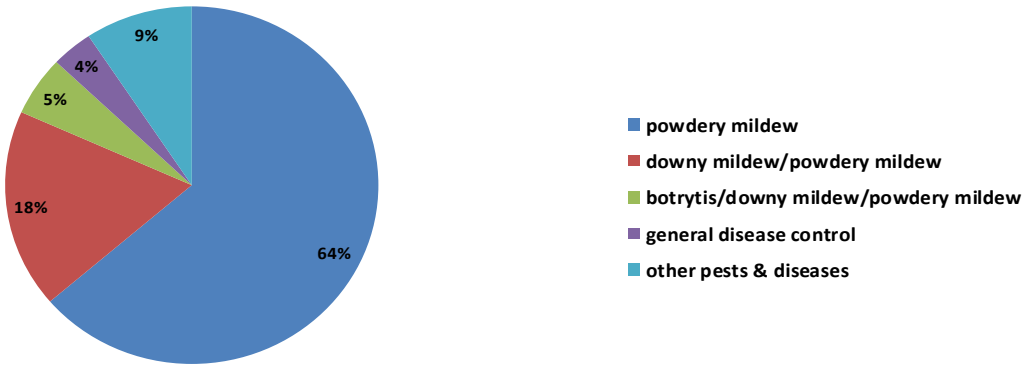
Figure 51 - Vines - Reasons for use of fungicides (where given)



Vines – Sulphur

- **Formulation area treated: 10,745 hectares**
- **Weight of formulations applied: 23.6 tonnes**

Figure 52 - Vines - Reasons for use of sulphur (where given)



Vines – Herbicides

- **Formulation area treated: 2,554 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
Glyphosate	1,558	603	0.61	0.42	1.41	0.57
Carfentrazone-ethyl	773	10	0.30	0.24	1.26	0.59
Propyzamide	104	44	0.04	0.04	1.00	0.82
Diquat	70	7	0.03	0.02	1.11	0.87
Fluazifop-P-butyl	16	1	0.01	0.01	1.00	1.00

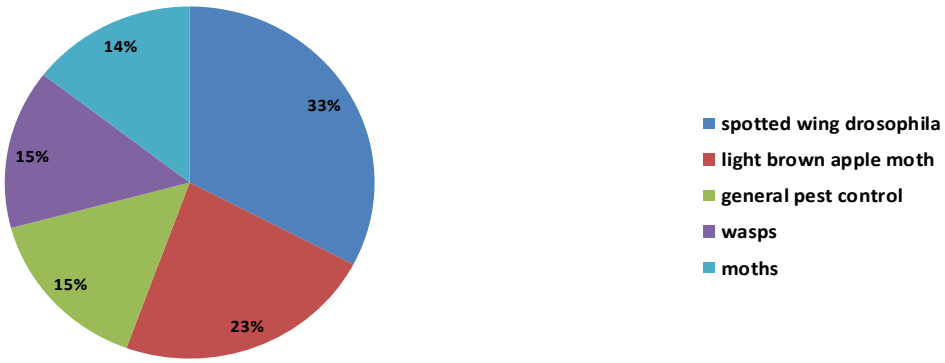
All reasons given for herbicide usage on vines were for general weed control.

Vines – Insecticides

- **Formulation area treated: 1,880 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
Indoxacarb	663	18	0.35	0.15	1.73	0.71
Spinosad	345	16	0.18	0.13	1.02	0.99
Lambda-cyhalothrin	311	3	0.17	0.08	1.44	0.95
Cyantraniliprole	292	14	0.16	0.11	1.03	0.54
Spirotetramat	265	8	0.14	0.10	1.01	0.40

Figure 53 - Vines - Reasons for use of insecticides (where given)



Vines – Other pesticides

There was minimal usage of the molluscicide ferric phosphate, accounting for less than 1% of the area treated and weight applied.

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

There was very limited use of bees within the vineyards.

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. The fact that 2020 data for England and Wales were not available further complicates the situation (please see page 72). The United Kingdom totals are based on 2019 June Survey data from England & Wales and 2020 data from Scotland and Northern Ireland.

Table 1 Area of soft fruit crops grown in the United Kingdom 2020 (hectares)

	United Kingdom
Strawberry	4,140
Blackcurrant - fresh	227
Blackcurrant - processing	2,420
Redcurrants & whitecurrants	50
Gooseberry	135
Blueberry	933
Raspberry	1,508
Blackberry	543
Hybrid berries	13
Vine	2,614
All soft fruit	**12,583**

Table 2a Treated area of soft fruit crops in the United Kingdom, 2020, by crop group (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All crops**
Insecticides & nematicides	13,550	423	5,088	15	54	2,509	5,008	2,052	2	1,880	30,578
Fungicides	78,145	606	11,005	111	346	2,386	5,710	2,671	3	34,637	135,620
Herbicides	3,246	348	10,367	60	229	1,063	2,073	292	13	2,554	20,246
Molluscicides & repellents	1,429	147	780	<1	<1	17	75	21	<1	63	2,532
Acaricides	3,234	13	435	<1	.	.	116	29	.	.	3,827
Biological control agents	45,142	.	.	.	.	1,646	2,353	299	.	.	49,439
Soil sterilants	.	.	.	.	.	.	11	.	.	.	11
Disinfectants	80	.	.	.	.	.	.	.	.	.	80
Sulphur	1,532	312	4,411	3	23	346	.	243	.	10,745	17,616
Physical control agents	328	<1	.	.	2	133	260	55	.	.	779
Growth stimulant	.	.	.	.	.	.	.	.	.	108	108
All pesticides	**146,686**	**1,850**	**32,086**	**189**	**654**	**8,100**	**15,607**	**5,662**	**18**	**49,987**	**260,838**

Table 2b Weight of pesticides applied to soft fruit crops in the United Kingdom, 2020, 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	3,180	13	335	1	6	179	3,007	363	<1	62	7,146
Fungicides	56,994	1,079	4,402	178	226	1,277	3,098	1,356	<1	19,554	88,164
Herbicides	2,308	81	4,124	18	104	356	579	58	3	677	8,307
Molluscicides & repellents	255	22	85	<1	<1	2	11	3	<1	3	381
Acaricides	348	1	35	<1	.	.	16	<1	.	.	401
Biological control agents	<1	.	.	.	.	.	.	.	.	.	<1
Soil sterilants	.	.	.	.	.	.	703	.	.	.	703
Disinfectants	121	.	.	.	.	.	.	.	.	.	121
Sulphur	2,941	1,289	28,312	3	19	776	.	573	.	23,601	57,514
Physical control agents	396	<1	.	.	2	133	291	55	.	.	878
Growth stimulant	.	.	.	.	.	.	.	.	.	<1	<1
All pesticides	**66,110**	**2,485**	**37,293**	**209**	**371**	**2,817**	**7,705**	**2,490**	**4**	**43,896**	**163,381**

Table 3 Usage of pesticides on soft fruit crops in the United Kingdom, 2020 - percentage area of crops treated with pesticides									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**Not treated**
Strawberry	92.5	96.7	22.0	29.6	38.1	26.0	63.4	5.1	0.9
Blackcurrant - fresh	55.8	68.7	67.1	47.4	4.8	49.8	.	0.3	16.6
Blackcurrant - processing	84.9	92.5	74.7	94.8	18.2	30.0	.	.	<0.1
Redcurrants & whitecurrants	13.5	64.6	5.1	70.6	0.3	0.1	.	.	21.9
Gooseberry	36.2	55.5	17.2	54.9	.	<0.1	.	1.5	29.7
Blueberry	83.0	79.4	29.0	25.1	.	1.8	30.1	6.2	13.8
Raspberry	87.0	88.9	.	57.3	6.3	4.9	49.1	8.3	2.0
Blackberry	94.5	94.5	33.7	27.1	4.8	3.9	31.7	10.6	2.4
Hybrid berries	6.6	13.2	.	36.8	.	0.2	.	.	62.7
Vine	39.4	79.0	75.2	55.2	.	.	.	.	12.8
All crops	**77.0**	**88.4**	**41.2**	**50.3**	**16.8**	**15.8**	**30.8**	**3.7**	**5.4**

Table 4a Usage of pesticides on soft fruit crops in the United Kingdom, 2020 - number of spray rounds applied to crops									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**All pesticides[1]**
Strawberry	3.7	15.3	1.8	1.8	1.7	1.2	16.5	1.2	28.1
Blackcurrant - fresh	2.3	3.4	2.3	2.0	1.4	1.2	.	1.0	6.6
Blackcurrant - processing	2.3	4.2	2.2	3.0	1.0	1.2	.	.	9.5
Redcurrants & whitecurrants	1.8	3.1	1.0	1.8	3.0	1.0	.	.	4.1
Gooseberry	1.3	3.4	1.0	2.0	.	1.0	.	1.0	5.1
Blueberry	2.8	2.8	1.3	2.1	.	1.0	3.8	2.3	6.2
Raspberry	3.6	4.1	.	1.9	1.1	1.0	3.2	1.9	8.8
Blackberry	4.1	5.4	2.0	1.7	1.2	1.0	2.2	1.0	9.0
Hybrid berries	2.5	1.2	.	2.3	.	1.0	.	.	3.6
Vine	1.8	9.6	5.4	1.7	.	.	.	.	10.7
All crops	**3.2**	**8.9**	**2.8**	**2.2**	**1.6**	**1.2**	**12.1**	**1.6**	**15.8**

[1] Includes information relating to all pesticides including growth stimulants, soil sterilants 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, 2020 - number of products applied to crops									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**All pesticides[1]**
Strawberry	3.8	20.0	1.8	2.6	1.8	1.2	16.5	1.2	36.5
Blackcurrant - fresh	2.3	4.0	2.3	3.0	1.4	1.2	.	1.0	8.8
Blackcurrant - processing	2.3	4.8	2.2	4.6	1.0	1.2	.	.	13.2
Redcurrants & whitecurrants	1.8	3.5	1.0	2.3	3.0	1.0	.	.	5.5
Gooseberry	1.3	4.3	1.0	3.0	.	1.0	.	1.0	7.3
Blueberry	3.0	2.8	1.3	4.1	.	1.0	3.8	2.3	8.2
Raspberry	3.7	4.3	.	2.5	1.1	1.0	3.2	1.9	10.4
Blackberry	4.2	5.6	2.0	2.4	1.2	1.0	2.2	1.0	11.8
Hybrid berries	2.5	1.2	.	3.1	.	1.0	.	.	4.4
Vine	1.8	17.7	5.4	2.0	.	.	.	.	22.8
All crops	**3.3**	**11.8**	**2.8**	**3.2**	**1.7**	**1.2**	**12.1**	**1.6**	**21.6**

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

Table 4c Usage of pesticides on soft fruit crops in the United Kingdom, 2020 - number of active substances applied to crops									
	Insecticides	**Fungicides**	**Sulphur**	**Herbicides**	**Acaricides**	**Molluscicides & repellents**	**Biological control agents**	**Physical control agents**	**All pesticides[1]**
Strawberry	3.8	25.0	1.8	2.7	1.8	1.2	17.4	1.2	42.0
Blackcurrant - fresh	2.3	4.8	2.3	3.4	1.4	1.2	.	1.0	9.7
Blackcurrant - processing	2.3	6.6	2.2	5.4	1.0	1.2	.	.	15.6
Redcurrants & whitecurrants	1.8	4.5	1.0	2.5	3.0	1.0	.	.	6.4
Gooseberry	1.3	5.0	1.0	3.2	.	1.0	.	1.0	8.2
Blueberry	3.0	4.1	1.3	4.6	.	1.0	3.8	2.3	9.5
Raspberry	3.7	5.3	.	2.5	1.1	1.0	3.2	1.9	11.3
Blackberry	4.2	7.4	2.0	2.4	1.2	1.0	2.1	1.0	13.5
Hybrid berries	2.5	1.6	.	3.1	.	1.0	.	.	4.6
Vine	1.8	22.6	5.4	2.0	.	.	.	.	27.2
All crops	**3.3**	**14.9**	**2.8**	**3.5**	**1.7**	**1.2**	**12.7**	**1.6**	**24.9**

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

Table 5 Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All crops**
Fungicides											
Ametoctradin/dimethomorph	.	.	.	.	.	.	.	.	.	2,891	2,891
Ampelomyces quisqualis strain AQ 10	663	.	.	.	.	.	.	.	.	.	663
Aureobasidium pullulans	82	.	.	.	.	9	11	.	.	697	798
Azoxystrobin	4,146	.	.	.	.	.	146	276	.	.	4,568
Azoxystrobin/difenoconazole	1,028	.	.	.	.	.	.	.	.	.	1,028
Bacillus amyloliquefaciens strain MBI 600	2,243	.	.	.	.	.	42	.	.	.	2,285
Bacillus amyloliquefaciens strain QST 713	5,433	221	92	.	.	56	219	161	.	758	6,938
Bacillus amyloliquefaciens subsp. plantarum strain D747	4,831	.	.	3	.	.	59	58	.	77	5,027
Bacillus pumilus strain QST 2808	1,252	.	.	.	.	.	1	.	.	.	1,253
Benthiavalicarb-isopropyl/mancozeb	.	.	.	.	.	.	.	.	.	1,741	1,741
Boscalid	.	.	.	.	.	.	.	.	.	1,300	1,300
Boscalid/pyraclostrobin	3,864	45	2,954	32	46	529	799	571	<1	.	8,840
Bupirimate	2,028	1	8	<1	22	.	26	.	.	.	2,086
Cerevisane (*Saccharomyces cerevisiae* strain LAS 117)	4	.	.	.	.	.	.	.	.	1,310	1,314
Copper oxychloride	15	.	.	.	.	262	377	279	2	2,929	3,863
Cyflufenamid	3,608	.	.	.	.	.	.	.	.	1,129	4,738
Cymoxanil	.	.	.	.	.	.	.	.	.	1,390	1,390
Cyprodinil/fludioxonil	3,819	33	1,290	9	8	772	738	304	.	1,714	8,687
Difenoconazole/fluxapyroxad	5,044	.	.	.	.	.	.	.	.	.	5,044
Dimethomorph	707	.	.	.	<1	.	583	3	.	.	1,293
Fenhexamid	7,027	42	1,060	26	54	388	1,504	789	<1	1,661	12,551
Fenpropimorph	8	<1	284	<1	44	.	.	.	.	.	337
Fenpyrazamine	1,329	.	.	.	.	.	.	.	.	806	2,135
Fluopyram/trifloxystrobin	6,341	.	.	.	.	.	.	.	.	.	6,341
Fluxapyroxad	.	.	.	.	.	.	.	.	.	935	935
Gliocladium catenulatum strain J1446	.	.	.	.	.	.	19	.	.	433	452
Kresoxim-methyl	2,598	37	1,445	<1	13	.	1	.	.	737	4,831
Mancozeb	.	.	.	.	.	.	.	.	.	3,468	3,468
Mancozeb/zoxamide	.	.	.	.	.	.	.	.	.	1,603	1,603
Mepanipyrim	1,727	.	.	.	.	.	.	.	.	.	1,727
Metalaxyl-M	.	.	.	.	.	.	68	.	.	783	851
Myclobutanil	5,302	123	2,144	26	107	.	151	30	.	500	8,382
Penconazole	4,751	2	166	<1	2	.	.	.	.	598	5,519
Potassium hydrogen carbonate	4,416	71	.	10	8	.	57	.	.	809	5,371
Potassium phosphonate (phosphite)	.	.	.	.	.	.	.	.	.	355	355
Proquinazid	2,155	.	.	.	3	.	.	.	.	2,480	4,638
Pyrimethanil	3,121	11	1,322	5	23	370	271	190	.	1,501	6,815
Quinoxyfen	479	.	.	.	11	.	34	.	.	.	524

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Fungicides (cont.)											
Tebuconazole	.	18	.	<1	2	.	561	11	.	.	592
Tebuconazole/trifloxystrobin	.	.	.	.	.	.	.	.	.	1,276	1,276
Other fungicides[1,2]	126	2	241	<1	2	.	46	.	.	756	1,172
All fungicides	**78,145**	**606**	**11,006**	**110**	**345**	**2,386**	**5,710**	**2,671**	**2**	**34,638**	**135,620**

[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 amisulbrom, *Bacillus subtilis*, chlorothalonil, COS-OGA, dodine, epoxiconazole, fenamidone/fosetyl-aluminium, fluazinam, meptyldinocap, metrafenone and sulphur/tebuconazole

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Herbicides											
Carfentrazone-ethyl	575	29	1,122	6	29	173	735	75	1	773	3,518
Clethodim	206	27	7	.	.	50	82	11	.	.	382
Clopyralid	140	<1	602	<1	2	28	.	.	.	.	772
Diquat	39	35	88	9	5	88	174	11	1	70	519
Fluazifop-P-butyl	63	29	24	<1	20	12	113	45	<1	16	322
Flufenacet/metribuzin	.	44	1,835	8	30	108	.	.	.	.	2,025
Glyphosate	727	15	2,941	23	47	222	310	22	.	1,558	5,866
Isoxaben	380	29	242	<1	5	.	166	35	4	.	860
Napropamide	272	<1	.	3	12	101	95	3	<1	.	486
Pendimethalin	165	92	2,019	1	44	160	167	33	4	3	2,688
Propyzamide	309	36	1,415	10	33	87	192	57	1	104	2,244
Other herbicides[3]	371	12	71	<1	2	35	41	1	<1	30	564
All herbicides	**3,246**	**347**	**10,367**	**59**	**229**	**1,063**	**2,073**	**291**	**12**	**2,554**	**20,247**

[3] Other herbicides include 2,4-D, 2,4-D/glyphosate, 2,4-D/MCPA, clopyralid/triclopyr, dimethenamid-p/pendimethalin, flazasulfuron, fluroxypyr, fluroxypyr/triclopyr, glufosinate-ammonium, imazamox/pendimethalin, lenacil, MCPB, metamitron, phenmedipham and S-metolachlor

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2020 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Insecticides											
Bacillus thuringiensis var. kurstaki	1,426	.	.	.	.	8	54	.	.	.	1,488
Cyantraniliprole	317	.	.	.	.	147	153	175	.	292	1,084
Deltamethrin	368	33	103	.	.	.	687	134	.	.	1,325
Fatty acids C7-C20	385	.	10	.	.	.	564	38	.	.	997
Indoxacarb	123	.	.	.	.	306	20	57	.	663	1,169
Lambda-cyhalothrin	2,079	13	1,966	3	7	672	433	295	.	311	5,778
Pyrethrins	225	364	168	4	.	21	315	25	.	.	1,122
Spinosad	3,857	.	195	3	.	304	1,124	355	<1	345	6,183
Spirotetramat	2,685	.	719	.	.	.	10	.	.	265	3,679
Thiacloprid	1,968	14	1,821	5	47	1,015	1,583	935	<1	.	7,388
Other insecticides[4]	118	.	105	.	.	35	65	39	.	4	365
All insecticides	**13,550**	**423**	**5,088**	**15**	**54**	**2,508**	**5,007**	**2,052**	**<1**	**1,880**	**30,577**
Acaricides											
Bifenazate	1,397	.	.	.	.	.	.	.	.	.	1,397
Clofentezine	603	.	.	.	.	.	82	.	.	.	685
Cyflumetofen	**325**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**325**
Etoxazole	499	.	.	.	.	.	.	.	.	.	499
Spirodiclofen	323	10	379	.	.	.	.	.	.	.	713
Other acaricides[5]	87	2	56	<1	.	.	34	29	.	.	208
All acaricides	**3,234**	**13**	**436**	**<1**	**.**	**.**	**116**	**29**	**.**	**.**	**3,827**
Molluscicides & repellents											
Ferric phosphate	872	147	458	.	.	17	75	21	.	63	1,651
Metaldehyde	558	<1	323	<1	<1	.	<1	.	<1	.	881
All molluscicides & repellents	**1,430**	**147**	**780**	**<1**	**<1**	**17**	**75**	**21**	**<1**	**63**	**2,532**
Sulphur	**1,532**	**312**	**4,411**	**3**	**23**	**346**	**.**	**243**	**.**	**10,745**	**17,616**

[4] Other insecticides include *Beauveria bassiana* ATCC-74040, *Beauveria bassiana* GHA, chlorantraniliprole, chlorpyrifos, *Metarhizium anisopliae*, pirimicarb, potassium salts of fatty acids, pymetrozine and sugar

[5] Other acaricides include abamectin and tebufenpyrad

Table 5 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2020 (spray hectares)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Biological controls											
Amblyseius spp.	1,441	.	.	.	.	.	21	.	.	.	1,462
Amblyseius andersoni	688	.	.	.	.	.	45	18	.	.	751
Aphelinus abdominalis/Aphidius colemani/Aphidius ervi/Aphidius matricariae/Ephedrus cerasicola/Praon volucre	496	.	.	.	.	.	.	16	.	.	512
Aphidius colemani	2,950	.	.	.	.	.	12	.	.	.	2,962
Chrysoperla carnea	392	.	.	.	.	.	.	.	.	.	392
Heterorhabditis bacteriophora	49	.	.	.	.	1,168	45	5	.	.	1,267
Hypoaspis spp	1,455	.	.	.	.	.	.	.	.	.	1,455
Neoseiulus cucumeris	16,807	.	.	.	.	48	131	137	.	.	17,123
Orius laevigatus	1,464	.	.	.	.	.	12	18	.	.	1,493
Orius spp.	5,237	.	.	.	.	.	.	.	.	.	5,237
Phytoseiulus persimilis	11,670	.	.	.	.	52	1,450	86	.	.	13,258
Steinernema feltiae	1,570	.	.	.	.	110	507	.	.	.	2,186
Steinernema kraussei	266	.	.	.	.	264	48	19	.	.	597
Other biological control[6]	657	.	.	.	.	4	83	.	.	.	745
All biological controls	**45,142**	**.**	**.**	**.**	**.**	**1,646**	**2,353**	**299**	**.**	**.**	**49,439**
Physical controls											
Unspecified physical controls	323	<1	.	.	2	133	256	55	.	.	771
Other physical control agents[7]	5	.	.	.	.	.	4	.	.	.	8
All physical controls	**328**	**<1**	**.**	**.**	**2**	**138**	**260**	**55**	**.**	**.**	**779**
Other disinfectants[8]	**80**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**80**
Other growth stimulants[9]	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**108**	**108**
Other soil sterilants[10]	**.**	**.**	**.**	**.**	**.**	**.**	**11**	**.**	**.**	**.**	**11**

[6] Other biological controls include *Amblydromalus limonicus, Aphidius ervi, Aphidius matricariae, Aphidius spp., Aphidoletes aphidimyza, Episyrphus balteatus,* parasitic wasp*, Stratiolaelaps scimitus, Transeius montdorensis and* unspecified nematodes

[7] Other physical controls include maltodextrin

[8] Other disinfectants include peroxyacetic acid

[9] Other growth stimulants include harpin protein

[10] Other soil sterilants include dazomet

Table 6 Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (kg of active substance applied)											
	Strawberry	Blackcurrant fresh	Blackcurrant processing	Redcurrants & whitecurrants	Gooseberry	Blueberry	Raspberry	Blackberry	Hybrid berries	Vine	All Crops
Fungicides											
Ametoctradin/dimethomorph	.	.	.	.	.	.	.	.	.	1,090	1,090
Ampelomyces quisqualis strain AQ 10	27	.	.	.	.	.	.	.	.	.	27
Aureobasidium pullulans	20	.	.	.	.	2	3	.	.	100	125
Azoxystrobin	1,012	.	.	.	.	.	33	68	.	.	1,113
Azoxystrobin/difenoconazole	329	.	.	.	.	.	.	.	.	.	329
Bacillus amyloliquefaciens strain MBI 600	123	.	.	.	.	.	2	.	.	.	125
Bacillus amyloliquefaciens strain QST 713	373	11	5	.	.	3	16	12	.	50	471
Bacillus amyloliquefaciens subsp.	2,622	.	.	2	.	.	37	36	.	48	2,744
Bacillus pumilus strain QST 2808	11,121	.	.	.	.	.	11	.	.	.	11,131
Benthiavalicarb-isopropyl/mancozeb	.	.	.	.	.	.	.	.	.	1,773	1,773
Boscalid	.	.	.	.	.	.	.	.	.	302	302
Boscalid/pyraclostrobin	1,990	20	1,370	11	13	154	326	242	<1	.	4,126
Bupirimate	500	<1	2	<1	4	.	7	.	.	.	513
Cerevisane (*Saccharomyces cerevisiae* strain LAS 117)	2	.	.	.	.	.	.	.	.	326	329
Copper oxychloride	3	.	.	.	.	231	165	174	<1	2,634	3,208
Cyflufenamid	53	.	.	.	.	.	.	.	.	25	77
Cymoxanil	.	.	.	.	.	.	.	.	.	110	110
Cyprodinil/fludioxonil	2,244	21	757	5	3	370	450	183	.	740	4,774
Difenoconazole/fluxapyroxad	376	.	.	.	.	.	.	.	.	.	376
Dimethomorph	967	.	.	.	<1	.	299	2	.	.	1,268
Fenhexamid	4,409	32	717	14	40	275	924	528	<1	970	7,909
Fenpropimorph	3	<1	168	<1	32	.	.	.	.	.	203
Fenpyrazamine	757	.	.	.	.	.	.	.	.	391	1,148
Fluopyram/trifloxystrobin	2,523	.	.	.	.	.	.	.	.	.	2,523
Fluxapyroxad	.	.	.	.	.	.	.	.	.	39	39
Gliocladium catenulatum strain J1446	.	.	.	.	.	.	8	.	.	566	574
Kresoxim-methyl	383	4	143	<1	1	.	<1	.	.	60	590
Mancozeb	.	.	.	.	.	.	.	.	.	4,087	4,087
Mancozeb/zoxamide	.	.	.	.	.	.	.	.	.	1,710	1,710
Mepanipyrim	663	.	.	.	.	.	.	.	.	.	663
Metalaxyl-M	.	.	.	.	.	.	40	.	.	52	93
Myclobutanil	318	11	169	2	8	.	10	2	.	19	539
Penconazole	234	<1	3	<1	<1	.	.	.	.	15	252
Potassium hydrogen carbonate	23,418	973	.	139	113	.	555	.	.	2,603	27,800
Potassium phosphonate (phosphite)	.	.	.	.	.	.	.	.	.	379	379
Proquinazid	78	.	.	.	<1	.	.	.	.	106	185
Pyrimethanil	2,356	5	976	4	9	240	134	106	.	995	4,826
Quinoxyfen	60	.	.	.	1	.	4	.	.	.	66

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All crops**
Fungicides (cont.)											
Tebuconazole	.	3	.	<1	<1	.	58	2	.	.	64
Tebuconazole/trifloxystrobin	.	.	.	.	.	.	.	.	.	141	141
Other fungicides[1]	29	<1	93	<1	<1	.	17	.	.	224	364
All fungicides	**56,993**	**1,078**	**4,402**	**178**	**224**	**1,277**	**3,098**	**1,356**	**<1**	**19,554**	**88,163**

[1] Other fungicides include amisulbrom, *Bacillus subtilis*, chlorothalonil, COS-OGA, dodine, epoxiconazole, fenamidone/fosetyl-aluminium, fluazinam, meptyldinocap, metrafenone and sulphur/tebuconazole

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (kg of active substance applied)											
	Strawberry	**Blackcurrant fresh**	**Blackcurrant processing**	**Redcurrants & whitecurrants**	**Gooseberry**	**Blueberry**	**Raspberry**	**Blackberry**	**Hybrid berries**	**Vine**	**All Crops**
Herbicides											
Carfentrazone-ethyl	13	<1	15	<1	<1	2	8	<1	<1	10	49
Clethodim	35	<1	<1	.	.	2	6	1	.	.	46
Clopyralid	16	<1	44	<1	<1	2	.	.	.	.	62
Diquat	15	4	8	2	1	14	17	2	<1	7	69
Fluazifop-P-butyl	15	1	3	<1	<1	<1	4	1	<1	<1	26
Flufenacet/metribuzin	.	14	730	3	10	29	.	.	.	.	786
Glyphosate	930	6	1,474	5	24	112	232	17	.	603	3,402
Isoxaben	47	1	22	<1	<1	.	10	2	<1	.	84
Napropamide	539	<1	.	3	24	106	141	1	<1	.	815
Pendimethalin	144	32	1,004	<1	24	57	87	12	1	2	1,363
Propyzamide	222	18	810	5	18	30	63	19	<1	44	1,228
Other herbicides[2]	332	3	14	0	0	0	12	1	0	10	376
All herbicides	**2,308**	**78**	**4,123**	**17**	**101**	**355**	**578**	**57**	**1**	**676**	**8,307**

[2] Other herbicides include 2,4-D, 2,4-D/glyphosate, 2,4-D/MCPA, clopyralid/triclopyr, dimethenamid-p/pendimethalin, flazasulfuron, fluroxypyr, fluroxypyr/triclopyr, glufosinate-ammonium, imazamox/pendimethalin, lenacil, MCPB, metamitron, phenmedipham and S-metolachlor

.

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in United Kingdom, 2020 ((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	573	.	.	.	.	1	22	.	.	.	596
Cyantraniliprole	25	.	.	.	.	13	13	16	.	14	81
Deltamethrin	2	<1	<1	.	.	.	7	2	.	.	11
Fatty acids C7-C20	1,752	.	32	.	.	.	2,630	184	.	.	4,598
Indoxacarb	6	.	.	.	.	16	<1	3	.	18	43
Lambda-cyhalothrin	17	<1	16	<1	<1	6	3	2	.	3	47
Pyrethrins	13	11	5	<1	.	<1	27	3	.	.	60
Spinosad	253	.	12	<1	.	28	104	34	<1	17	447
Spirotetramat	259	.	51	.	.	.	1	.	.	8	319
Thiacloprid	229	2	216	<1	6	113	188	112	<1	.	865
Other insecticides[3]	54	.	3	.	.	1	12	8	.	3	80
All insecticides	**3,181**	**13**	**334**	**<1**	**6**	**178**	**3,006**	**363**	**<1**	**62**	**7,146**
Acaricides											
Bifenazate	134	.	.	.	.	.	.	.	.	.	134
Clofentezine	106	.	.	.	.	.	16	.	.	.	122
Cyflumetofen	63	.	.	.	.	.	.	.	.	.	63
Etoxazole	18	.	.	.	.	.	.	.	.	.	18
Spirodiclofen	27	<1	25	.	.	.	.	.	.	.	53
Other acaricides[4]	<1	<1	10	<1	.	.	<1	<1	.	.	11
All acaricides	**347**	**<1**	**35**	**<1**	**.**	**.**	**16**	**<1**	**.**	**.**	**400**
Molluscicides & repellents											
Ferric phosphate	123	22	56	.	.	3	10	3	.	3	219
Metaldehyde	133	<1	29	<1	<1	.	<1	.	<1	.	162
All molluscicides & repellents	**256**	**22**	**85**	**<1**	**<1**	**3**	**10**	**3**	**<1**	**3**	**381**
Sulphur	**2,941**	**1,289**	**28,312**	**3**	**19**	**776**	**.**	**573**	**.**	**23,601**	**57,514**

[3] Other insecticides include *Beauveria bassiana* ATCC-74040, *Beauveria bassiana* GHA, chlorantraniliprole, chlorpyrifos, *Metarhizium anisopliae*, pirimicarb, potassium salts of fatty acids, pymetrozine and sugar

[4] Other acaricides include abamectin and tebufenpyrad

Table 6 (cont.) Usage of pesticides on soft fruit crops grown in the United Kingdom, 2020 (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[5]	.	.	.	.	.	.	.	.	.	.	.
All biological controls	.	.	.	.	.	.	.	.	.	.	.
Physical controls											
Unspecified physical controls	324	<1	.	.	2	133	239	55	.	.	754
Other physical control agents[6]	72	.	.	.	.	.	52	.	.	.	124
All physical controls	**396**	**<1**	**.**	**.**	**2**	**133**	**291**	**55**	**.**	**.**	**878**
Other disinfectants[7]	**121**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**121**
Other growth stimulants[8]	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**<1**	**<1**
Other soil sterilants[9]	**.**	**.**	**.**	**.**	**.**	**.**	**703**	**.**	**.**	**.**	**703**

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

[6] Other physical controls include maltodextrin

[7] Other disinfectants include peroxyacetic acid

[8] Other growth stimulants include harpin protein

[9] Other soil sterilants include dazomet

Table 7 Estimated area (ha) of application of the fifty most extensively used active substances on all soft fruit crops surveyed in 2020 in the United Kingdom				
	Active substance	**Area treated 2020 (ha)**	**Area treated 2018 (ha)**	**% change on 2018**
1	Sulphur	17,754	15,394	15
2	*Neoseiulus cucumeris*	17,123	10,741	59
3	*Phytoseiulus persimilis*	13,258	6,002	121
4	Fenhexamid	12,551	10,277	22
5	Boscalid	10,140	10,103	0
6	Pyraclostrobin	8,840	8,373	6
7	Fludioxonil	8,687	8,776	-1
8	Cyprodinil	8,687	8,776	-1
9	Myclobutanil	8,382	645	1,200
10	Trifloxystrobin	7,616	4,730	61
11	Thiacloprid	7,388	10,022	-26
12	*Bacillus amyloliquefaciens* strain QST 713	6,938	7,939	-13
13	Pyrimethanil	6,815	6,535	4
14	Mancozeb	6,812	6,602	3
15	Fluopyram	6,340	4,702	35
16	Spinosad	6,183	5,660	9
17	Difenoconazole	6,071	3,907	55
18	Fluxapyroxad	5,978	3,463	73
19	Glyphosate	5,871	5,787	1
20	Lambda-cyhalothrin	5,778	6,452	-10
21	Azoxystrobin	5,596	6,038	-7
22	Penconazole	5,519	6,752	-18
23	Potassium hydrogen carbonate	5,371	7,918	-32
24	*Orius spp.*	5,237	973	438
25	*Bacillus amyloliquefaciens subsp. plantarum* strain D747	5,027	408	1,131
26	Kresoxim-methyl	4,831	5,550	-13
27	Cyflufenamid	4,738	3,196	48
28	Proquinazid	4,638	3,088	50
29	Dimethomorph	4,184	3,987	5
30	Copper oxychloride	3,863	2,016	92
31	Spirotetramat	3,679	520	607
32	Carfentrazone-ethyl	3,518	3,817	-8
33	*Aphidius colemani*	3,411	341	901
34	Ametoctradin	2,891	2,498	16
35	Pendimethalin	2,837	3,191	-11
36	*Bacillus amyloliquefaciens* strain MBI 600	2,285	0	.
37	Propyzamide	2,243	2,832	-21
38	*Steinernema feltiae*	2,186	210	941
39	Fenpyrazamine	2,135	2,883	-26
40	Bupirimate	2,086	4,934	-58
41	Metribuzin	2,025	2,208	-8
42	Flufenacet	2,025	2,208	-8
43	Tebuconazole	2,006	377	432
44	Benthiavalicarb-isopropyl	1,741	1,935	-10
45	Mepanipyrim	1,727	2,047	-16
46	Ferric phosphate	1,651	1,924	-14
47	Zoxamide	1,603	1,387	16
48	*Orius laevigatus*	1,493	1,314	14
49	*Bacillus thuringiensis* var. kurstaki	1,488	1,522	-2
50	*Amblyseius spp.*	1,462	389	275

Table 8 Estimated amount used (kg) of the fifty most extensively used active substances on all soft fruit crops surveyed in 2020 in the United Kingdom				
	Active substance	**Amount used 2020 (kg)**	**Amount used 2018 (kg)**	**% change on 2018**
1	Sulphur	57,667	45,800	26
2	Potassium hydrogen carbonate	27,800	36,071	-23
3	*Bacillus pumilus* strain QST 2808	11,131	0	.
4	Fenhexamid	7,909	6,725	18
5	Mancozeb	7,337	5,935	24
6	Pyrimethanil	4,826	4,462	8
7	Fatty acids C7-C20	4,598	300	1,435
8	Boscalid	3,600	3,378	7
9	Glyphosate	3,403	3,159	8
10	Copper oxychloride	3,208	1,607	100
11	Cyprodinil	2,864	2,694	6
12	*Bacillus amyloliquefaciens subsp. plantarum* strain D747	2,744	235	1,065
13	Fludioxonil	1,909	1,796	6
14	Dimethomorph	1,735	2,048	-15
15	Pendimethalin	1,432	1,796	-20
16	Azoxystrobin	1,316	1,447	-9
17	Trifloxystrobin	1,308	929	41
18	Fluopyram	1,261	928	36
19	Propyzamide	1,228	1,619	-24
20	Fenpyrazamine	1,148	1,607	-29
21	Thiacloprid	865	1,170	-26
22	Pyraclostrobin	828	748	11
23	Napropamide	815	1,536	-47
24	Unspecified physical control agents	754	0	.
25	Dazomet	703	2,391	-71
26	Mepanipyrim	663	793	-16
27	Ametoctradin	623	506	23
28	*Bacillus thuringiensis* var. kurstaki	596	600	-1
29	Kresoxim-methyl	590	641	-8
30	*Gliocladium catenulatum* strain J1446	574	39	1,377
31	Myclobutanil	539	41	1,200
32	Bupirimate	513	1,623	-68
33	*Bacillus amyloliquefaciens* strain QST 713	471	607	-23
34	Flufenacet	454	494	-8
35	Spinosad	447	415	8
36	Potassium phosphonate (phosphite)	379	0	.
37	Metribuzin	331	360	-8
38	Cerevisane (*Saccharomyces cerevisiae* strain LAS 117)	329	0	.
39	Spirotetramat	319	39	710
40	Difenoconazole	277	186	49
41	Fluxapyroxad	265	153	73
42	Penconazole	252	299	-16
43	Ferric phosphate	219	328	-33
44	Fenpropimorph	203	1,077	-81
45	Zoxamide	189	140	35
46	Proquinazid	185	121	52
47	Tebuconazole	169	61	177
48	Metaldehyde	162	281	-43
49	Metamitron	144	63	130
50	Bifenazate	134	125	7

Table 9 Active substances recorded at a significant level on soft fruit crops in the United Kingdom in 2020 but not in 2018			
	Active substance	**Area treated 2020 (ha)**	**Amount used 2018 (kg)**
1	*Bacillus amyloliquefaciens* strain MBI 600	2,285	125
2	Cerevisane (S*accharomyces cerevisiae* strain LAS 117)	1,314	329
3	*Bacillus pumilus* strain QST 2808	1,253	11,131
4	*Aureobasidium pullulans*	798	125
5	Potassium phosphonate (phosphite)	355	379
6	Cyflumetofen	325	63
7	Metrafenone	233	37
8	Amisulbrom	227	17
9	COS-OGA	41	1
10	Fluazinam	31	2

Table 10 Major increases in the use of individual active substances on soft fruit crops in the United Kingdom since 2018 (area treated)				
	Active substance	**Area treated 2020 (ha)**	**Area treated 2018 (ha)**	**% change on 2018**
1	*Amblyseius andersoni*	751	21	3,410
2	Fatty acids C7-C20	997	39	2,456
3	Myclobutanil	8,382	645	1,200
4	*Bacillus amyloliquefaciens subsp. plantarum* strain D747	5,027	408	1,131
5	Clethodim	382	34	1,019
6	*Steinernema feltiae*	2,186	210	941
7	*Aphidius colemani*	3,411	341	901
8	Peroxyacetic acid	80	9	813
9	*Gliocladium catenulatum* strain J1446	452	51	781
10	Spirotetramat	3,679	520	607
11	*Hypoaspis spp.*	1,454	230	532
12	Flazasulfuron	114	20	468
13	*Orius spp.*	5,237	973	438
14	Tebuconazole	2,006	377	432
15	*Aphelinus abdominalis*	449	111	305
16	*Praon volucre*	449	111	305
17	*Ephedrus cerasicola*	449	111	305
18	*Amblyseius spp.*	1,462	389	275
19	*Aphidius matricariae*	508	138	269
20	Sugar	24	7	240

Table 11 Major decreases in the use of individual active substances on soft fruit crops in the United Kingdom since 2018 (area treated)				
	Active substance	**Area treated 2020 (ha)**	**Area treated 2018 (ha)**	**% change on 2018**
1	Fenamidone	16	1,358	-99
2	Fosetyl-aluminium	16	1,358	-99
3	Parasitic wasp	4	236	-98
4	Meptyldinocap	81	3,781	-98
5	Pymetrozine	23	1,063	-98
6	Abamectin	149	3,286	-95
7	Tebufenpyrad	59	1,079	-95
8	Lenacil	11	188	-94
9	Diquat	519	6,452	-92
10	Maltodextrin	8	70	-88
11	Quinoxyfen	524	3,903	-87
12	MCPA	23	119	-81
13	2,4-D	45	206	-78
14	Pyrethrins	1,122	4,400	-74
15	*Beauveria bassiana* GHA	18	66	-72
16	*Bacillus subtilis*	125	373	-67
17	S-metolachlor	29	78	-63
18	*Ampelomyces quisqualis* strain AQ 10	663	1,735	-62
19	Napropamide	486	1,203	-60
20	Bupirimate	2,086	4,934	-58

Table 12 Comparison of pesticide usage on soft fruit, 2012 - 2020, area treated (ha) and amount used (kg)										
	2012		2014		2016		2018		2020	
	ha	kg	ha	kg	ha	kg	ha	kg	ha	kg
Acaricides	6,087	507	10,610	853	8,313	718	7,599	530	3,827	401
Insecticides	26,060	5,535	29,183	6,015	30,881	3,229	34,900	3,371	30,578	7,146
Fungicides	110,267	77,032	120,892	98,930	129,285	92,079	127,245	83,829	135,620	88,164
Sulphur	16,427	50,047	19,730	52,980	17,670	54,783	15,394	45,800	17,616	57,514
Herbicides	28,365	15,418	26,112	13,229	27,576	12,294	28,039	11,290	20,246	8,307
Molluscicides & repellents	4,119	1,129	3,818	793	3,806	888	3,784	610	2,532	381
Soil sterilants	439	105,486	59	16,195	55	11,697	15	2,391	11	703
Tar oil/acids	25	228	.	.	.	.	.	.	.	.
Total - all authorised pesticides[1]	191,789	255,382	210,404	188,995	217,586	175,690	216,976	147,821	210,430	162,616
Biological control agents	12,814	34	3,869	18	12,814	34	3,869	18	49,439	.
Area grown	10,072		10,407		11,218		11,966		12,583	

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

APPENDIX 2 – METHODOLOGY

METHODS

The samples of holdings to be surveyed were selected using data from the Agricultural Census Returns, June 2019 for England & Wales (Anon., 2020a and 2020b), Scotland (Anon., 2020c) and for Northern Ireland (Anon., 2020d).

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.

As part of the Long Term Service Agreement with Defra, there is a requirement for an overall maximum of 5% Relative Standard Error (RSE) by area treated for all of the surveys conducted by the survey team. A total of 236 soft fruit holdings were surveyed in England & Wales in 2018, compared to 253 in 2016. Despite this reduction in holdings surveyed, the RSE by area treated for the 2018 survey was 3.8%. Due to a reduction in the soft fruit population in England & Wales the decision was taken to reduce the target number of holdings for the 2020 survey and a total of 223 holdings have been surveyed in 2020. The resultant RSE for the 2020 survey, 6.3% can be found in Appendix 3.

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 296 UK holdings during the winter of 2020/21 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 532 holdings were contacted, of which 139 (26%) were not growing soft fruit crops commercially. Of the 393 premises growing soft fruit crops, 223 provided pesticide usage data , 124 (32%) were unwilling to help with the survey and the remaining 46 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 287 holdings visited in Great Britain (no data were available from Northern Ireland) and where information was available (270 holdings), 47% 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. Eighteen of the holdings (7%) 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. Electronic record keeping was used by 49% of the holdings contacted in England & Wales, with these records accounting for 88% of the total area of soft fruit grown. Of the holdings using

electronic record keeping, 57% used commercial farm management software systems with the remaining 43% using in-house computer systems developed by the growers themselves.

Due to government restrictions surrounding the COVID-19 pandemic, it was not possible to undertake any face-to-face visits for this year's survey and all data were collected by email, post and over the telephone. Whilst there may have been an impact in terms of participation, due to not being able to offer growers a face-to-face visit, it is hard to quantify the impact this change in methodology has had on data quality. 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 the majority of cases, where growers were using paper-based record keeping, they were happy to provide data over the telephone 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 2019/2020 season.

Form 2 dealt with all aspects of pesticide usage on the individual crops grown on the holding and harvested in 2020, 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).

Due to the impact of the COVID-19 pandemic it was not possible for Defra or the Welsh Government to run the 2020 June Survey of Agriculture and Horticulture for England & Wales as planned. To reduce the burden on farmers a smaller scale (approximately 22,000 holdings) voluntary survey was run by Defra instead. As a result of this approach, data on the area of soft fruit crops grown in each size group and region were not available for 2020. We have, therefore, used the 2019 June Survey data (Anon., 2020a) to calculate all three raising factors for England & Wales.

Data on the area of soft fruit crops grown in 2020 for each size group were available for Scotland (Anon., 2021b) and Northern Ireland (Anon., 2021c) and these data have been used to calculate the raising factors for each country.

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 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.

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 fairly often 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 3 – 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*
$A_j = \sum_{k=1}^{k=K} H_{j,k} \cdot r_{a_{j,k}}$	*Equation 7*
$M_j = \sum_{k=1}^{k=K} H_{j,k} \cdot r_{m_{j,k}}$	*Equation 8*
$se_{A_j} = \sqrt{\sum_{k=1}^{k=K} H_{j,k}^2 \cdot \frac{s_{a_{j,k}}^2}{L_{j,k}} \cdot \frac{N_{j,k} - L_{j,k}}{N_{j,k} - 1}}$	*Equation 9*
$se_{M_j} = \sqrt{\sum_{k=1}^{k=K} H_{j,k}^2 \cdot \frac{s_{m_{j,k}}^2}{L_{j,k}} \cdot \frac{N_{j,k} - L_{j,k}}{N_{j,k} - 1}}$	*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%.

Due to disruption caused by the COVID 19 pandemic, estimates of the number of holdings and total cropping area for crops in England & Wales are based on published estimates for 2019, and assume consistency for applications made in 2020.

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	Total area (Ha)	Number of holdings	Number surveyed	Estimate (Ha)	se (Ha)	rse (%)	95% confidence interval (Ha)	
All soft fruit crops	East Midlands	440.7	82	9	3,358.3	1,196.6	35.6	NA	NA
All soft fruit crops	Eastern	1,477	193	36	22,195.6	1,833.5	8.3	18,601.9	25,789.3
All soft fruit crops	London & South East	5,120.7	319	92	116,672.9	12,897.5	11.1	91,393.8	141,952
All soft fruit crops	North East/North West/ Yorkshire & the Humber	307.9	137	10	5,124.6	2,210	43.1	NA	NA
All soft fruit crops	South West	814.7	238	25	6,408.9	2,035.9	31.8	NA	NA
All soft fruit crops	West Midlands	2,119.7	150	37	47,125.1	6,288.5	13.3	34,799.6	59,450.5
All soft fruit crops	England	10,280.8	1,119	209	200,885.3	14,822.7	7.4	171,832.8	229,937.9
All soft fruit crops	Wales	180.1	380	14	247	163.2	66.1	NA	NA
All soft fruit crops	Scotland	2,168.4	757	64	36,627.7	2,540.1	6.9	31,649.1	41,606.3
All soft fruit crops	Northern Ireland	14	27	9	63.9	17.4	27.2	29.8	98

[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

Crop	Estimate (Ha)	se (Ha)	rse (%)	95% C.I (Ha)	
All soft fruit crops	237,824	15,039.7	6.3	208,346.1	267,301.8

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

Crop	Region	Total area (Ha)	Number of holdings	Number surveyed	Estimate (Kg)	se (Kg)	rse (%)	95% confidence interval (Kg)	
All soft fruit crops	East Midlands	440.7	82	9	3,672.5	2,346.5	63.9	NA	NA
All soft fruit crops	Eastern	1,477	193	36	19,806.8	3,022.8	15.3	13,882.1	25,731.6
All soft fruit crops	London & South East	5,120.7	319	92	76,361.9	5,291.8	6.9	65,990	86,733.9
All soft fruit crops	North East/North West/ Yorkshire & the Humber	307.9	137	10	3,388.5	1,431.6	42.2	NA	NA
All soft fruit crops	South West	814.7	238	25	5,152.3	2,114.4	41	NA	NA
All soft fruit crops	West Midlands	2,119.7	150	37	32,742.1	4,284.7	13.1	24,344.2	41,140.1
All soft fruit crops	England	10,280.8	1,119	209	141,124.2	8,217.4	5.8	125,018.1	157,230.2
All soft fruit crops	Wales	180.1	380	14	629.2	556.8	88.5	NA	NA
All soft fruit crops	Scotland	2,168.4	757	64	20,331	2,142	10.5	16,132.6	24,529.4
All soft fruit crops	Northern Ireland	14	27	9	39.5	15.1	38.2	NA	NA

[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

Crop	Estimate (Kg)	se (Kg)	rse (%)	95% C.I (Kg)	
All soft fruit crops	162,123.9	8,510.2	5.2	145,443.8	178,803.9

APPENDIX 4 – 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	8.42	42	5	*
	B	4.27	40	9	*
	D	3.66	130	35	*
	E	3.10	177	57	*
Eastern	A	6.27	85	14	13
	B	6.34	86	13	*
	C	3.37	169	50	7
	D	2.13	243	114	6
	E	2.06	895	434	6
London & South East	A	2.80	96	34	30
	B	3.80	193	51	13
	C	4.15	293	71	11
	D	2.67	844	316	19
	E	2.98	3,694	1,240	19
North West	A	47.33	23	<1	*
Northern Ireland	A	2.29	14	6	9
Scotland	A	9.66	71	7	28
	B	2.57	78	30	8
	C	2.56	167	65	9
	D	3.38	544	161	9
	E	2.52	1,309	520	10
South West	A	7.33	99	13	13
	B	8.32	110	13	*
	C	7.90	150	19	*
	D	4.14	150	36	*
	E	1.91	305	160	*
Wales	A	7.81	70	9	13
	D	1.00	10	10	*
West Midlands	A	7.10	60	8	11
	B	2.40	56	23	6
	C	3.65	115	32	*
	D	2.98	289	97	*
	E	2.06	1,598	776	11
Yorkshire & the Humber	A	15.96	41	3	*
	B	4.92	28	6	*
	E	1.00	54	54	*

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.

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REFERENCES

Anon. (2020a) Agricultural Statistics in England 2019. London: HMSO

Anon. (2020b) Agricultural Statistics in Wales 2019. London: HMSO

Anon. (2020c) Agricultural Statistics in Scotland 2019. Edinburgh: HMSO

Anon. (2020d) Agricultural Statistics, Northern Ireland 2019. Belfast: HMSO

Anon. (2021b) Agricultural Statistics in Scotland 2020. Edinburgh: HMSO

Anon. (2021c) Agricultural Statistics, Northern Ireland 2020. Belfast: HMSO

Ridley, L., Mace, A., Parrish, G., Barker I., Rainford, J., MacArthur, R., & Garthwaite, D. (2020) Pesticide Usage Survey Report 285 – Soft Fruit Crops in the United Kingdom, 2018. London: Defra

Thomas, M.R., (1999), Guidelines for the Collection of Pesticide Usage Statistics within Agriculture and Horticulture, OECD, Eurostat, https://secure.fera.defra.gov.uk/pusstats/surveys/documents/guide.pdf [online] (last accessed 25.11.2021)

Wood, H.J. (1931) An Agricultural Atlas of Scotland. London: George Gill & Sons

LINKS TO JUNE SURVEY DATA

June Survey – England: https://data.gov.uk/dataset/332b5dfc-9616-47b2-81ee-4fcd407196ca/june-survey-of-agriculture-and-horticulture-england (last accessed 25.11.2021)

June Survey – Wales: https://gov.wales/survey-agriculture-and-horticulture (last accessed 25.11.2021)

June Survey – Scotland: https://www2.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/Publications/JuneAgriculturalCensus (last accessed 25.11.2021)

June Survey – Northern Ireland: https://www.gov.uk/government/statistics/announcements/june-agricultural-and-horticultural-survey-preliminary-results-ni-2019 (last accessed 25.11.2021)