Accredited Official Statistics

Pesticide Usage in Scotland: Arable Crops 2024

October 2025

Scottish Government
Riaghaltas na h-Alba

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Key Points

- Overall, estimated pesticide application to arable crops in 2024 was broadly similar to that recorded in the previous surveys in 2022 and 2020.
- However, pesticide use patterns in 2024 were influenced by several complex factors such as crop composition and weather conditions. Spring 2024 was warmer, and winter, spring and summer 2024 were wetter than 2022, providing more favourable climatic conditions for pests, weeds and diseases, increasing the need for pesticide applications. However, the wet weather in autumn 2023 resulted in a decrease in the area of winter sown crops and an increase in spring sown crops which generally receive fewer pesticide treatments. The wet weather in 2024 also limited opportunities to spray which influenced the timing and composition of spray applications and increased the need for the use of desiccants prior to harvest.
- In 2024, the census area of arable crops grown in Scotland was approximately 502,400 hectares. This represents an increase of 3% in area from 2022 and a 1% increase from 2020.
- Cereals accounted for 86% of the total arable area (spring barley 51%, wheat 20%, winter barley 9%, spring oats 4%, winter oats 2% and winter rye 1%). Oilseeds accounted for 7% of the total arable area, potatoes 6% and legumes less than 1%.
- The area of pesticides applied to arable crops per hectare of crop grown was 4% higher than that reported in the 2022 survey and 3% higher than the 2020 survey.
- The weight of pesticides applied to arable crops per hectare of crop grown was 4% higher in 2024 than in 2022 and 7% lower compared to 2020.
- When area grown is taken into account, the application of herbicides/ desiccants, insecticides/nematicides, seed treatments, molluscicides and fungicides all increased in 2024 (13%, 12%, 4%, 1% and < 0.5% respectively). Sulphur and growth regulator applications decreased by 24% and 7% respectively.
- The estimated total area of arable crops treated with a pesticide formulation was ca. 5,003,000 ha (± 3% Relative Standard Error, RSE) with a combined weight of ca. 1,300 tonnes (± 4% RSE).
- Overall, pesticides were applied to 98% of the arable crop area, this is very similar to the 97% treated area in 2022. Herbicides/desiccants were applied to 97% of the crop area, fungicides to 97%, growth regulators to 54%, insecticides/ nematicides to 19%, molluscicides to 8% and 86% of seed was treated.
- In terms of area treated, the most used foliar fungicide active substance was prothioconazole. Fluroxypyr and lambda-cyhalothrin were the most used herbicide and insecticide active substances respectively.
- Five active substances were recorded for the first time in the 2024 arable survey. These included the fungicides potassium phosphonate, pydiflumetofen, isoflucypram and valifenalate and the herbicide cinmethylin.

Introduction

This report presents information from a survey of pesticide use on arable crops grown in Scotland during 2024. The crops surveyed included cereals, oilseeds, potatoes and legumes.

The Scottish Government (SG) is required by legislation [1][2] to carry out post-approval surveillance of pesticide use. This is conducted by the Pesticide Survey Unit at SASA, a division of the Scottish Government’s Agriculture and Rural Economy Directorate. This survey is part of a series of annual reports which are produced to detail pesticide usage in Scotland for arable, vegetable and soft fruit crops on a biennial basis and for fodder and forage crops every four years. The Scottish survey data are incorporated with England, Wales, and Northern Ireland data to provide estimates of annual UK-wide pesticide use. Information on all aspects of pesticide usage in the United Kingdom as a whole may be obtained from the Pesticide Usage Survey Team at Fera Science Ltd, Sand Hutton, York, or visit the Fera website.

It is important to note that the figures presented in this report are produced from surveying a sample of holdings rather than a census of all the holdings in Scotland. Data was collected from a total of 313 holdings, representing 9% of the total arable area grown in Scotland. Ratio raising was used to produce estimates of national pesticide usage from sampled data. Therefore, the figures are estimates of the total pesticide use for Scotland and should not be interpreted as exact. To give an indication of the precision of estimates, the report includes relative standard errors.

Data tables are not included in this report. All data tables are available to download in Excel format in a seperate supporting document.

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The Scottish Pesticide Usage reports have been accredited official statistics since October 2014.

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More information about Scottish Government statistics is available on the Scottish Government website.

General trends

Crop area

In 2024 the census area of arable crops grown in Scotland was 502,359 hectares. This represents a 3% increase in cropped area since 2022 and a 1% increase from 2020. Since the last survey, areas of legumes, spring barley, seed potatoes, ware potatoes, spring oats and oilseeds have increased (14%, 9%, 8%, 7%, 4%, 3% respectively) while wheat, winter rye, winter oats and winter barley have decreased (8%, 8%, 4%, 3% respectively) (Figure 1 and 2). The wet weather in autumn 2023 resulted in a decrease in the area of winter sown crops and an increase in spring sown crops [7].

Figure 1: Area of cereal crops grown in Scotland from 2020 to 2024

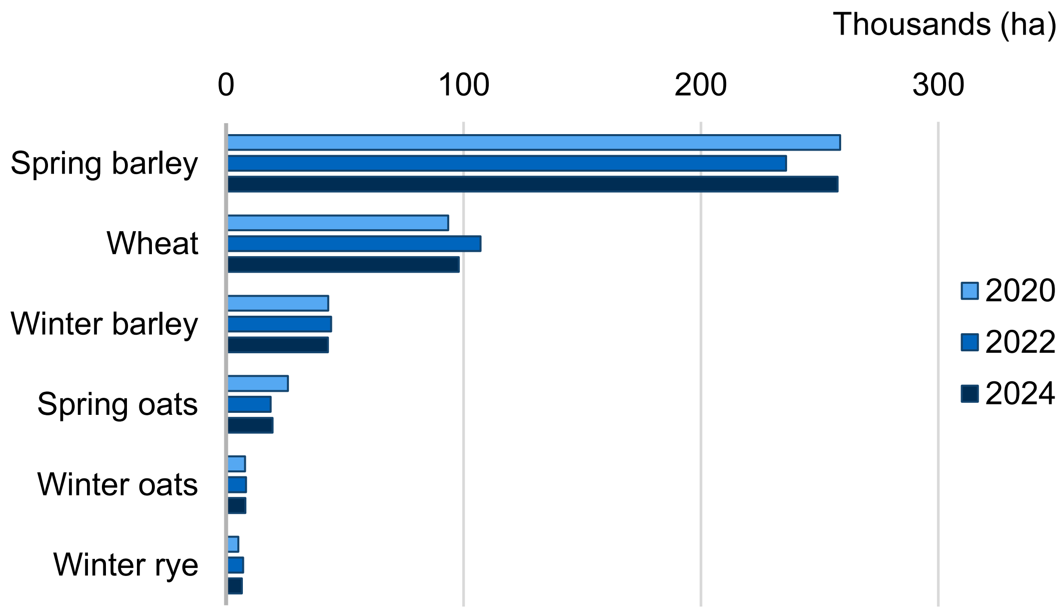


Figure 1 footnote: Triticale and mixed grain have been excluded as these represent < 500 ha. Source - June Agricultural Census. Note there was no June Census in 2022, therefore areas in this year were taken from Single Application Form (SAF) data – see the 2022 report for full details.

Cereals accounted for 86% of the total arable area (spring barley 51%, wheat 20%, winter barley 9%, spring oats 4%, winter oats 2% and winter rye 1%). Oilseeds accounted for 7% of the total arable area, potatoes 6% and legumes less than 1% (Figure 3). For full details of census crop areas, see supporting documentation Table 14. The largest area of arable crops was in the Aberdeen region, followed by Angus, Tweed Valley and Moray Firth (Figure 4).

Figure 2: Area of oilseeds, potatoes and legumes grown in Scotland from 2020 to 2024

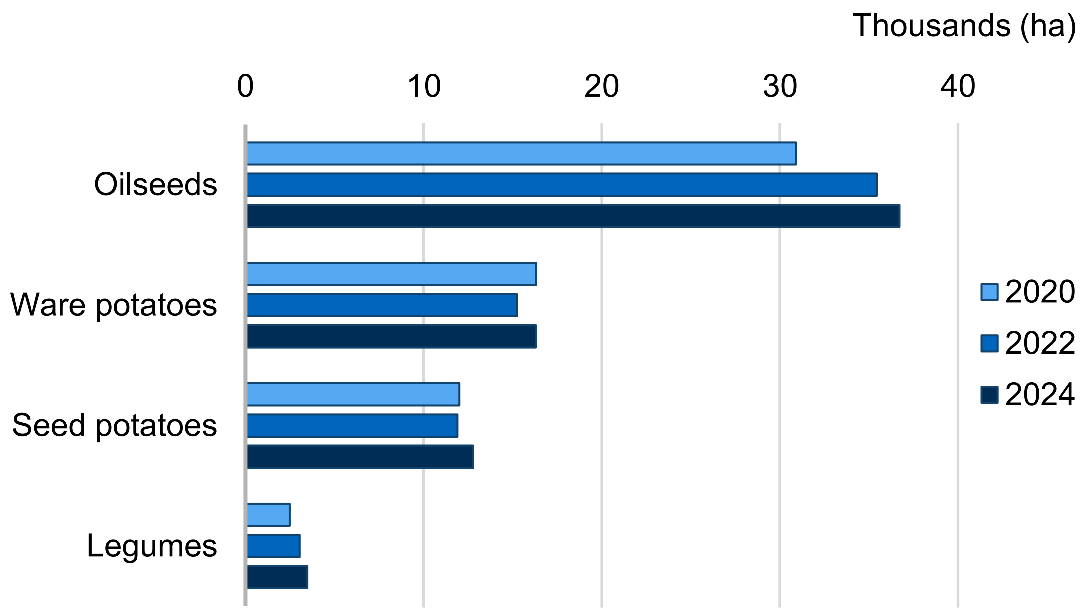


Figure 2 footnote: Oilseeds include winter and spring oilseed rape and linseed, legumes include field beans, dry harvest peas and lupins. Source - June Agricultural census. Note there was no June Census in 2022, therefore areas in this year were taken from Single Application Form (SAF) data – see the 2022 report for full details.

Figure 3: Arable crop areas 2024 (percentage of total areas)

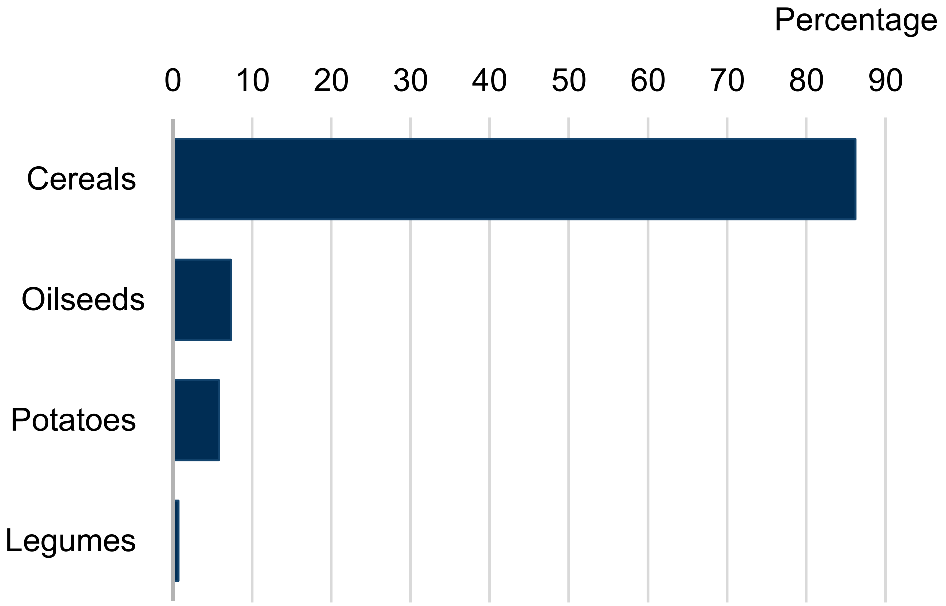
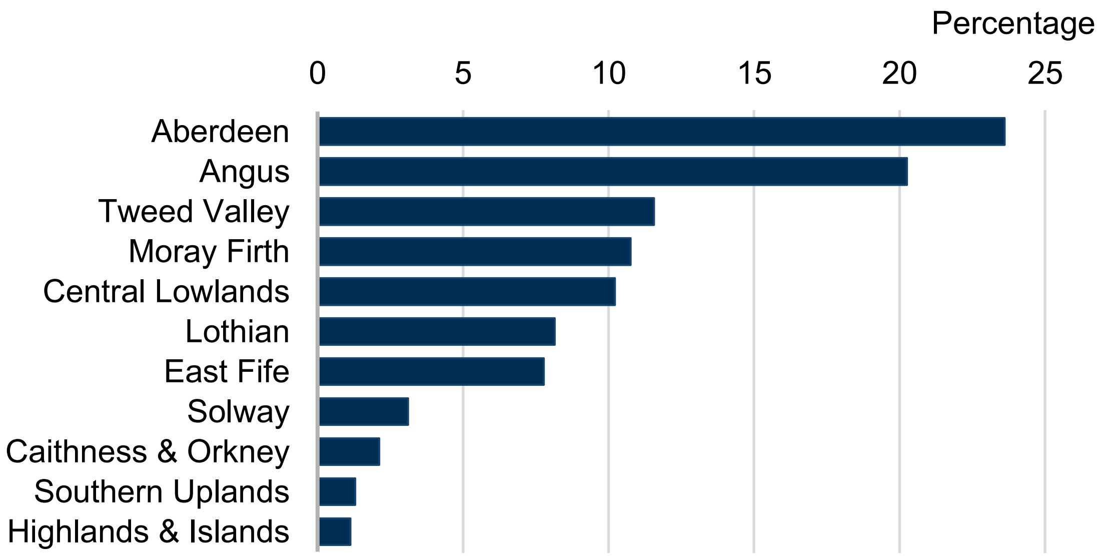


Figure 3 footnote: Cereals include winter and spring barley, wheat, winter and spring oats, winter rye, triticale and mixed grain; potatoes include seed and ware potatoes; oilseeds include linseed, winter and spring oilseed rape; legumes includes field beans, dry harvest peas and lupins. Source - June Agricultural census.

Figure 4: Regional distribution of arable crops grown in Scotland in 2024



Pesticide usage

In 2024, as in 2022, the majority of arable crops (98%) received a pesticide treatment.

Winter and spring barley, winter wheat, winter oats, winter rye, oilseeds, seed and ware potatoes had the highest overall proportion of crop treated with a pesticide (between 98% and 100% Table 1). Spring oats and legumes had lower proportions of treated crop area (83% and 78% respectively). The average number of sprays applied to treated arable land, excluding seed treatments, was 4.0, very similar to that recorded in the 2022 survey of 4.1 sprays. Ware potatoes and seed potatoes received the highest average number of sprays (13.5 and 10.7 respectively), while spring barley, legumes and spring oats received the lowest (2.6, 2.6 and 2.8 respectively, Table 1). These figures only apply to the treated area of crops.

It is estimated that the area of arable crops treated with a pesticide formulation in 2024 was ca. 5,003,000 hectares compared with ca. 4,685,000 hectares in 2022 and ca. 4,793,000 hectares in 2020 (Table 10, Figure 5). This represents an increase of 7% from 2022 and 4% from 2020.

Figure 5: Area of arable crops treated with major pesticide groups in Scotland from 2020 to 2024

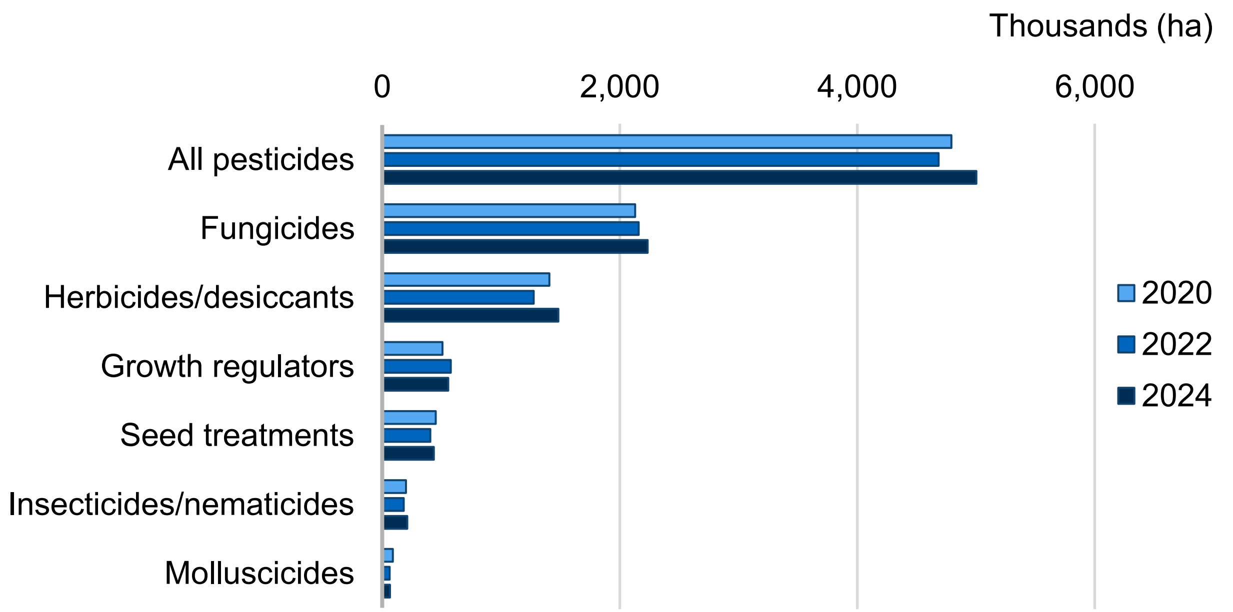


Figure 5 footnote: Sulphur and fungicide/growth regulator mixed formulations have been excluded as their use represents < 15,000 hectares.

In terms of weight of pesticide applied, it is estimated ca. 1,300 tonnes were applied in 2024, representing an increase of 7% from 2022 and a decrease of 6% from 2020 (Table 10, Figure 6).

Figure 6: Weight of the major pesticide groups applied to arable crops in Scotland from 2020 to 2024

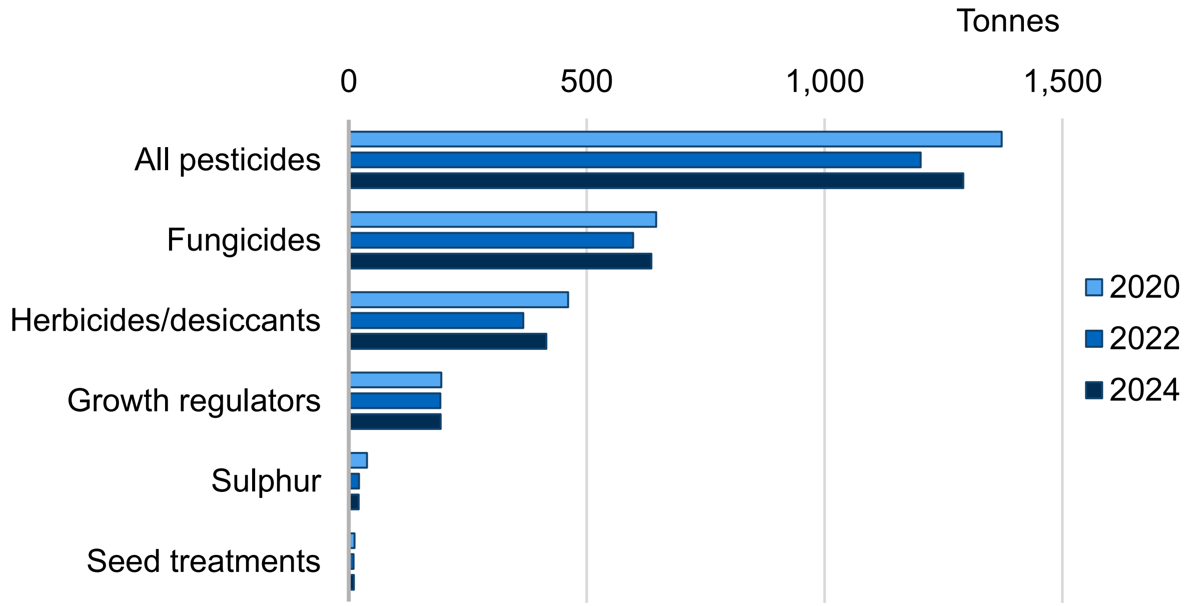


Figure 6 footnote: Molluscicides, insecticide/nematicides and fungicide/growth regulator mixed formulations have been excluded as they represent < 10 tonnes.

In order to make accurate comparisons between the 2024 data and the data collected in previous surveys, it is important to take into account the differences in crop area between survey years. Therefore, the number of treated hectares per hectare of crop grown and the total weight of pesticide used per hectare of crop grown were calculated. In 2024, for each hectare of crop grown, 10.0 pesticide treated hectares were recorded. This represents an increase of 4% from 2022 to 2024 and an increase of 3% from 2020 (Figure 7). The estimated weight of pesticide applied per hectare of crop grown in 2024 was 2.6 kilograms. This represents an increase of 4% from 2022 and a decrease of 7% from 2020 (Figure 8). Therefore the overall pesticide use was broadly similar to that reported in the previous surveys in 2022 and 2020 (within precision estimates - relative standard errors). However, despite little overall variation in pesticide applicaton pesticide use in 2024 may have been influenced by several complex factors such crop composition and more favourable climatic conditions for pests, weeds and diseases in 2024. The 2023/24 growing season was challenging. Autumn storms of 2023 resulted in a decrease in the area of some winter sown crops grown and an increase in spring sown crops. Spring crops generally receive fewer pesticide applications. Winter and spring were 25% wetter, summer 50% wetter, and spring mean temperatures were 8% higher in 2024 than in 2022 [5] resulting in more favourable conditions for pests and pathogens. However the persistent rain and windy conditions also limited opportunities to apply sprays. As a result, there were some variation in spray timings and some complex tank mixes applied to minimise the number of passes required on fields [6]. The wet conditions also impacted harvest with delayed crop ripening. August 2024 had 21 wet days compared to 12 days in 2022 [5]. These wet conditions are likely to have influenced the increased use of desiccants prior to harvest [8].

Figure 7: Number of pesticide treated hectares (formulations) per hectare of crop grown in Scotland from 2020 to 2024

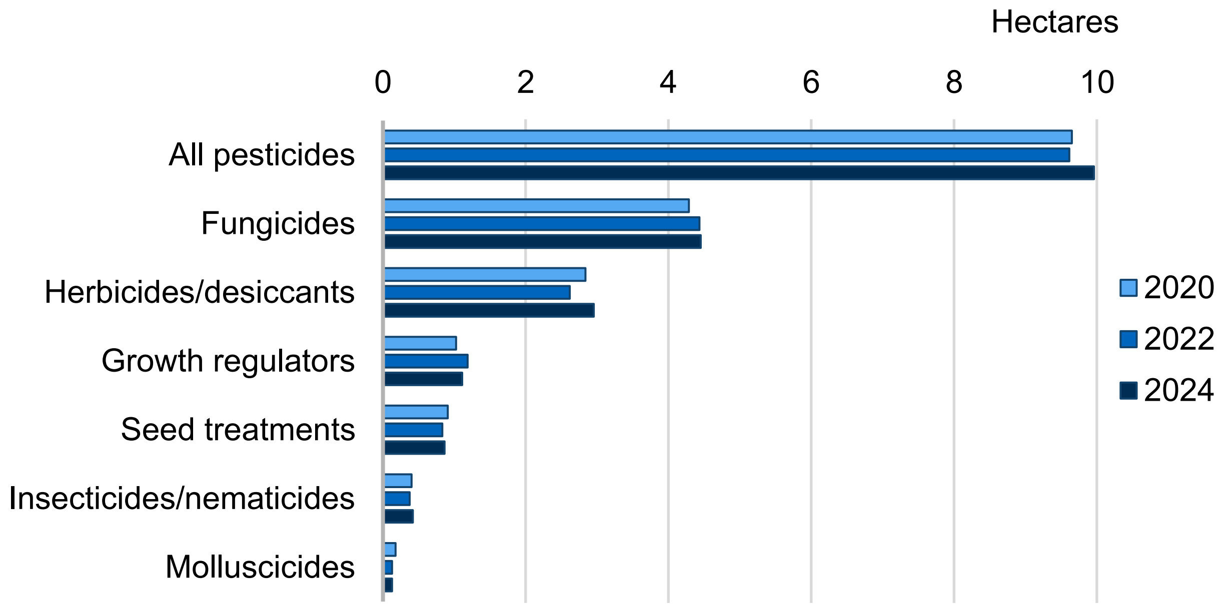


Figure 7 footnote: Sulphur and fungicides/growth regulators mixed formulations are not shown as these represent < 0.1 treated hectares per hectare of crop grown.

Figure 8: Weight of pesticide applied per hectare of crop grown in Scotland from 2020 to 2024

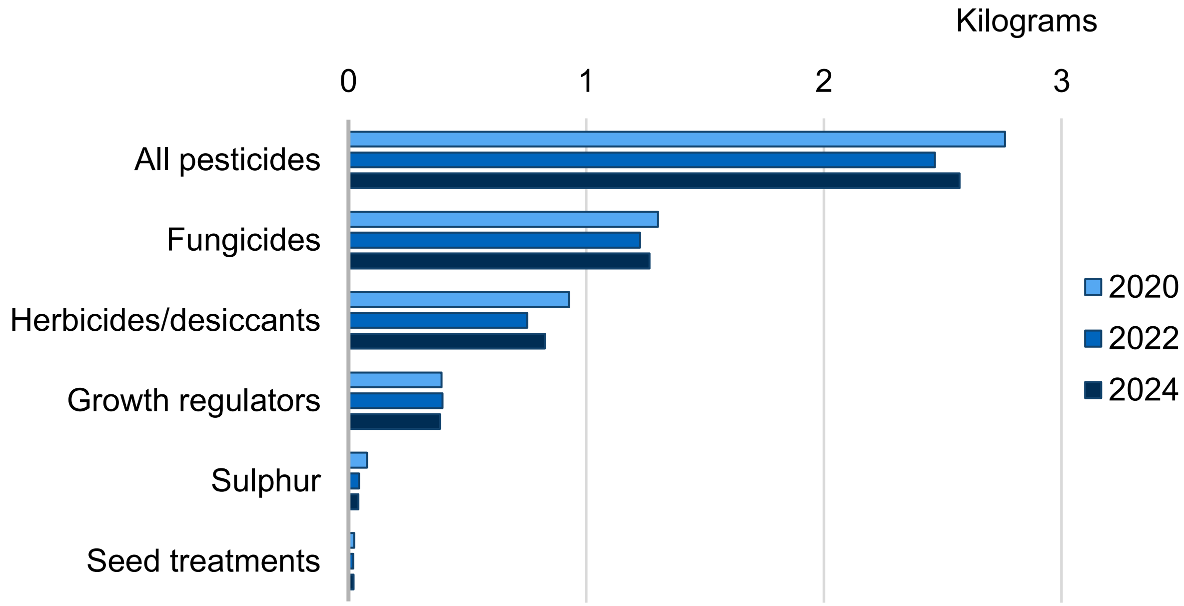


Figure 8 footnote: Molluscicides, insecticides/nematicides and fungicides/growth regulators mixed formulations are not shown as they represent < 0.02 kg per hectare of crop grown.

Figure 9: Use of pesticides on arable crops in 2024 (percentage of total area treated with formulations) in 2024

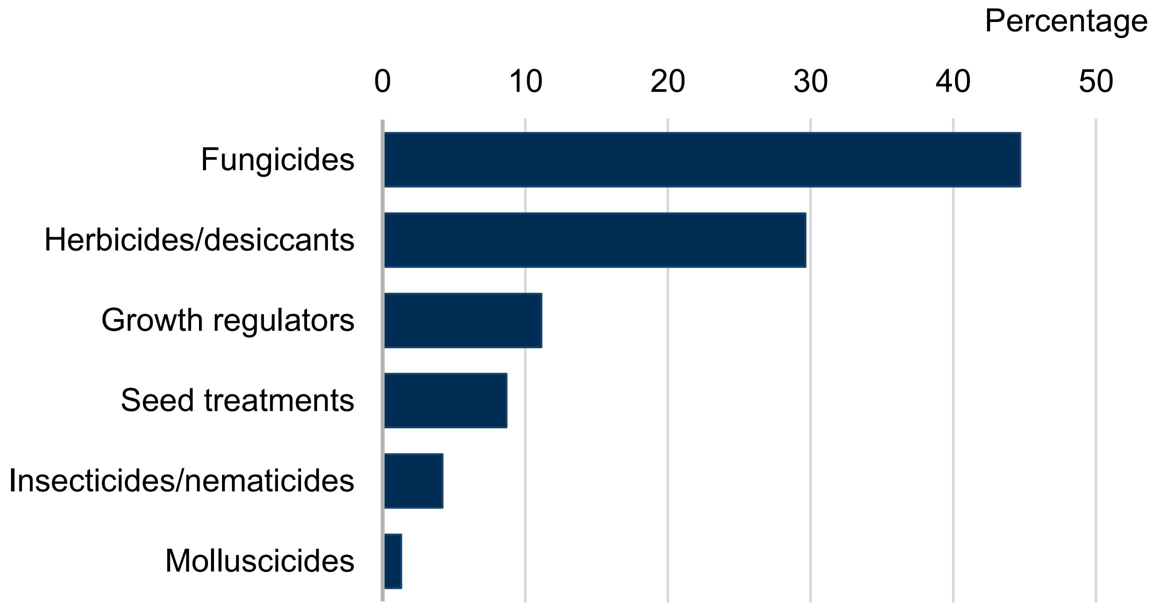


Figure 9 footnote: Sulphur and fungicide/growth regulators mixed formulations have been excluded as their use represents < 0.5% of area treated.

Figure 10: Use of pesticides on arable crops (percentage of total weight of active substances applied) in 2024

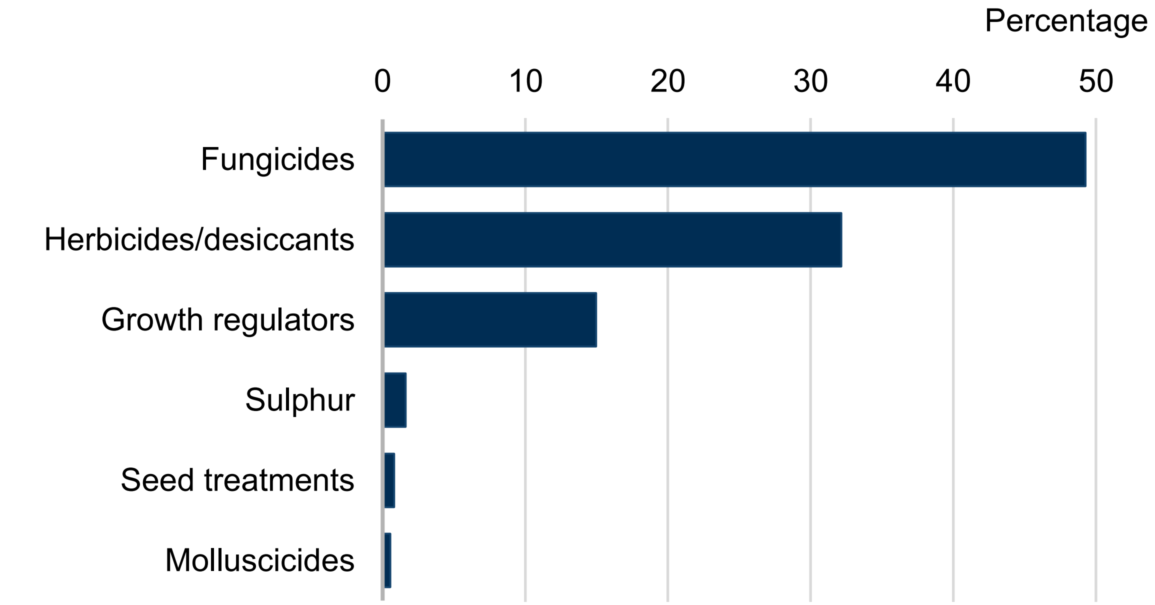


Figure 10 footnote: Insecticide/nematicide and fungicide/growth regulator mixed formulations have been excluded as their use represents < 0.5% of weight applied.

Fungicides

In 2024, as reported in previous surveys, fungicides were the most frequently used pesticide by area treated, followed by herbicides/desiccants and growth regulators (Figure 5). Fungicides accounted for 45% of the total pesticide treated area and 49% of the total weight of pesticides applied (Figures 9 and 10). When changes in crop area are taken into account, the area treated with fungicides was similar in 2022 and 2024 and increased by 4% between 2020 and 2024 (Figure 7). From 2022 to 2024, there was a 3% increase in the weight of fungicides used per hectare of crop grown and a decrease of 3% between 2020 and 2024 (Figure 8). The principal fungicide mode of action on arable crops in terms of area treated continues to be sterol biosythesis in membranes, which includes the azoles (supporting document Table 5).

Herbicides/desiccants

In 2024, herbicides/desiccants accounted for 30% of the total pesticide treated area and 32% of the total weight of pesticides applied (Figure 9 and 10). When changes in crop area are taken into account, there was a 13% increase in area treated with herbicide/desiccant formulations from 2022 to 2024 and a 4% increase from 2020 to 2024 (Figure 7). In terms of weight of pesticide applied, when area of crop grown is taken into account, there was a 10% increase from 2022 to 2024 and a 11% decrease from 2020 to 2024 (Figure 8). In 2022 there were prolonged dry conditions resulting in low weed pressure and hot, dry weather at harvest time which reduced the need for the use of a desiccant with crops ripening naturally [3]. In contrast in 2024, winter and spring were 25% wetter, summer 50% wetter, and spring mean temperatures were 8% higher than in 2022 [5]. The harvest period in 2024 was wet in most regions and challenging for growers. The slow ripening of crops increased the need for the use of a desiccant [8]. The use of the herbicide/ desiccant glyphosate increased by 58% by area treated and 45% in weight applied from the previous survey in 2022 (Table 8 and 9).

Growth regulators

Growth regulators accounted for 11% of the total pesticide treated area and 15% of the total weight of active substances applied (Figures 9 and 10). When changes in crop area are taken into account, the area treated decreased by 7% from 2022 to 2024 and increased by 8% from 2020 to 2024 (Figure 7). The weight of growth regulators applied per hectare of crop grown decreased by 3% from 2022 to 2024 and 2% from 2020 to 2024 (Figure 8).

Seed treatments

Seed treatments accounted for 9% of the total pesticide treated area and less than 1% of the total weight of active substances applied (Figures 9 and 10). When changes in crop area are taken into account, there was a 4% increase in area treated between 2022 and 2024 and a 5% decrease between 2020 and 2024 (Figure 7). The weight of seed treatments applied per hectare increased by 4% from 2022 to 2024 and decreased by 14% from 2020 to 2024 (Figure 8). The slight increase in the use of seed treatments between 2022 and 2024 is predominately from the increased use of ipconazole and imazalil on cereals (55% and 51% increase in area treated respectively). The decrease in seed treatments over the longer term may relate to the withdrawal of some seed treatments such as thiram, pencycuron and penflufen (withdrawn in January 2020, March 2020 and June 2021 respectively).

Insecticides/nematicides

Insecticides and nematicides accounted for 4% of the total pesticide treated area and less than 1% of the total weight of pesticides applied (Figures 9 and 10). When changes in crop area are taken into account, there was a 12% increase in the area treated with insecticide/nematicide formulations from 2022 to 2024 and a 4% increase from 2020 to 2024 (Figure 7). In terms of weight applied per hectare of crop grown, there was a 22% increase from 2022 to 2024 and a 39% decrease from 2020 to 2024 (Figure 8). This increase in both area and weight from 2022 to 2024 is correlated with an increase in the number of insecticide applications on seed potatoes (7.2 applications in 2024 compared with 5.4 applications in 2022). Aphid borne viruses in Scottish seed potato crops have increased in recent years. As in 2022, lambda-cyhalothrin (pyrethroid) was the the most used insecticide active substance in 2024.

Molluscicides

Molluscicides accounted for 1% of the total pesticide treated area and less than 1% of weight (Figures 9 and 10). When changes in crop area are taken into account, the area treated between 2022 and 2024 was very similar, and there was a 27% decrease between 2020 and 2024 (Figure 7). The weight of molluscicides applied per hectare of crop grown increased by 4% from 2022 to 2024 and decreased by 26% from 2020 to 2024. The decrease in area treated and weight applied of molluscicides since 2020 is influenced by the withdrawal of the active substance metaldehyde in March 2022. The only active substance available to use for slug control in the 2024 growing season was ferric phosphate.

Sulphur

Sulphur accounted for less than 0.5% of the total pesticide treated area and 2% of the total weight of active substances applied (Figures 9 and 10). When changes in crop area are taken into account, there was a 24% decrease in area treated from 2022 to 2024 and a 14% increase from 2020 to 2024 (Figure 7). The quantity of sulphur applied per hectare of crop grown decreased by 7% from 2022 to 2024 and decreased 46% from 2020 to 2024 (Figure 8). Sulphur, applied primarily to cereals, is a multisite alternative to fungicides and was used for disease control and applied as a foliar feed.

Notable changes to individual active substances

As well as changes in overall trends in application of pesticide groups since the previous survey, there has been variation in the use of individual active substances. Five active substances were recorded for the first time in the 2024 arable survey (Table 4). These included the fungicides potassium phosphonate, pydiflumetofen, isoflucypram and valifenalate and the herbicide cinmethylin. The active substances cinmethylin, isoflucypram and pydiflumetofen have all been approved in GB since the previous survey (approved in July 2022, October 2023 and April 2024 respectively) and are yet to be approved in the EU. Potassium phosphonate is formulated in a new product with ametoctradin for blight control on potatoes. Its use may increase in future following the loss of mancozeb in November 2025. The area treated with the insecticides spirotetramat and flonicamid, both used on potatoes to control aphids, increased by 5,351% and 119% respectively. Aphid borne viruses in Scottish seed potato crops are known to be increasing in recent years, including new varients of potato leaf roll virus (PLRV) [9], and may be influencing the increase of insecticide applications. The use of the herbicide/desiccant glyphosate increased by 58% by area treated and 45% in weight applied from the previous 2022 survey. As discussed previously, the wet season in 2024 and the slow ripening of crops increased the need for the use of a desiccant. In terms of area treated, fluroxypyr was the most used herbicide in 2024. As mentioned, winter 2023 and spring and summer 2024 were 25 to 50% wetter than 2022 increasing weed pressure. The use of the fungicide fluazanim increased by 88% in area treated and 55% by weight applied. Fluazinam is applied to potatoes for the control of late blight. Blight risk was increased in 2024 due to the wet conditions [8]. Folpet was the most used fungicide in terms of both area treated and weight applied. Folpet is a multisite fungicide, and is a valuable tool for managing resistance and extending the life of other fungicide groups such as SDHIs.

2024 Pesticide usage

Winter barley

- An estimated 42,874 hectares of winter barley were gown in Scotland in 2024, a 3% decrease since 2022
- 100% of the crop was treated with a pesticide
- Pesticides were applied to 453,785 treated hectares with 125,771 kilograms of pesticide applied in total
- Winter barley received on average 3.7 pesticide applications (supporting document Table 1). These applications included 2.3 herbicides/desiccants, 2.2 fungicides, 1.7 growth regulators and 1.0 insecticide (applied to 96%, 100%, 94% and 20% of the crop area respectively)
- The majority of fungicides and sulphur were applied in May and growth regulators in April. Insecticides were predominantly applied in October 2023 and molluscicides in September 2023. The majority of herbicides were applied in September 2023 and April 2024 (Figure 12)
- Reasons for fungicide application were specified for 42% of total use, 12% for disease control, 11% for rhyncosporium, 6% each for net blotch and mildew. Ten other reasons accounted for less than 8% in total
- Reasons were supplied for 50% of herbicide/desiccant use, 13% for annual broad leaf weeds, 12% for general weed control, 9% as a desiccation/harvest aid, 7% for annual meadow grass and 4% for wild oats. Thirteen other reasons accounted for 5% in total
- Reasons for insecticide use were provided for 56% of total use, 46% for aphids and 10% for barley yellow dwarf virus
- The most common varieties encountered were KWS Tardis and LG Caravella (28% and 12% respectively)
- The average reported yield was 7.4 t/ha

Table A: Summary of pesticide use on winter barley

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	186,551	45,071	100	Folpet (48,105), Prothioconazole (27,912), Fluxapyroxad (15,816)
Herbicides/ desiccants	128,018	48,126	96	Glyphosate (23,297), Diflufenican/flufenacet (15,798), Pendimethalin/ picolinafen (9,113)
Growth regulators	88,382	28,352	94	Trinexapac-ethyl (29,095), Chlormequat (24,862), 2-Chloroethylphosphonic acid (13,264)
Seed treatments	39,488	646	91	Imazalil/ipconazole (18,728), Fluopyram/ prothioconazole/ tebuconazole (7,070), Prothioconazole/ tebuconazole (5,276)
Insecticides	8,879	38	20	Esfenvalerate (4,901), Spirotetramat (3,979)
Sulphur	2,322	3,518	5	[z]
Molluscicides	143	19	< 0.5	Ferric phosphate (143)
All pesticides	**453,785**	**125,771**	**100**	**Folpet (48,105), Trinexapac-ethyl (29,095), Prothioconazole (27,912)**

Some shorthand is used in this table: [z] = not applicable. For details of all pesticide use on winter barley, please refer to the supporting document.

Figure 11: Use of pesticides on winter barley (percentage of total area with formulations) in 2024

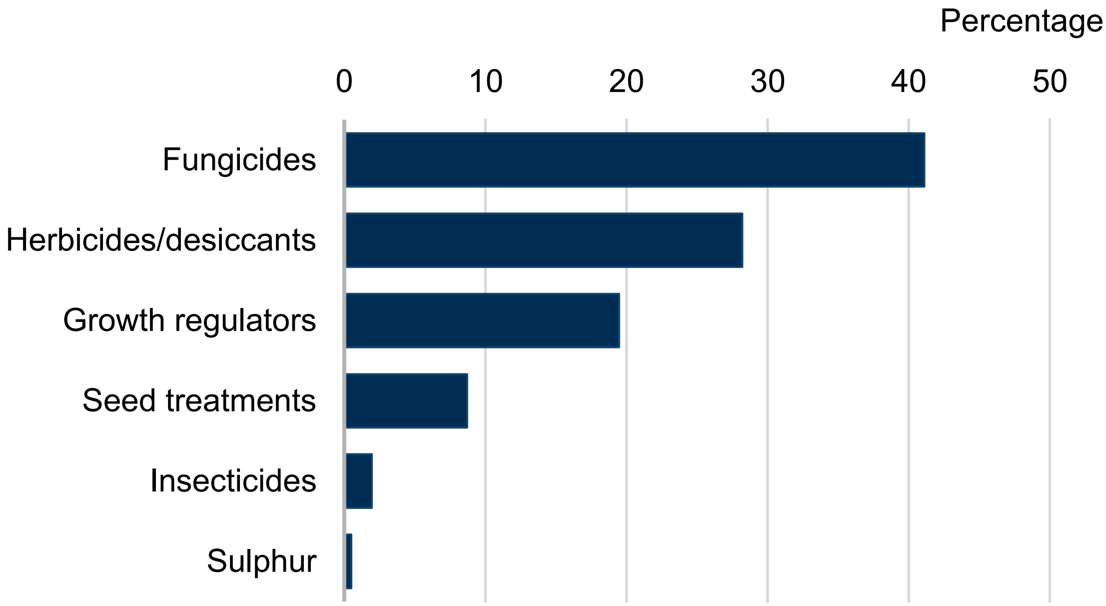
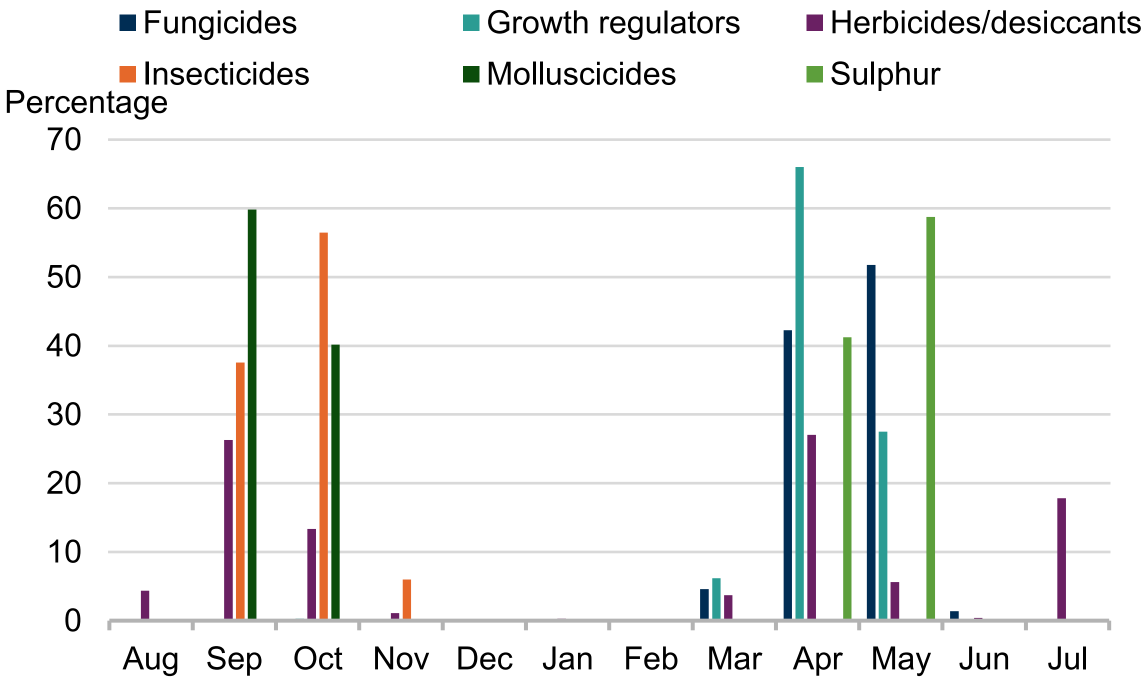


Figure 11 footnote: Molluscicides have been excluded from this figure as they represent < 0.5% of the total area treated.

Figure 12: Timing of pesticide applications (percentage of area sprayed for each pesticide group used in each month) on winter barley in 2024



Spring barley

- An estimated 257,507 hectares of spring barley were grown in Scotland in 2024, representing a increase of 9% since 2022
- 98% of the crop was treated with a pesticide
- Pesticides were applied to 1,869,607 treated hectares with 348,315 kilograms of pesticide applied in total
- The spring barley crop received on average 2.6 pesticide applications (supporting document Table 1). These applications included 1.8 fungicides, 1.8 herbicides/desiccants and 1.3 growth regulators (applied to 97%, 97% and 40% of the crop area respectively)
- The majority of fungicides, growth regulators, insecticides and sulphur were applied in June. Herbicides were predominantly applied in May (Figure 14)
- Reasons for fungicide application were supplied for 45% of total use, 27% for disease control, 5% for rhyncosporium, 3% each for mildew, ramularia and disease precaution. Six other reasons accounted for 5% in total
- Reasons were supplied for 61% of herbicide/desiccant use, 18% each for annual broad leaf weeds and for general weed control, 7% as a desiccation/harvest aid, 6% for wild oats, 4% for chickweed and 2% for annual meadow grass. Twenty-two other reasons accounted for 5% in total
- Reasons for insecticide use were provided for 61% of total use, 52% for aphids, 5% for leaf miner and 4% for cereal leaf beetle
- The most common varieties encountered were Laureate and LG Diablo (63% and 14% respectively)
- The average reported yield was 6.8 t/ha

Table B: Summary of pesticide use on spring barley

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	757,977	169,084	97	Folpet (200,482), Prothioconazole (113,830), Prothioconazole/ tebuconazole (81,290)
Herbicides/ desiccants	727,682	138,853	97	Metsulfuron-methyl/ thifensulfuron-methyl (108,787), Fluroxypyr (100,004), Glyphosate (88,650)
Seed treatments	228,689	3,755	89	Imazalil/ipconazole (143,646), Prothioconazole/ tebuconazole (54,063), Fludioxonil (23,957)
Growth regulators	136,128	25,300	40	2-Chloroethylphosphonic acid (43,368), Trinexapac-ethyl (36,394), Chlormequat (31,947)
Insecticides	13,595	59	5	Lambda-cyhalothrin (10,512), Esfenvalerate(3,083)
Sulphur	5,537	11,263	2	[z]
All pesticides	**1,869,607**	**348,315**	**98**	**Folpet (200,482), Imazalil/ ipconazole (143,646), Prothioconazole (113,830)**

Some shorthand is used in this table: [z] = not applicable. For details of all pesticide use on spring barley, please refer to the supporting document.

Figure 13: Use of pesticides on spring barley (percentage of total area treated with formulations) in 2024

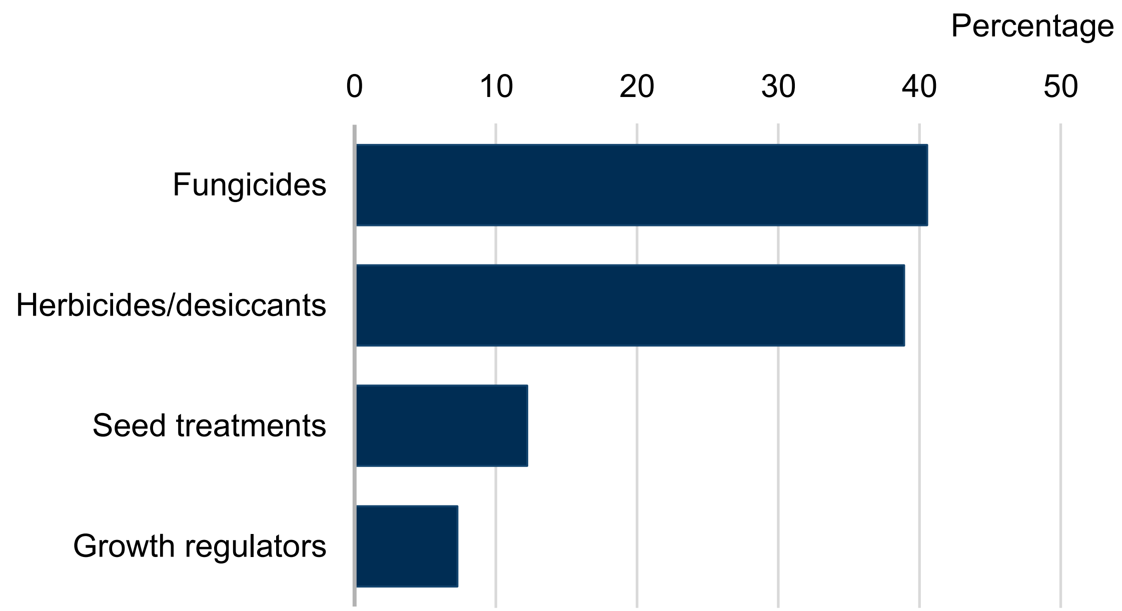


Figure 13 footnote: Insecticides and sulphur excluded as they represent < 1% of the total area treated.

Figure 14: Timing of pesticide applications (percentage of area sprayed for each pestcide group used in each month) spring barley in 2024

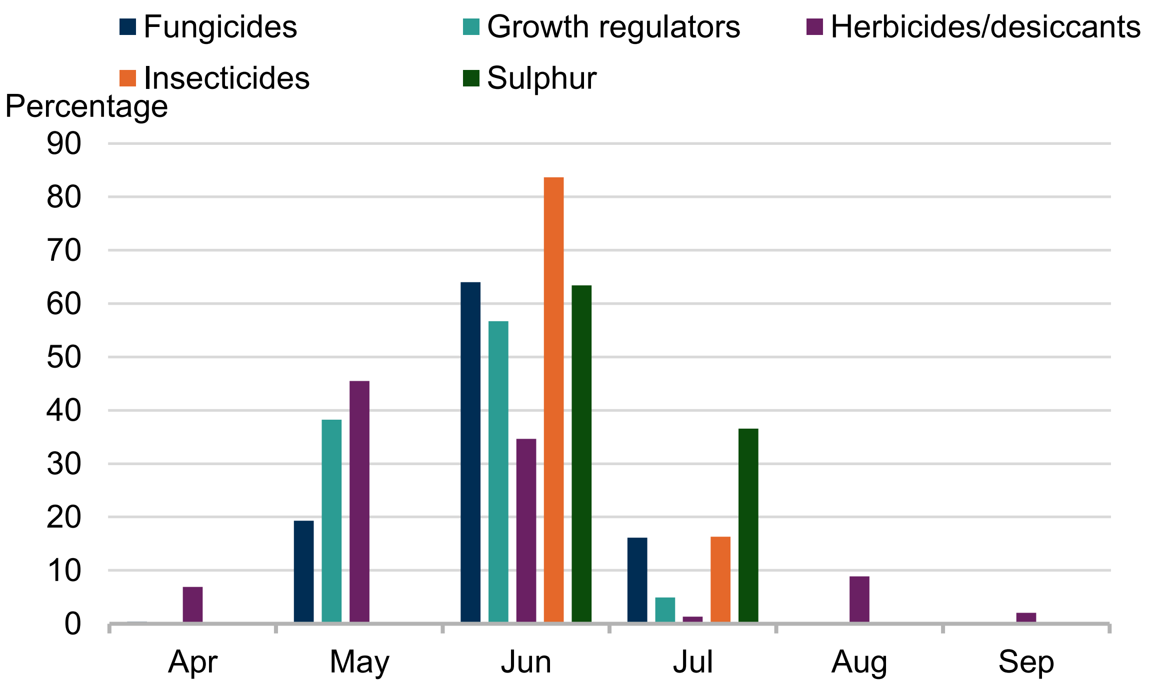


Figure 14 footnote: In August 2023 through March 2024, the use of herbicides were < 1% in each month and have been excluded from this figure.

Winter wheat

- An estimated 97,329 hectares of winter wheat were grown in Scotland in 2022, a decrease of 8% since 2022
- 99% of the crop was treated with a pesticide
- Pesticides were applied to 1,370,027 treated hectares with 354,741 kilograms of pesticide applied in total
- Winter wheat received on average 5.0 pesticide applications (supporting document Table 1). These applications included 3.3 fungicides, 2.4 herbicides/desiccants, 2.0 growth regulators, 1.2 insecticides and 1.1 molluscicides (applied to 99%, 98%, 94%, 18% and 11% of the crop area respectively)
- The majority of fungicides and growth regulators were applied in May and herbicides in April. Insecticides were predominantly applied in October and June, molluscicides in October and sulphur in June (Figure 16)
- Reasons for fungicide application were specified for 46% of total use, 14% for septoria, 8% each for rust and general disease control, 4% fusarium, 3% yellow rust and 2% each for eyespot, mildew and ear diseases. Eleven other reasons accounted for 3% in total
- Reasons were supplied for 57% of herbicide/desiccant use, 15% for annual broad leaf weeds, 10% for general weed control, 8% for annual meadow grass, 5% as a desiccation/harvest aid, 4% for brome, 3% each for cleavers and annual grass weeds and 2% for wild oats. Twenty other reasons accounted for 8% in total
- Reasons for insecticide use were provided for 69% of total use, 57% for aphids and 12% for barley yellow dwarf virus
- The most common varieties encountered were LG Skyscraper and KWS Dawsum (32% and 13% respectively)
- The average reported yield was 8.5 t/ha

Table C: Summary of pesticide use on winter wheat

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	660,386	153,189	99	Folpet (138,971), Prothioconazole (65,445), Tebuconazole (63,196)
Herbicides/ desiccants	311,397	88,880	98	Glyphosate (38,139), Diflufenican/flufenacet (30,772), Fluroxypyr (20,995)
Growth regulators	270,209	105,994	94	Chlormequat (103,021), Trinexapac-ethyl (92,653), 2-Chloroethylphosphonic acid (32,285)
Seed treatments	92,207	1,528	92	Fludioxonil (57,321), Prothioconazole/ tebuconazole (13,338), Fludioxonil/sedaxane (12,508)
Insecticides	20,911	87	18	Lambda-cyhalothrin (13,795), Esfenvalerate (7,116)
Molluscicides	12,750	1,414	11	Ferric phosphate (12,750)
Sulphur	2,167	3,648	2	[z]
All pesticides	**1,370,027**	**354,741**	**99**	**Folpet (138,971), Chlormequat (103,021), Trinexapac-ethyl (92,653)**

Some shorthand is used in this table: [z] = not applicable. For details of all pesticide use on winter wheat, please refer to the supporting document.

Figure 15: Use of pesticides on winter wheat (percentage of total area treated with formulations) in 2024

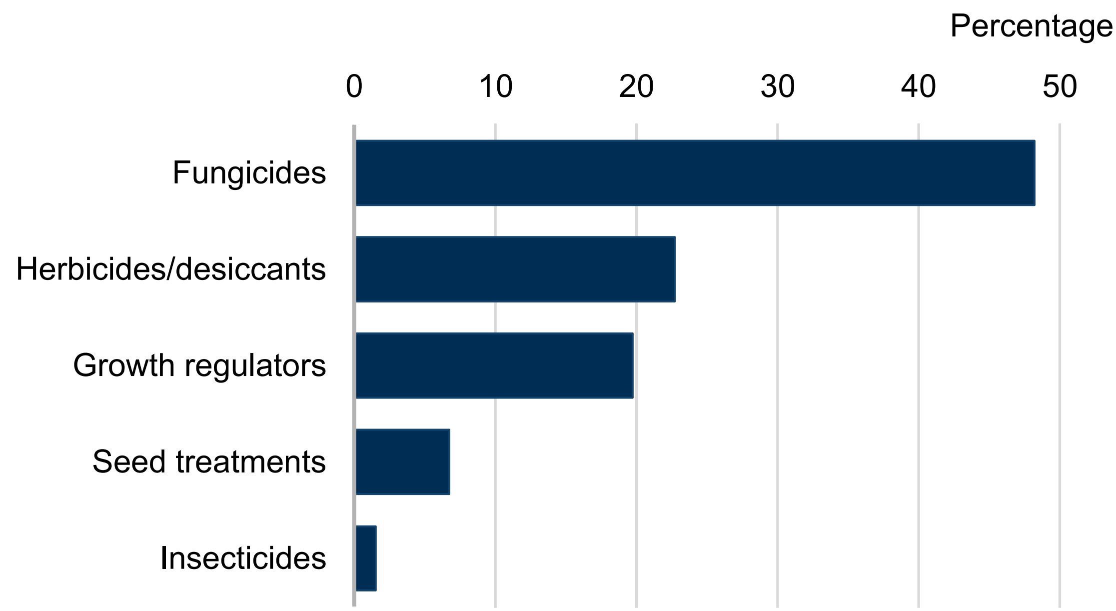
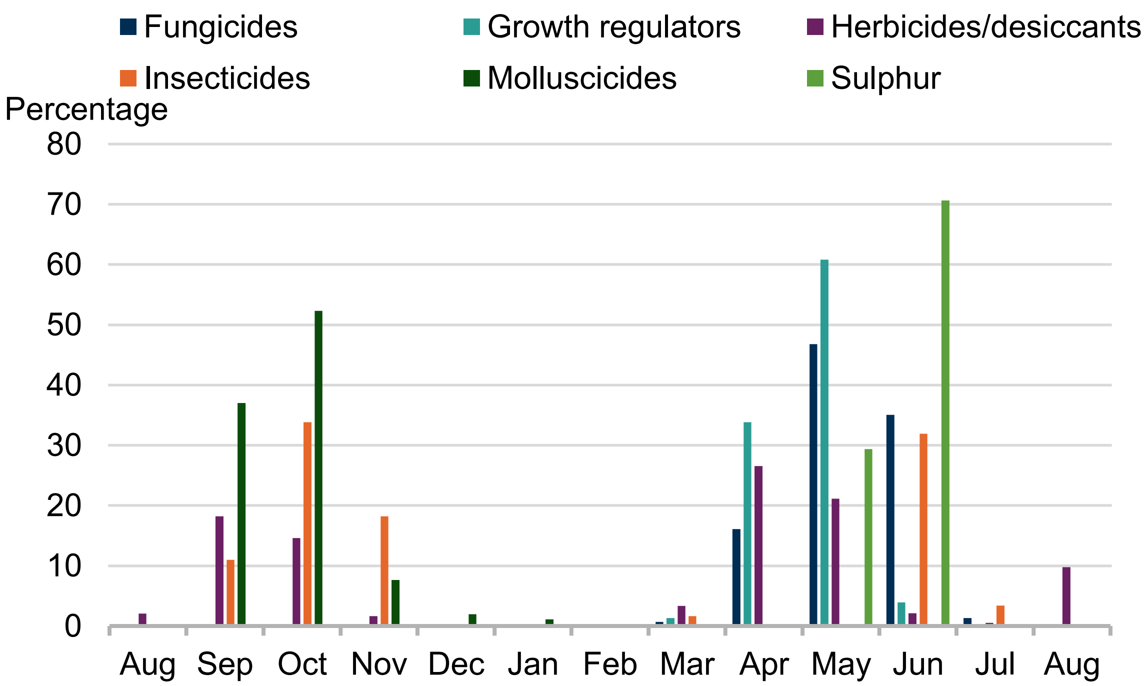


Figure 15 footnote: Mollusicides and sulphur have been excluded from this figure as they represent < 1% of the total area treated.

Figure 16: Timing of pesticide applications (percentage of area sprayed for each pesticide group used in each month) on winter wheat in 2024



Winter oats

- An estimated 8,076 hectares of winter oats were gown in Scotland in 2024, a decrease of 4% since 2022
- 100% of the crop was treated with a pesticide
- Pesticides were applied to 71,187 treated hectares with 15,259 kilograms of pesticide applied in total
- Winter oats received on average 3.6 pesticide sprays (supporting document Table 1). These applications included 2.3 fungicides, 1.7 herbicides/desiccants, 1.5 growth regulators, and 1.0 insecticides (applied to 100%, 93%, 100% and 18% of the crop area respectively)
- The majority of fungicides were applied in May and June, growth regulators in May, herbicides in April and insecticides in October. Insecticides were predominantly applied in October 2023 and June 2024 and molluscicides applied equally in September and October 2023 (Figure 18)
- Reasons for fungicide application were specified for 36% of total use, 9% for mildew, 5% for ear diseases, 4% general disease control, 3% each for septoria, fusarium, rust, sooty mould and crown rust. Four other reasons accounted for 3% in total
- Reasons were supplied for 50% of herbicide/desiccant use, 8% for general weed control, 6% for groundsel, 5% for cleavers, 4% for chickweed and mayweed and 3% for annual broad leaf weeds. Eight other reasons accounted for 11% in total
- Reasons for insecticide use were provided for 64% of total use, the only reason given was for aphid control
- The most common varieties encountered were Dalguise and Cromwell (39% and 13% respectively)
- The average reported yield was 7.1 t/ha

Table D: Summary of pesticide use on winter oats

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	26,105	3,225	100	Prothioconazole (8,368), Cyflufenamid (5,202), Tebuconazole (3,412)
Herbicides/ desiccants	18,687	4,347	93	Glyphosate (3,293), Florasulam/tribenuron-methyl (2,759), Mecoprop-p (2,379)
Growth regulators	18,095	7,598	100	Trinexapac-ethyl (7,597), Chlormequat (7,498), Mepiquat chloride/ prohexadione-calcium (2,667)
Seed treatments	6,682	63	83	Fludioxonil (4,783), Prothioconazole/ tebuconazole (1,004), Unspecified seed treatment (895)
Insecticides	1,433	7	18	Lambda-cyhalothrin (1,433)
Molluscicides	185	19	1	Ferric phosphate (185)
All pesticides	**71,187**	**15,259**	**100**	**Prothioconazole (8,368), Trinexapac-ethyl (7,597), Chlormequat (7,498)**

For details of all pesticide use on winter oats, please refer to the supporting document.

Figure 17: Use of pesticides on winter oats (percentage of total area treated with formulations) in 2024

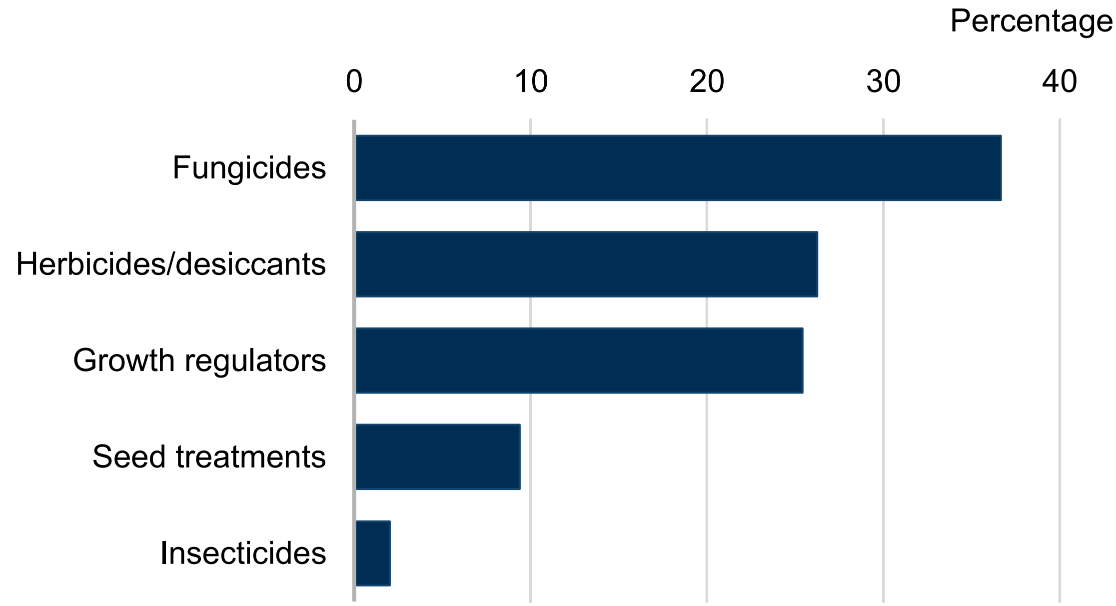


Figure 17 footnote: Molluscicides have been excluded from this figure as they represent < 0.5% of the total area treated.

Figure 18: Timing of pesticide applications (percentage of area sprayed for each pesticide group used in each month) on winter oats in 2024

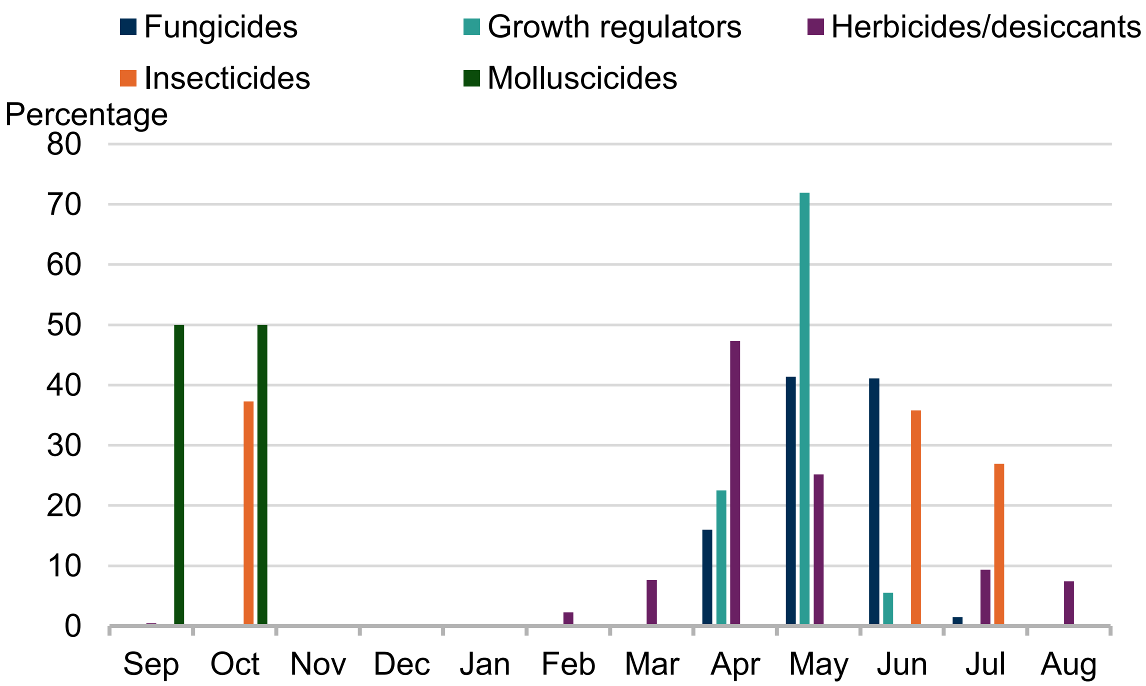


Figure 18 footnote: Herbicides applied in August 2023 have been excluded from this figure as they represent < 0.5% of the area sprayed.

Spring oats

- An estimated 19,514 hectares of spring oats were grown in Scotland in 2024, an increase of 4% since 2022
- 83% of the crop was treated with a pesticide
- Pesticides were applied to 110,596 treated hectares with 26,351 kilograms of pesticide applied in total
- Spring oats received on average 2.8 pesticide sprays (supporting document Table 1). These applications included 1.9 fungicides, 1.6 herbicides/desiccants and 1.2 for both growth regulators and insecticides (applied to 79%, 80%, 67% and 23% of the crop area respectively)
- The majority of fungicides, growth regulators and insecticides were applied in June. Herbicides were predominantly applied in May (Figure 20)
- Reasons for fungicide application were supplied for 45% of total use, 15% for mildew, 7% each for crown rust and general disease control, 6% for disease precaution, 4% for leaf spot, 3% for rust and less than 1% each for brown rust and septoria
- Reasons were supplied for 66% of herbicide/desiccant use, 17% both for annual broad leaf weeds and general weed control, 12% as a desiccation/harvest aid, 7% for chickweed, 6% for cleavers, and 2% each for fumitory and volunteer rape. Eight other reasons accounted for 4% in total
- Reasons for insecticide use were provided for 60% of total use, 51% for aphids and 9% for cereal leaf beetle
- The most common varieties were SY Canyon and Conway (54% and 21% respectively)
- The average reported yield was 6.3 t/ha

Table E: Summary of pesticide use on spring oats

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	38,649	6,697	79	Prothioconazole/ spiroxamine (7,694), Bixafen/prothioconazole/ spiroxamine (5,743), Prothioconazole (5,189)
Herbicides/ desiccants	35,694	8,463	80	Fluroxypyr (7,207), Thifensulfuron-methyl/ tribenuron-methyl (6,997), Glyphosate (5,625)
Growth regulators	19,383	11,022	67	Chlormequat (9,970), Trinexapac-ethyl (5,837), Mepiquat chloride/ prohexadione-calcium (2,930)
Seed treatments	11,670	140	60	Fludioxinil (7,332), Fludioxinil/sedaxane (2,294), Prothioconazole/ tebuconazole (2,044)
Insecticides	5,200	30	23	Lambda-cyhalothrin (5,200)
All pesticides	**110,596**	**26,351**	**83**	**Chlormequat (9,970), Prothioconazole/ spiroxamine (7,694), Fludioxinil (7,332)**

For details of all pesticide use on spring oats, please refer to the supporting document.

Figure 19: Use of pesticides on spring oats (percentage of total area treated with formulations) in 2024

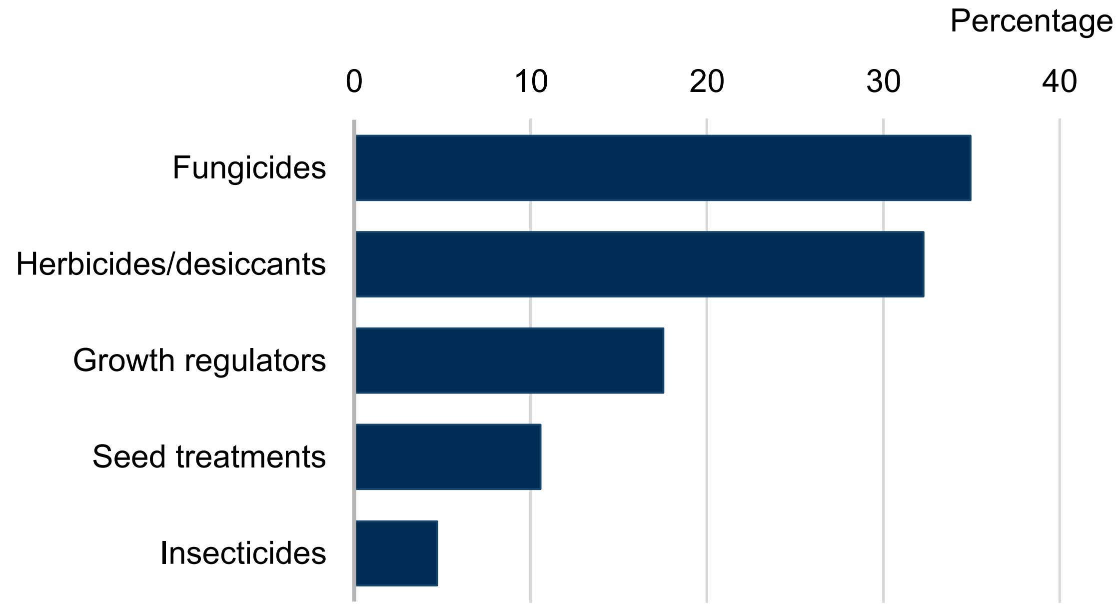


Figure 20: Timing of pesticide applications (percentage of area sprayed for each pesticide group used in each month) on spring oats in 2024

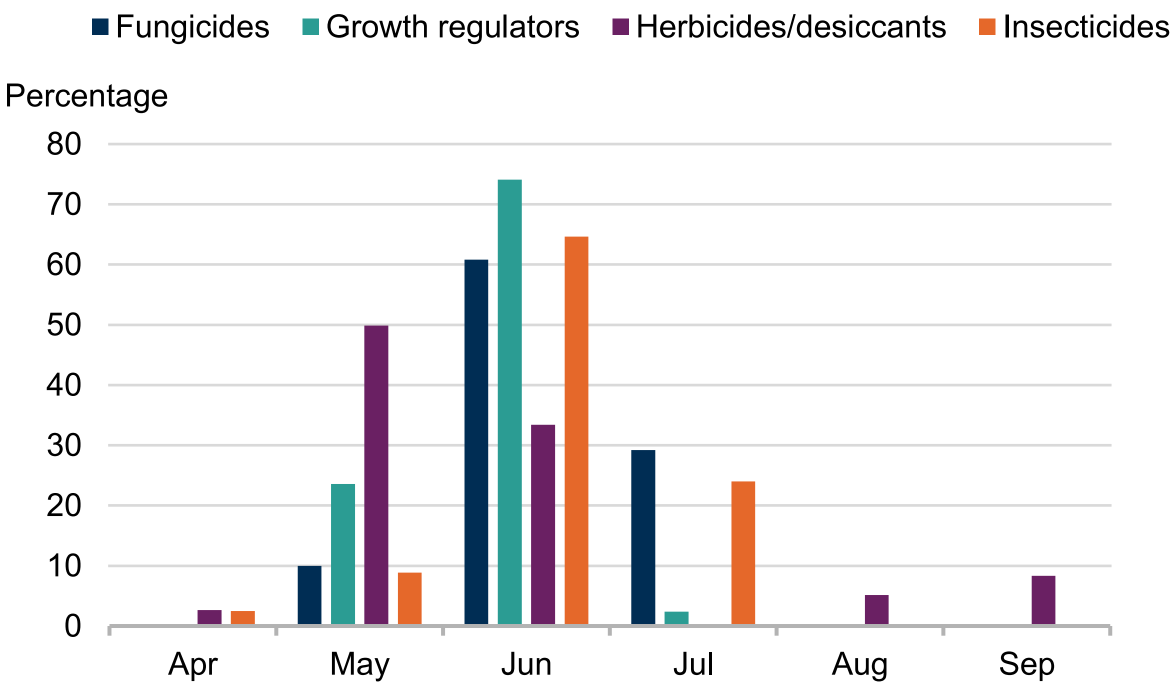


Figure 20 footnote: Herbicides applied in October 2023 and February 2024 accounted for < 1% of the spray area and have been excluded from this figure.

Winter rye

- An estimated 6,583 hectares of winter rye were grown in Scotland in 2024, a decrease of 8% since 2022
- 100% of the crop was treated with a pesticide
- Pesticides were applied to 47,367 treated hectares with 14,968 kilograms of pesticide applied in total
- Winter rye received on average 3.8 pesticide sprays (supporting document Table 1). These applications included 1.9 growth regulators, 1.7 herbicides/desiccants, 1.6 fungicides and 1.3 molluscicides (applied to 89%,100%, 89% and 15% of the crop area respectively). No insecticide use was recorded on winter rye in 2024
- The majority of fungicides, growth regulators and herbicides were applied in April and molluscicides in September 2023 (Figure 22)
- Reasons for fungicide application were supplied for 38% of total use, 7% each for brown rust, eye spot, mildew and septoria, 4% for general disease control and 3% each for rhynchosporium and rust
- Reasons were supplied for 50% of herbicide/desiccant use, 17% for annual broad leaf weeds, 11% each for annual meadow grass and as a harvest aid, 6% for general weed control and 3% each for fumitory and as a stubble clean up
- The most common varieties encountered were SU Performer and SU Arvid (36% and 23% respectively)

Table F: Summary of pesticide use on winter rye

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Herbicides/ desiccants	14,726	5,591	100	Glyphosate (2,203), Chlorotoluron/diflufenican /pendimethalin (2,037), Iodosulfuron-methyl-sodium/mesosulfuron-methyl (1,886)
Growth regulators	14,451	7,474	89	Chlormequat (7,650), Trinexapac-ethyl (4,822), Mepiquat chloride/ prohexadione-calcium (1,221)
Fungicides	12,728	1,732	89	Tebuconazole (4,169), Prothioconazole/ tebuconazole (2,588), Prothioconazole (2,070)
Seed treatments	4,138	26	63	Fludioxonil (2,923), Fludioxonil/sedaxane (665), Prothioconazole (550)
Molluscicides	1,323	144	15	Ferric phosphate (1,323)
All pesticides	**47,367**	**14,968**	**100**	**Chlormequat (7,650), Trinexapac-ethyl (4,822), Tebuconazole (4,169)**

For details of all pesticide use on winter rye, please refer to the supporting document.

Figure 21: Use of pesticides on winter rye (percentage of total area treated with formulations) in 2024

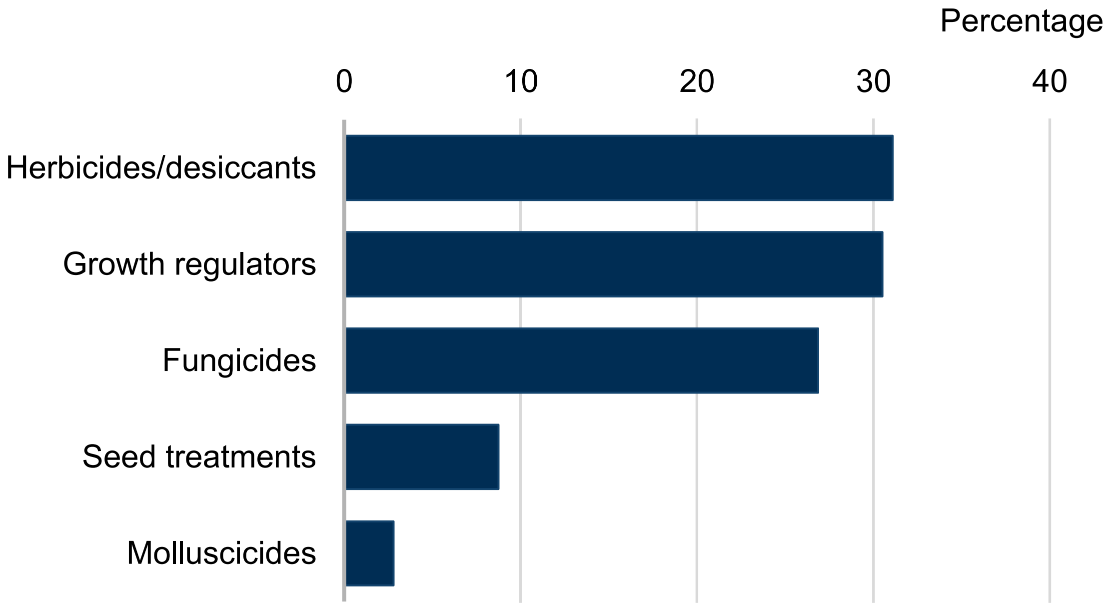
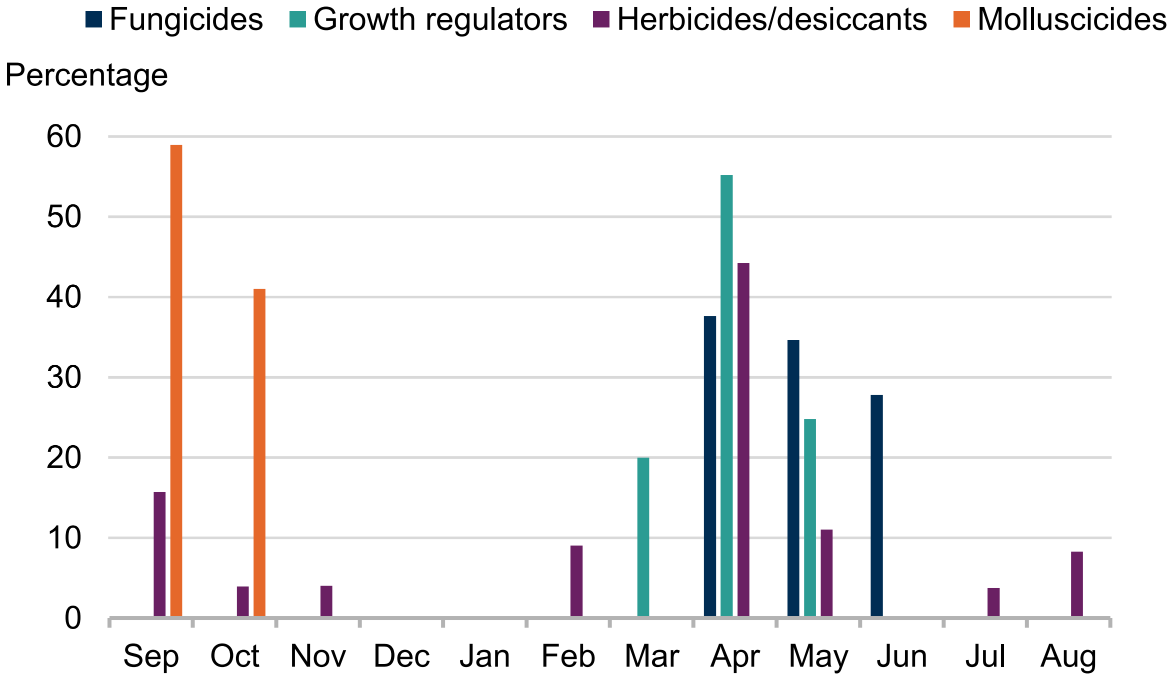


Figure 22: Timing of pesticides applications (percentage of area sprayed for each pesticide group used in each month) on winter rye in 2024



Oilseeds

- An estimated 36,669 hectares of oilseeds (winter and spring oilseed rape) were grown in Scotland in 2024 representing an increase of 4% since 2022
- 100% of the crop was treated with a pesticide
- Pesticides were applied to 333,250 treated hectares with 94,586 kilograms of pesticide used in total
- The oilseeds crop received on average 5.6 pesticide applications (supporting document Table 1). These applications included 2.8 herbicides/desiccants, 2.2 fungicides, 1.6 insecticides, 1.3 applications of a combined fungicide & growth regulator, 1.1 molluscicides and 1.0 growth regulator (applied to 100%, 94%, 79%, 17%, 49% and 22% of the crop area respectively)
- The majority of fungicides and insecticides were applied in May, combined fungicide & growth regulator in March and growth regulator in April. The majority of herbicides/desiccants were applied in August 2023 (Figure 24)
- Reasons for fungicide application were supplied for 43% of total use, 16% for sclerotinia, 13% for light leaf spot, 7% for general disease control and 2% for alternaria. Seven other reasons accounted for 5% in total
- Reasons were supplied for 55% of herbicide/desiccant use, 11% for general weed control, 10% as a desiccation/harvest aid, 6% for volunteer cereals, 5% each for annual broad leaf weeds and annual meadow grass, 4% each for brome and volunteer barley and 2% each for volunteer oats and mayweed. Thirteen other reasons accounted for 6% in total
- Reasons for insecticide use were provided for 56% of total use, 16% for cabbage stem flea beetle, 10% stem weevils, 8% flea beetle, 6% for aphids, 5% for pollen beetle, 3% each for general pests and winter stem weevil and 2% for pod midge
- The most common varieties were Crome and Aurelia (26% and 16% respectively)
- The average reported yield was 3.8 t/ha

Table G: Summary of pesticide use on oilseeds

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Herbicides/ desiccants	128,044	72,328	100	Glyphosate (29,617), Metazachlor (23,080), Clomazone (15,807)
Fungicides	95,259	15,497	94	Prothioconazole (28,334), Prothioconazole/ tebuconazole (12,404), Boscalid/dimoxystrobin (11,881)
Insecticides	46,940	831	79	Lambda-cyhalothrin (31,349), Tau-fluvalinate (14,662), Deltamethrin (595)
Seed treatments	26,800	8	73	Bacillus amyloliquefaciens strain MBI600 (26,800)
Molluscicides	20,474	2,243	49	Ferric phosphate (20,474)
Growth regulators	8,087	1,476	22	Mepiquat chloride/ metconazole (8,087)
Fungicide & Growth regulators	7,647	2,202	17	Mepiquat chloride/ prohexadione-calcium/ pyraclostrobin (7,647)
All pesticides	**333,250**	**94,586**	**100**	**Lambda-cyhalothrin (31,349), Glyphosate (29,617), Prothioconazole (28,334)**

For details of all pesticide use on oilseeds, please refer to the supporting document.

Figure 23: Use of pesticides on oilseeds (percentage of total area treated with formulations) in 2024

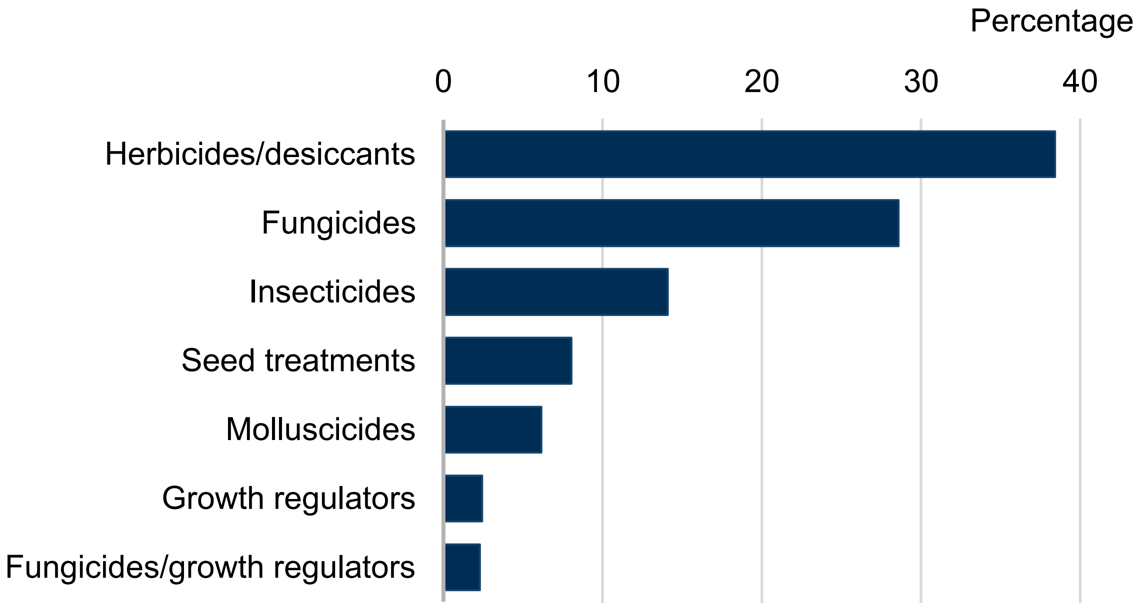


Figure 24: Timing of pesicide applications (percentage of area sprayed for each pesticide group used in each month) on oilseeds in 2024

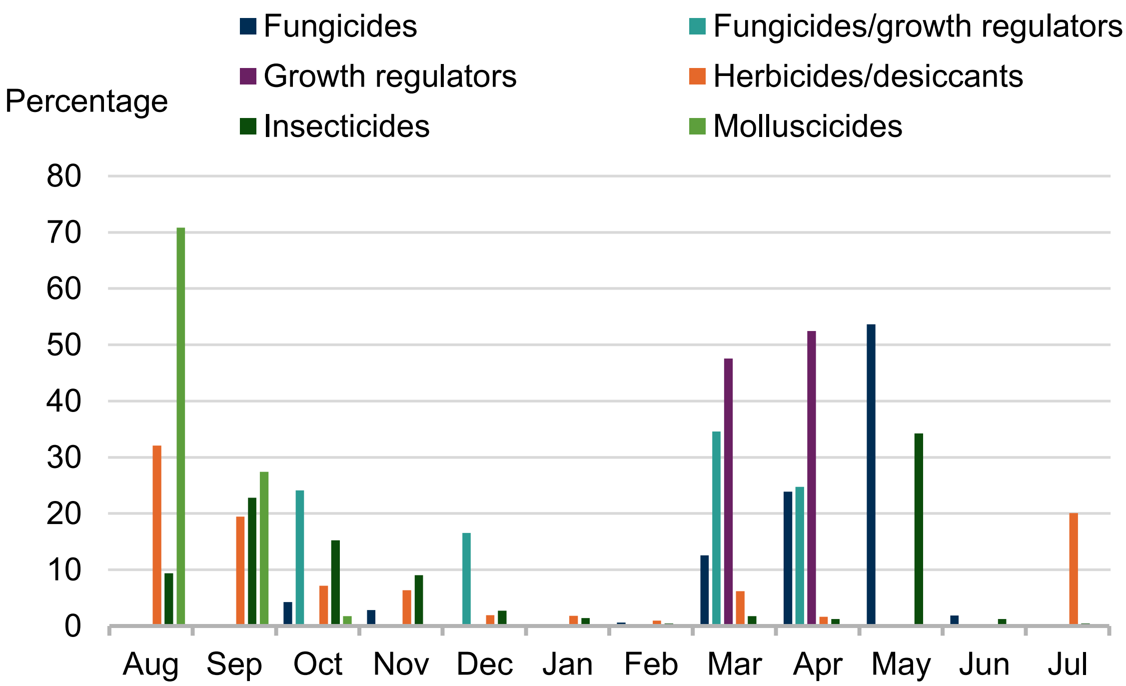


Figure 24 footnote: Herbicides/desiccants applied in August 2024 represent 2% of the total treated area and have been excluded from this figure.

Seed potatoes

- An estimated 12,788 hectares of seed potatoes were grown in Scotland in 2024, representing an increase of 8% since 2022
- 98% of the crop was treated with a pesticide
- Pesticides were applied to 335,525 treated hectares with 116,036 kilograms of pesticide used in total on the crop (see summary table below)
- The seed potato crop received on average 10.7 pesticide applications (supporting document Table 1). These applications included 8.9 fungicides, 7.2 insecticides/nematicides, 2.3 herbicides/desiccants and 1.5 molluscicides (applied to 98%, 94%, 98%, and 22% of the area respectively)
- The majority of fungicides, insecticides/nematicides and molluscicides were applied in July and herbicides/desiccants in June (Figure 26)
- Reasons for fungicide application were supplied for 38% of total use, 37% for blight and 1% for general disease control
- Reasons were supplied for 37% of herbicide/desiccant use, 18% for general weed control, 7% both as a desiccation/harvest aid and for annual meadow grass and 6% for annual broad leaf weeds
- Reasons for insecticide/nematicide use were provided for 45% of total use, 37% for aphids, 8% for general pests and less than 1% in total for control of nematodes and weevils
- The most common varieties were Cara and Maris Piper (14% and 11% respectively)
- The average reported yield was 36 t/ha

Table H: Summary of pesticide use on seed potatoes

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	175,619	89,548	98	Cymoxanil (33,427), Mancozeb (30,762), Cyazofamid (24,998)
Insecticides/ nematicides	96,392	3,120	94	Lambda-cyhalothrin (38,328), Esfenvalerate (22,406), Flonicamid (16,679)
Herbicides/ desiccants	49,620	20,997	98	Pyraflufen-ethyl (16,324), Carfentrazone-ethyl (10,869), Metribuzin (9,280)
Seed treatments	9,632	1,898	75	Fludioxonil (5,938), Flutolanil (3,555), Imazalil (140)
Molluscicides	4,262	473	22	Ferric phosphate (4,262)
All pesticides	**335,525**	**116,036**	**98**	**Lambda-cyhalothrin (38,328), Cymoxanil (33,427), Mancozeb (30,762)**

For details of all pesticide use on seed potatoes, please refer to the supporting document.

Figure 25: Use of pesticides on seed potatoes (percentage of total area treated with formulations) in 2024

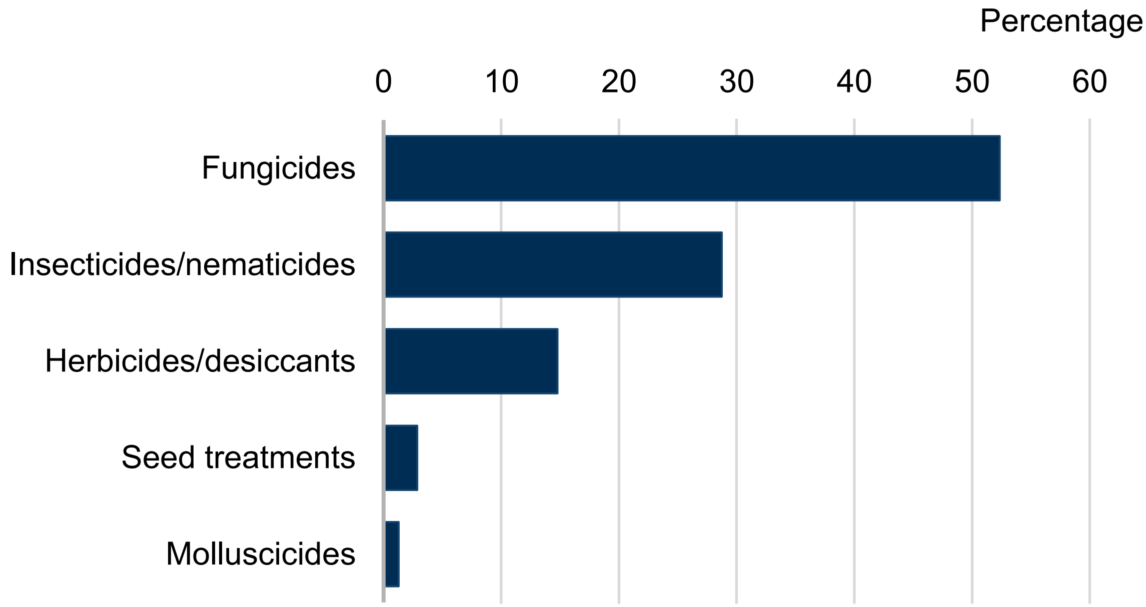


Figure 26: Timing of pesticide applications (percentage of area sprayed for each pesticide group in each month) on seed potatoes in 2024

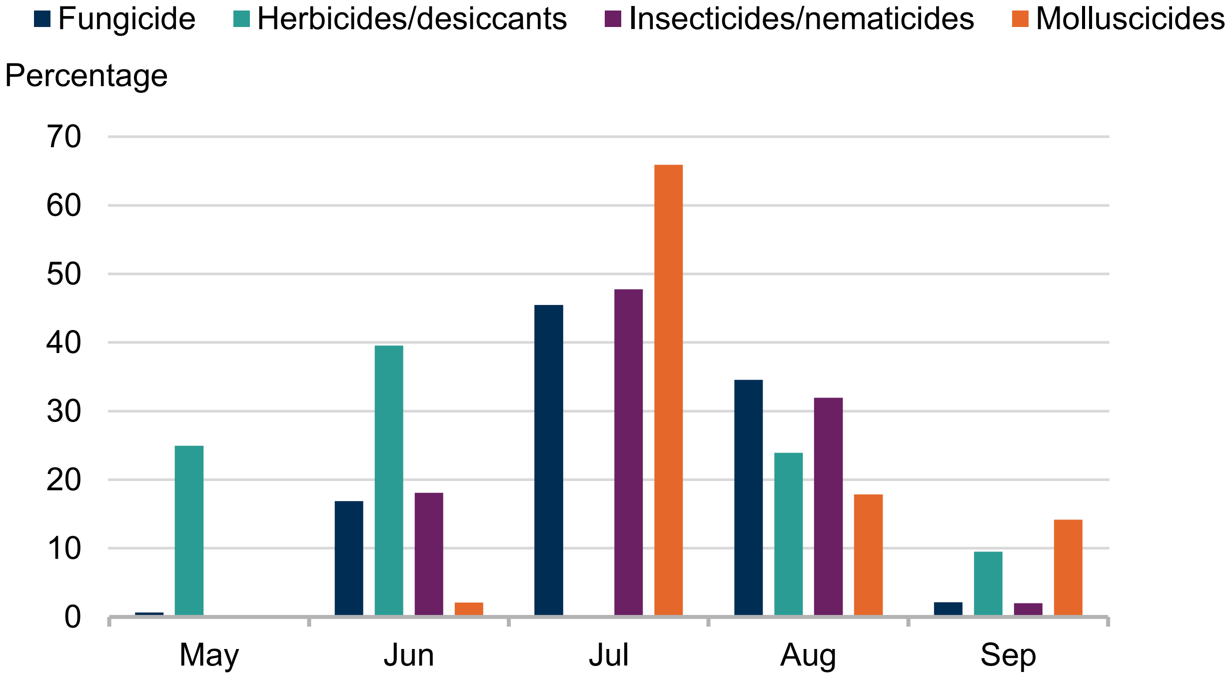


Figure 26 footnote: In October 2023 the use of herbicides were < 1%. In April the use of fungicides and herbicides were < 1%. These have been excluded from this figure.

Ware potatoes

- An estimated 16,298 hectares of ware potatoes were grown in Scotland in 2024, representing an increase of 7% since 2022
- 99% of the crop was treated with a pesticide
- Pesticides were applied to 397,580 treated hectares with 188,578 kilograms of pesticide applied in total
- The ware potato crop received on average 13.5 pesticide applications (supporting document Table 1). These applications included 10.3 fungicides, 3.0 molluscicides, 2.2 herbicides/desiccants, 1.8 insecticides/nematicides and 1.0 growth regulator (applied to 99%, 52%, 99%, 51%,12% of the crop area)
- The majority of fungicides, insecticides/nematicides and molluscicides were applied in July, growth regulators in August, and herbicides in May (Figure 28)
- Reasons for fungicide application were supplied for 29% of total use, 28% for blight and less than 1% in total for disease precaution, sclerotinia and general disease control
- Reasons were supplied for 23% of herbicide/desiccant use, 12% for general weed control, 7% as a desiccation/harvest aid and 2% for annual meadow grass. Six other reasons accounted for 1% in total
- Reasons for insecticide/nematicide use were provided for 35% of total use, 29% for aphids, 3% for general pests and 1% each for control of nematodes and wireworm
- The most common varieties grown were Maris Piper and Saxon (38% and 18% respectively)
- The average reported yield was 51.6 t/ha

Table I: Summary of pesticide use on ware potatoes

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	276,112	150,638	99	Mancozeb (50,553), Cymoxanil (48,837), Cyazofamid (35,556)
Herbicides/ desiccants	63,270	24,780	99	Pyraflufen-ethyl (17,701), Metribuzin (14,261), Carfentrazone-ethyl (14,209)
Molluscicides	25,722	2,618	52	Ferric phosphate (25,722)
Insecticides/ nematicides	16,636	2,117	51	Lambda-cyhalothrin (5,195), Acetamiprid (4,796), Esfenvalerate (3,391)
Seed treatments	13,815	2,468	82	Flutolanil (9,139), Fludioxonil (4,099), Imazalil (577)
Growth regulators	2,025	5,956	12	Maleic hydrazide (2,025)
All pesticides	**397,580**	**188,578**	**99**	**Mancozeb (50,553), Cymoxanil (48,837), Cyazofamid (35,556)**

For details of all pesticide use on ware potatoes, please refer to the supporting document.

Figure 27: Use of pesticides on ware potatoes (percentage of total area treated with formulations) in 2024

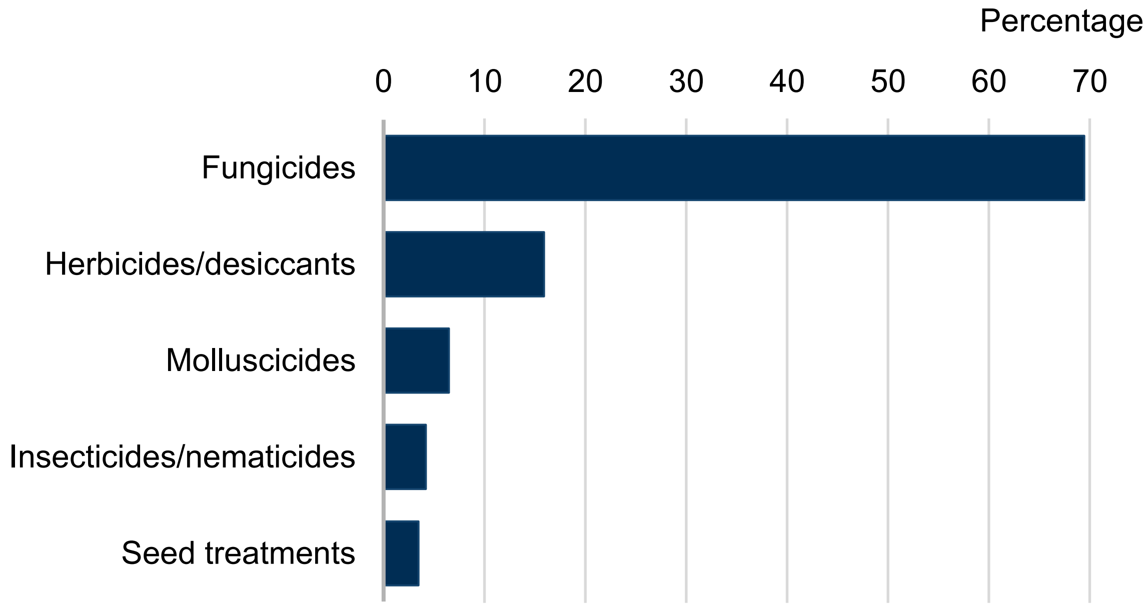


Figure 27 footnote: Growth regulators are excluded from this figure as they represent < 1% of the total area treated.

Figure 28: Timing of pesticide applications (percentage of area sprayed for each pesticide group used in each month) on ware potatoes in 2024

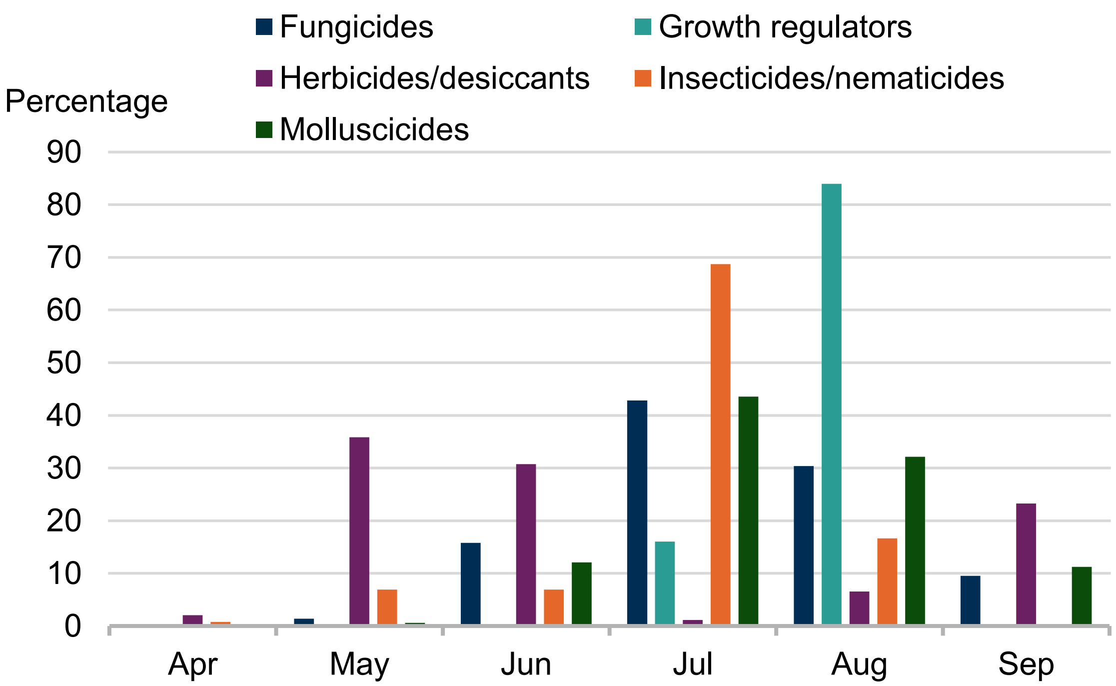


Figure 28 footnote: Fungicides and herbicides applied in March accounted for < 0.5% and have been excluded from this figure.

Legumes

- The legumes category includes dry harvest peas and field beans. These crops have been combined as too few holdings were encountered to report the pesticide use for each crop separately
- An estimated 3,461 hectares of legumes were grown in Scotland in 2024, representing an increase of 14% since 2022
- 78% of the crop was treated with a pesticide
- Pesticides were applied to 9,803 treated hectares with 6,195 kilograms of pesticide used in total
- The legume crop received on average 2.6 pesticide applications (supporting document Table 1). These applications included 1.7 fungicides,1.3 herbicides/desiccants and 1.0 sulphur (applied to 62%, 78% and 17% of the crop area respectively)
- The majority of fungicides were applied in June, herbicides in April and sulphur in May (Figure 30)
- Reasons for fungicide application were supplied for 17% of total use, 12% for chocolate spot, 3% for rust and 2% for general disease control
- Reasons were supplied for 58% of herbicide/desiccant use, 18% for annual broad leaf weeds, 11% for annual meadow grass, 9% for general weed control, 6% for both brome and wild oats, 5% as a desiccation/harvest aid and 3% for volunteer rape
- The most common varieties were Tundra and Vertigo (both field beans), accounting for 25% and 17% of the sample area respectively
- The average reported yield was 4.5 t/ha

Table J: Summary of pesticide use on legumes

Pesticide group	Formulation area treated (ha)	Weight of pesticides applied (kg)	Percentage of crop treated (%)	Top three most used formulations (ha)
Fungicides	4,671	897	62	Azoxystrobin (1,891), Boscalid/pyraclostrobin (928), Tebuconazole (920)
Herbicides/ desiccants	4,431	2,760	78	Imazamox/pendimethalin (2,065), Clomazone (680), Glyphosate (480)
Sulphur	590	2,537	17	[z]
Seed treatments	111	2	3	Fludioxonil (111)
All pesticides	**9,803**	**6,195**	**78**	**Imazamox/pendimethalin (2,065), Azoxystrobin (1,891), Boscalid/ pyraclostrobin (928)**

Some shorthand is used in this table: [z] = not applicable. For details of all pesticide use on legumes, please refer to the supporting document.

Figure 29: Use of pesticides on legumes (percentage of total area treated with formulations) in 2024

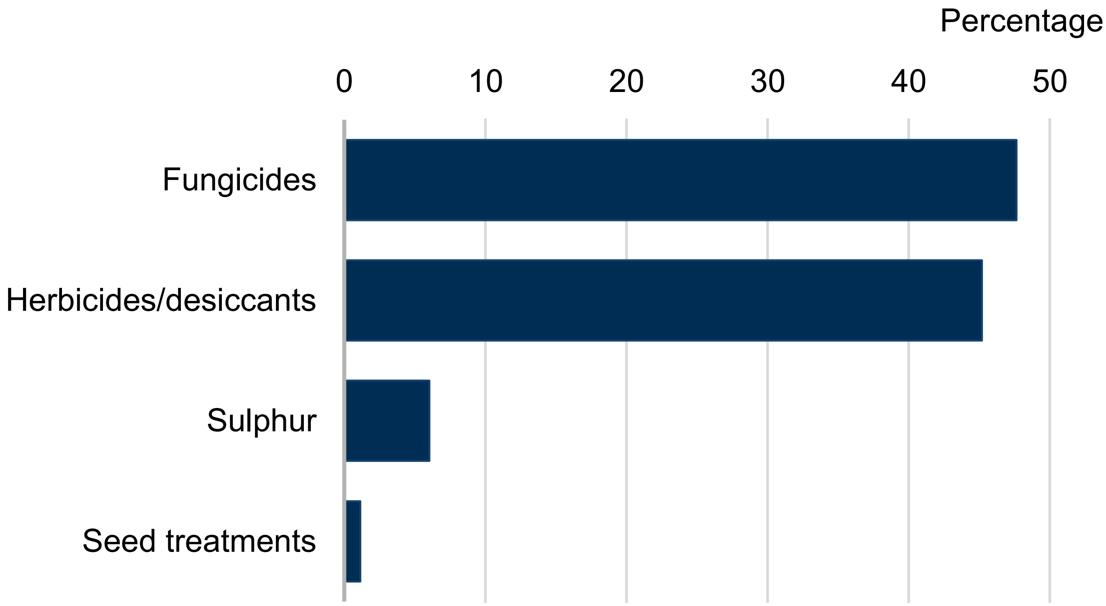
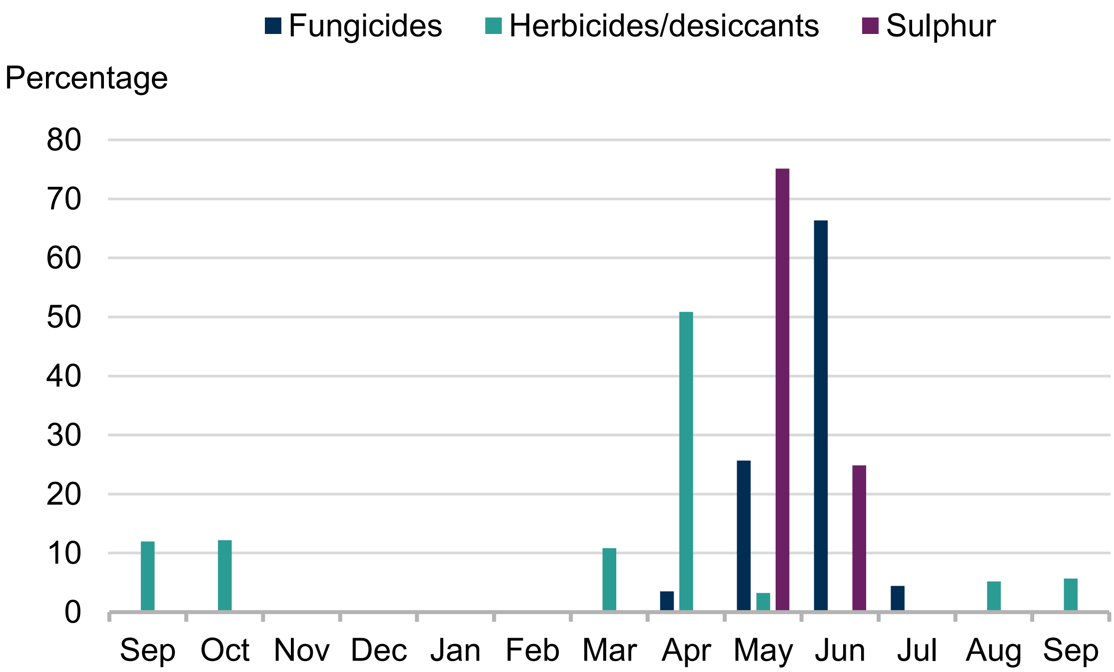


Figure 30: Timing of pesticide applications (percentage of area sprayed for each pesticide group used in each month) on legumes in 2024



Glossary and background notes

Pesticide is used throughout this report to include commercial formulations containing active substances (a.s.) used as herbicides, fungicides, insecticides, molluscicides, nematicides, biological control agents, biopesticides, growth regulators, seed treatments and physical control. A pesticide product consists of one or more active substances co-formulated with other materials.

An **active substance** (or active ingredient) is any substance or micro-organism which has a general or specific action against harmful organisms; or on plants, parts of plants or plant products.

The term **formulation**(s) is used to describe the pesticide active substance or mixture of active substances in a product(s). It does not refer to any of the solvents, pH modifiers or adjuvants also contained within a product that contribute to its efficacy.

A **fungicide** is a pesticide used to control fungal diseases in plants.

A **herbicide** is a pesticide used to control unwanted vegetation (weed killer). A **desiccant** is a pesticide used to dry out unwanted plant material.

A **growth regulator** is a pesticide used to regulate the growth of the plant, for example to prevent the crop from growing too tall.

An **insecticide** is a pesticide used to control unwanted insects. A **nematicide** is a pesticide used to control unwanted nematodes.

A **molluscicide** is a pesticide used to control unwanted slugs and snails.

A **seed treatment** is a pesticide applied to seed before planting to protect that plant against diseases and pests from the earliest stage of development. The pesticide can be a fungicide, an insecticide or a biological control agent.

In the pesticide tables (see data tables in supporting document), some pesticide treatments may be reported as ‘**unspecified**’. This description was used for occasions where the use of a particular treatment was reported by the grower, but they were unable to provide details of the product used. For these treatments, we are able to provide an area treated but no weight of pesticide used since the exact pesticide is unknown.

Some seed treatments were recorded as ‘**no information seed treatment**’. This description was used for occasions where the grower was unable to confirm whether the seed had received a treatment.

Basic area is the planted area of crop which was treated with a given pesticide or pesticide group, irrespective of the number of times it was applied to that area. Basic areas are not presented anywhere in the report, but their values are used to calculate the percentage of crop treated with a given pesticide or pesticide group.

Area treated is the basic area of a crop treated with a given pesticide multiplied by the number of treatments that area received. These terms are synonymous with “spray area” and “spray hectare” which have appeared in previous reports. For example, if a field of five hectares is sprayed with the same fungicide twice, the basic area is five hectares, and the treated area is ten hectares.

Farmers/growers can apply pesticides to crops by a number of different methods. Multiple pesticides can be applied to a crop in a single tank mix. For example, a crop could be sprayed with two different fungicides and an insecticide at the same time.

In this report, summary data for pesticide formulations including the area treated and weight applied are discussed. Full detail and data tables are available in the Excel supporting document published alongside this report. In the supporting document, data is reported in various formats. For each pesticide formulation (mixture of active substances in a product) the area treated and weight applied is reported (Table 2). Areas and weights for individual active substances are also shown (Table 3). These different formats are provided to satisfy the needs of all data users and allow them to assess pesticide use trends. Some users may be interested in use of pesticide products which contain a number of active substances, thus formulation data would be required. Other users are interested in particular active substances which may be formulated on their own or in combination with other active substances. In addition, both weight and area of pesticide applications are important indicators of changes in use over time. Different pesticides are applied at different dose rates and only by comparing both area and weight can trends in use be elucidated.

It should be noted that some herbicides may not have been applied directly to the crop itself but either as land preparation treatments prior to sowing/planting the crop, or to control weeds at the field margins or inter-row areas.

The **June Agricultural Census** [10] is conducted annually by the Scottish Government's Rural and Environmental Science Analytical Services (RESAS). The June Agricultural Census collects data on land use, crop areas, livestock and the number of people working on agricultural holdings. For this report the June Agricultural Census was used to draw a sample of farmers growing the relevant crops to participate in the survey.

Throughout this report the term '**census area**' refers to the total area for a particular crop or group of crops recorded within the June Agricultural Census. These are the areas which the sample areas are raised to. Please see data and methodology section for details. The June Agricultural Census Form is divided up into different categories which relates to a particular crop or group of crops. These are referred to as '**census categories**' throughout this report.

During the survey, the wheat crop is differentiated as either winter wheat or spring wheat. In the census, wheat is not subdivided. Any data from the census refers to the wheat crop as 'total wheat', but the survey data refers to winter and spring wheat.

There were a limited number of holdings with spring wheat sampled in 2024. Therefore, no details of pesticide use on this crop is reported separately. However pesticide use on spring wheat is included in the 'all crop totals' presented in the data tables in the supporting document and discussed in this report.

Where quoted in the text, reasons for application are the grower's stated reasons for use of that particular pesticide on that crop and may not always seem appropriate. It should be noted that growers do not always provide reasons; therefore, those presented only reflect those specified and may not reflect overall use.

Due to rounding, there may be slight differences in totals both within and between tables.

Data from the 2022 [3] and 2020 [4] surveys are provided for comparison purposes in some of the tables (see supporting document), although it should be noted that there may be minor differences in the range of crops surveyed, together with changes in areas of each of the crops grown. When comparisons are made between surveys it is important to consider changes in the area of crop grown. In order to take this into account, comparisons have been made on a per hectare grown basis, i.e. the number of hectares that have been sprayed (treated hectares) has been divided by the area of crop grown for each survey, and the weight (kilograms) applied has also been divided by the area of crop grown. This is to enable like for like comparisons between surveys, so that changes in pesticide use patterns are not masked by changes in crop area.

When oilseeds are referred to in the text, this includes, winter oilseed rape and spring oilseed rape crops (no linseed was encountered in 2024). Legume crops in 2024 include dry harvest peas and field beans. No lupins were encountered in 2024.

The crop type '**dry harvest peas'** is used for consistency with the Fera Science Ltd UK pesticide usage reports. This equates to peas for combining on the Scottish Agricultural Census form and is synonymous with 'combine peas' which appeared in previous Scottish reports.

The average number of applications indicated in the text for each crop is based on the occurrence of a pesticide group on at least 10% of the area grown. The average number of applications is calculated only on the areas receiving each pesticide group and therefore the minimum number of applications is always one. Several pesticides may be applied as a tank mix as part of the same spray event; therefore the average number of pesticide sprays reported is less than the sum of sprays of each pesticide group.

Data and methodology

Sampling and data collection

Using the June 2024 Agricultural Census [10], a sample was drawn representing arable cultivation in Scotland.

The country was divided into 11 land-use regions (Figure 31). Each sample was stratified by these land-use regions and according to holding size. The holding size groups were based on the total area of arable crops grown. The sampling fractions used within both regions and size groups were based on the areas of relevant crops grown rather than number of holdings, so that smaller holdings would not dominate the sample.

The survey covered pesticide applications to arable crops where all or the majority of the growing season was in 2024. As well as recording treatments applied directly to the crop, data was also collected on land preparation treatments prior to sowing or planting the crop.

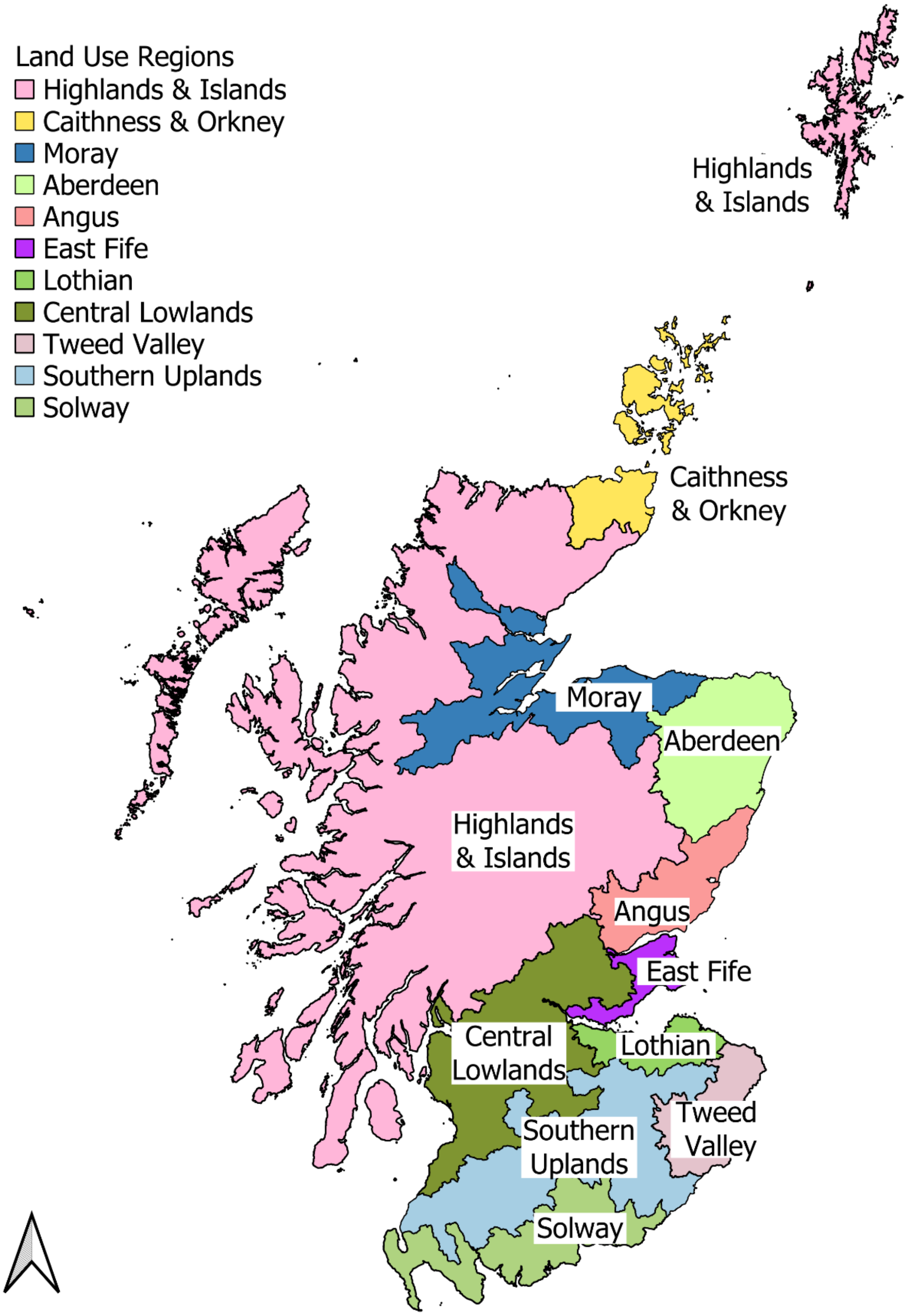
Following an introductory letter and phone call, data was collected during a phone interview or by email. Where necessary, information was also collected from agronomists and contractors. In total, information was collected from 313 holdings growing arable crops (Tables 12). These 313 holdings represent 9% of the total crop area grown.

Raising factors

National pesticide use was estimated by ratio raising. This is a standard statistical technique for producing estimates from a sample. It is the same methodology used by the other UK survey teams and has been used for all historical datasets produced by the Pesticide Survey Unit, allowing comparability over time. The sample data were multiplied by raising factors (Table 15). These factors were calculated by comparing the sampled area to the areas recorded in the Agricultural Census within each region and size group. An adjustment (Tables 16) was made for each crop within each region by applying the raising factors to the sample area of each crop grown and comparing this with the census area. This adjustment modifies the estimate to take into account differences in composition of crops encountered in the sample and those present in the population. A second adjustment was necessary for some crops which were present in the population but were not encountered in the sample in some strata.

Detailed data tables and data used to create the charts in this report are available in Excel format in the supporting document published separately.

Figure 31: Land use regions of Scotland [11]



Changes from previous years

There are changes which should be noted when comparing the 2024 data with the previous survey.

The 2024 report follows a different structure to earlier survey reports. Previously full data tables were included in survey reports. This report only includes short summary data tables for each of the crops but references full data tables published in Excel format in a supporting document. This is a similar format used in other Scottish Government accredited publications. Figures have also been improved to meet accessibility criteria.

For this report and other reports prior to 2022, the June Agricultural Census was used to draw a sample of farmers growing relevant crops to participate in the survey. National pesticide use was then estimated by ratio raising, by comparing the sample area to the areas recorded in the June Agricultural Census data. However, there was no June Agricultural Census in 2022. Instead the May 2022 Single Application Form data was used to draw the sample and estimate national pesticide use (see the 2022 report for full details). This should be taken into account when comparing 2024 data with the previous survey in 2022.

Integrated Pest Management (IPM) data was not collected during the 2024 survey. It is anticipated that IPM data will be collected during the 2026 survey and subsequently published.

Data quality assurance

The dataset underwent several validation processes as follows; (i) checking for any obvious errors upon data receipt (ii) checking and identifying inconsistencies with use and pesticide approval conditions once entered into the database (iii) checking of data held in the database against the raw data. Where inconsistencies are found these are checked against the records and with the grower if necessary. Additional quality assurance is provided by sending reports for review to members of the Working Party on Pesticide Usage Surveys and other agricultural experts. In addition, the Scottish Pesticide Survey Unit is accredited to ISO 9001:2015. All survey related processes are documented in Standard Operating Procedures (SOPs) and our output is audited against these SOPs by internal auditors annually and by external auditors every three years.

Main sources of bias

The use of a random stratified sample is an appropriate survey methodology. A stratified random sample, grouped by farm size and region, is used to select holdings used in this survey. Sampling within size groups is based on area rather than numbers of holdings, so that smaller size groups are not over-represented in the sample. The pesticide survey may be subject to measurement bias as it is reliant on farmers/growers recording data accurately. As this survey is not compulsory it may also subject to non-response bias, as growers on certain farm/holding types may be more likely to respond to the survey than others. Reserve lists of holdings are held for each stratum to allow non-responding holdings to be replaced with similar holdings.

Experience indicates that stratified random sampling, including reserves, coupled with personal interview technique, delivers the highest quality data and minimises non-response bias.

Standard errors

The figures presented in this report are produced from surveying a sample of holdings rather than a census of all the holdings in Scotland. Therefore, the figures are estimates of the total pesticide use for Scotland and should not be interpreted as exact. To give an idea of the precision of estimates, relative standard errors (RSE) for total pesticide use on arable crops for both area and weight have been calculated. Standard errors are produced using the raising factors. An overall variance is calculated by summing the variance estimates for individual strata (region and size group) multiplied by the square of their raising factors. These variance estimates include a finite population correction. The overall standard error is calculated from the overall variance by taking its square root. This method of standard estimation was implemented as it is both relatively straightforward and has advantages over ratio estimator methods when within-strata sample sizes are small.

Standard errors are expressed as percentage relative standard errors for both total pesticide use by area treated and for weight applied. Larger relative standard errors mean that the estimates are less precise. A relative standard error of 0% would be achieved by a census. A relative standard error of 100% indicates that the error in the survey is of the same order as the measurement. Relative standard errors may be reduced with larger sample sizes. However, larger relative standard errors can also result from greater variability in pesticide use among holdings.

The RSE for estimates of total pesticide use on arable crops in 2024 was 3% for area and 4% for weight, the same as in 2022. For constituent crop groups, the RSE varied from 3% to 43% for area and 5% to 57% for weight, varying with sample size and uniformity of pesticide regime encountered (Table 18). High standard errors mean that there is more uncertainty associated with estimates of pesticide use.

Response rates

See supporting document (Table 17) which summarises the number of holdings contacted during the survey.

Financial burden to farmers

In order to minimise the burden on farmers, the survey team used non-visit methods of collection such as email, post or telephone call.

To determine the total burden that the 2024 arable crop survey placed on those providing the information, the surveyors recorded the time that 313 respondents spent providing the data during the surveys. This sample represents 100% of growers surveyed. The median time taken to provide the information was 18 minutes.

The following formula was used to estimate the total cost of participating:

Burden (£) = No. surveyed x median time taken (hours) x typical hourly rate*
(* using median "Full Time Gross" hourly pay for Scotland of £19.26) [12]

The total financial burden to all growers resulting from participation in the 2024 arable crop survey was calculated to be £1,809.

References

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10. Results from the Scottish Agricultural Census: June 2024 - gov.scot [Accessed 3 October 2025]
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12. Earnings and hours worked, region by occupation by two-digit SOC: ASHE Table 3 - Office for National Statistics [Accessed 20 August 2025]

Accredited Official Statistics

Pesticide Usage in Scotland: Potato Stores 2024

October 2025

Scottish Government
Riaghaltas na h-Alba

Key Points

- Overall, the proportion of stored seed and ware potatoes treated with a pesticide was similar to that reported in the previous survey in 2022. Despite a difficult growing season in 2024, tuber quality in store was good.
- The estimated quantity of potatoes stored in Scotland in 2024 was approximately 948,100 tonnes. This is similar to 2022 and 4% less than 2020.
- The estimated quantity of ware potatoes stored was approximately 634,900 tonnes representing a 3% increase from 2022 and a 6% increase from 2020. The quantity of seed potatoes stored in 2024 was estimated to be approximately 313,200 tonnes, a reduction of 6% from 2022 and 20% since 2020.
- Over half (58%) of seed and 88% of ware potatoes sampled in 2024 were kept in refrigerated stores. The remainder were kept in ambient ventilated stores. All the potatoes surveyed in Scotland were stored in boxes.
- The proportion of seed potatoes treated with a pesticide in 2024 was 26%. This is similar to the 25% treated in 2022 but lower than the proportion treated in 2020 (39%).
- The proportion of stored ware potatoes treated with a pesticide in 2024 was 9%, similar to the 8% treated in 2022 and the 6% treated in 2020.
- The pesticides encountered on seed potatoes were the fungicides imazalil and thiabendazole applied at to an estimated 26% and 3% respectively. Imazalil was also the principal pesticide encountered on seed potatoes in 2022.
- The principal pesticide used on ware potatoes in 2024 continued to be the growth regulator ethylene applied to an estimated 6% of the stored ware crop, compared with 4% in both 2022 and 2020.
- Other active substances applied to stored ware crops in 2024 included the sprout suppressants, 1,4-dimethylnaphthalene and spearmint oil (applied to approximately 2% and 1% of the stored ware potato crop respectively). As in 2022, less than 0.5% of the stored ware crop was treated with a fungicide.

Introduction

This report presents information from a survey of pesticide use on stored potatoes harvested in Scotland in 2024. Pesticide use in potato stores was recorded for crops grown for seed production and for consumption (ware potatoes).

It is important to note that the figures presented in this report are produced from surveying a sample of holdings rather than a census of all the holdings in Scotland. Data was collected from a total of 69 holdings, representing 29% of the total potato area grown in Scotland. Ratio raising was used to produce estimates of national pesticide usage from sampled data. Therefore, the figures are estimates of the total pesticide use for Scotland and should not be interpreted as exact.

Data tables are not included in this report. All data tables are available to download in Excel format in a seperate supporting document.

General trends

Scottish potato storage

In 2024, the estimated quantity of potatoes stored in Scotland was 948,136 tonnes. This is very similar to the 951,194 tonnes reported in 2022 [1] and 4% less than that reported in 2020 [2] (987,615 tonnes) (Figure 1).

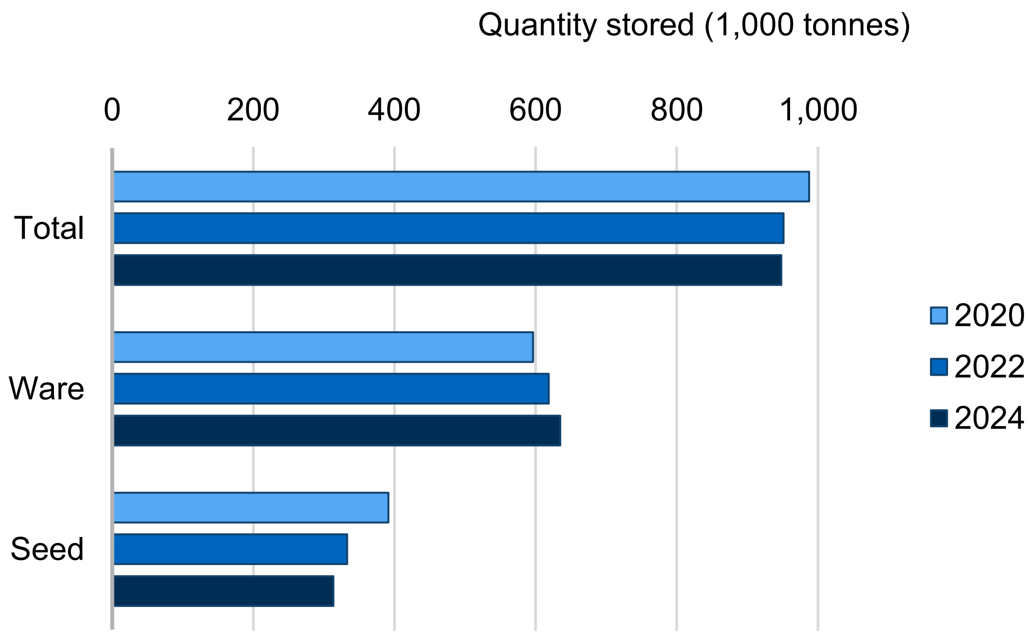
The quantity of seed potatoes stored in 2024 was estimated to be 313,206 tonnes, a reduction of 6% on the 2022 total of 332,745 tonnes. There has been a further reduction of 20% since 2020 when 391,208 tonnes of seed were recorded as stored.

In 2024, the estimated quantity of ware potatoes stored was 634,930 tonnes representing a 3% increase from 2022 and a 6% increase from 2020.

All potatoes surveyed were stored in boxes. Over half of seed crops were stored in refrigerated facilities (58%) with the remainder housed in ambient ventilated stores (42%). The majority of seed crops were also stored in refrigerated stores in 2022 (78%) and 2020 (60%).

Most ware potatoes in 2024 were refrigerated (88%), with the balance stored in ambient stores (12%). No unventilated stores were encountered in the survey. The proportion of ware potatoes refrigerated is comparable to 2022 (82%) and 2020 (86%).

Figure 1: Estimated total potato storage in Scotland from 2020 to 2024

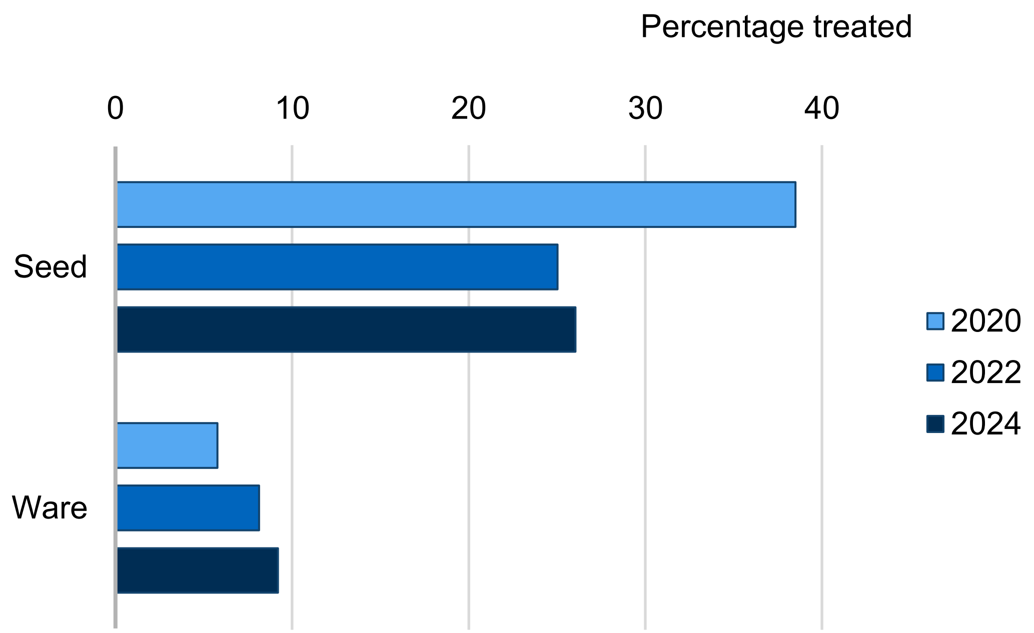


Pesticide usage

Seed potatoes

In 2024 the estimated proportion of seed potatoes treated with a pesticide was 26%. This is similar to the 25% treated in 2022 but lower that in 2020 (39%) (Figure 2). Despite a challenging year for potato growers with wet weather delaying planting, increasing blight risk and producing variable yields, quality in store was good [3]. Therefore, pesticide use in stores remained similar to the previous survey in 2022.

Figure 2: Percentage of stored potatoes treated with pesticides in Scotland from 2020 to 2024

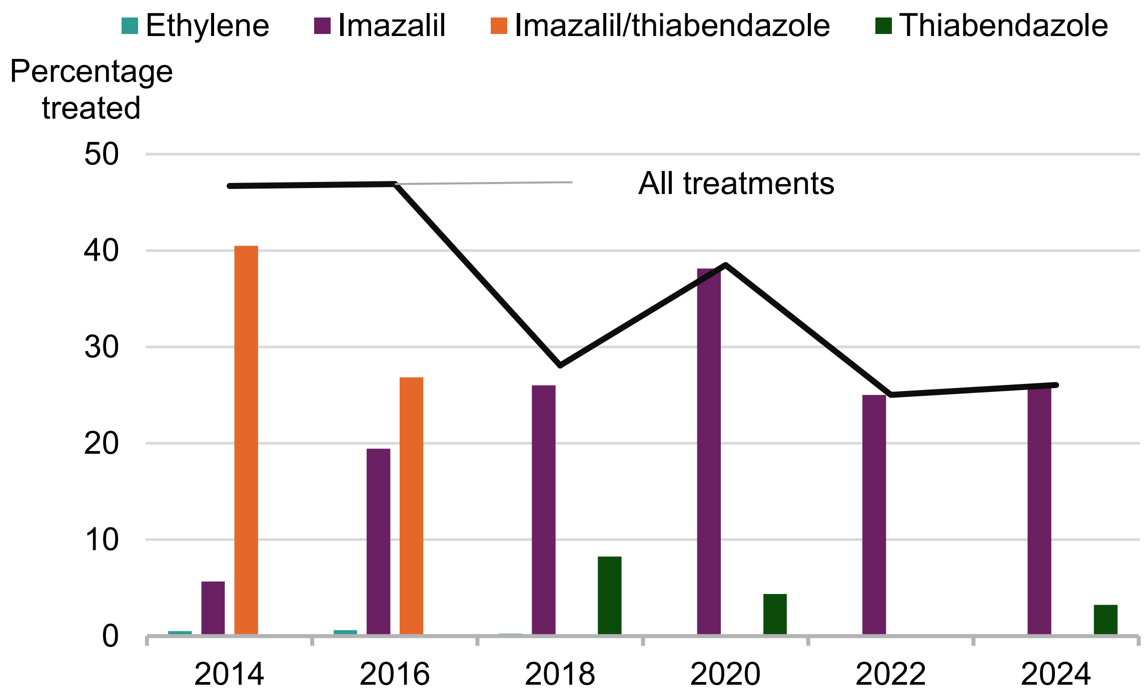


In 2024 two active substances were encountered in seed potato stores. These were both fungicides with imazalil applied to 26% of the seed crop and thiabendazole applied to 3% (Figure 3, supporting document Table 2). The most used fungicide in 2022 and 2020 was also imazalil which was applied to 25% and 38% respectively. Thiabendazole use has declined in recent years. This may be linked to some storage diseases exhibiting resistance to this active substance [4]. There was no use recorded in 2022, 4% in 2020 and 8% in 2018.

Prior to 2018 the most used fungicide was a formulation of imazalil/thiabendazole applied to 27% of stored seed in 2016 and 40% in 2014. This formulation was withdrawn in 2015 and had a final use date of June 2017. Since then imazalil and thiabendazole have been applied as single active substance products in seed stores.

No ethylene has been recorded on stored seed potatoes in any survey since 2018.

Figure 3: Percentage of stored seed potatoes treated with a pesticide in Scotland from 2014 to 2024



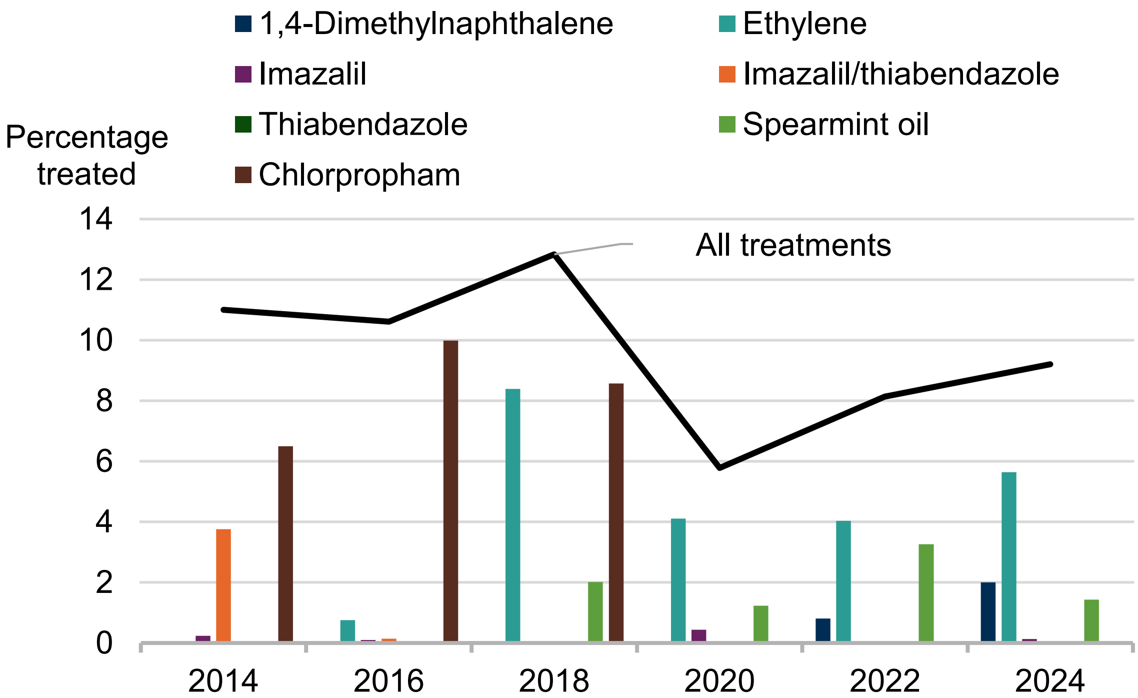
Ware potatoes

In 2024 the proportion of stored ware potatoes treated with a pesticide was 9%, similar to the 8% in 2022 and 6% in 2020 (Figure 2). The proportion of ware potatoes treated with a pesticide has slowly increased since 2020, though still below the proportion treated prior to the loss of the growth regulator active substance chlorpropham (final use October 2020) (Figure 4).

Fungicide was applied to less than 0.5% of the stored ware crop in 2024. Less than 5% of stored ware potatoes have received a fungicide treatment over the last decade. Imazalil, one of only two fungicides encountered in ware potato stores in 2024, is not authorised as a plant protection product for stored ware potatoes. As noted in the 2022 potato stores report it was applied to seed crops which were later reclassified as ware.

The majority of pesticide used on stored ware potatoes were growth regulators (>99% Figure 4). Ethylene applications on stored ware potatoes increased slightly from 4% in 2022 to 6% in 2024. Spearmint oil decreased from 3% in 2022 to 1% in 2024. First approved for use in 2022, 1,4-dimethylnaphthalene increased from 1% in 2022, to 2% in 2024. This active is a naturally occurring compound found in potatoes that inhibits sprouting. Since the loss of chlorpropham in 2020, there has not been a significant increase in the use of other growth regulators in store. However, as noted in the previous report, use of maleic hydrazide has increased since the withdrawal of chlorpropham. The product is applied to the growing crop to prevent sprouting in storage. Maleic hydrazide was applied at 2% in 2018, 8% in 2020 and 12% in both 2022 [1] and 2024. Growing conditions can also influence applications of growth regulators.

Figure 4: Percentage of stored ware potatoes treated with a pesticide in Scotland from 2014 to 2024



2024 Potato storage and pesticide usage

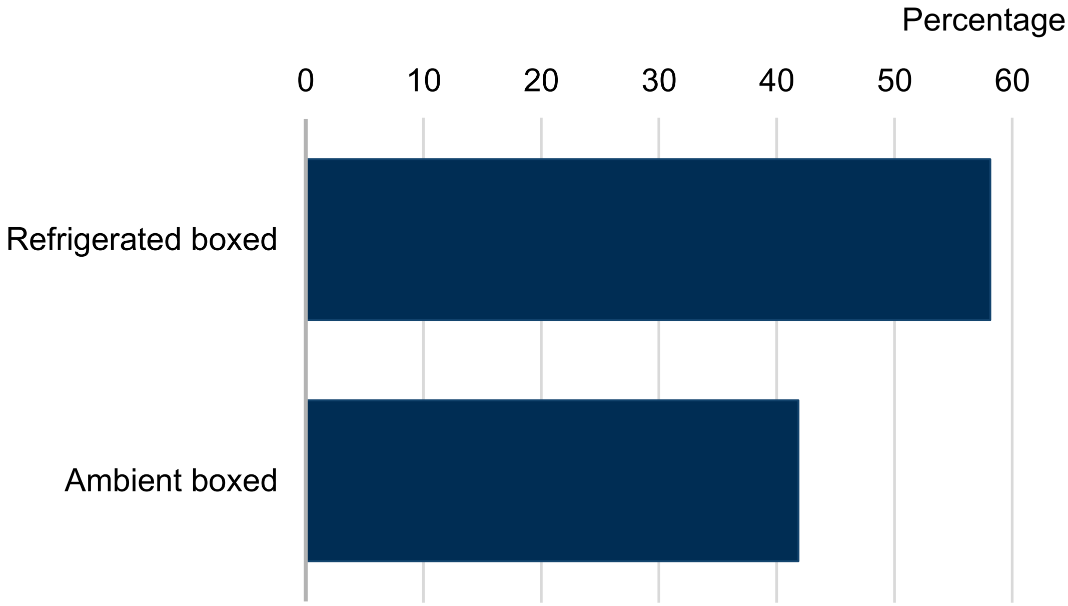
Seed potatoes

- An estimated 313,206 tonnes of seed potatoes were stored in Scotland in 2024, compared with an estimated 332,745 tonnes stored in 2022
- 58% of seed potatoes were stored in refrigerated stores and 42% in ambient ventilated stores (Figure 5)
- All seed potatoes sampled in 2022 were stored in boxes
- 26% of stored seed potatoes received a pesticide treatment
- 28% of seed potatoes in refrigerated stores received an in-store pesticide treatment and 23% of those in ambient ventilated stores (Table 1)
- The fungicides imazalil and thiabendazole were the only active substances encountered in stored seed potatoes (summary below)
- Imazalil and thiabendazole are applied as sprays to tubers
- There were no reasons provided for pesticide use on stored seed potatoes in the 2024 survey

Table A: Summary of estimated pesticide use on seed potatoes in store

Pesticide formulation	Total tonnes treated	Percentage treated	Weight of pesticide applied (kg)
Imazalil	81,566	26	1,140
Thiabendazole	10,149	3	304
All pesticides	81,566	26	1,444

Figure 5: Seed potato by storage type in 2024



Ware potatoes

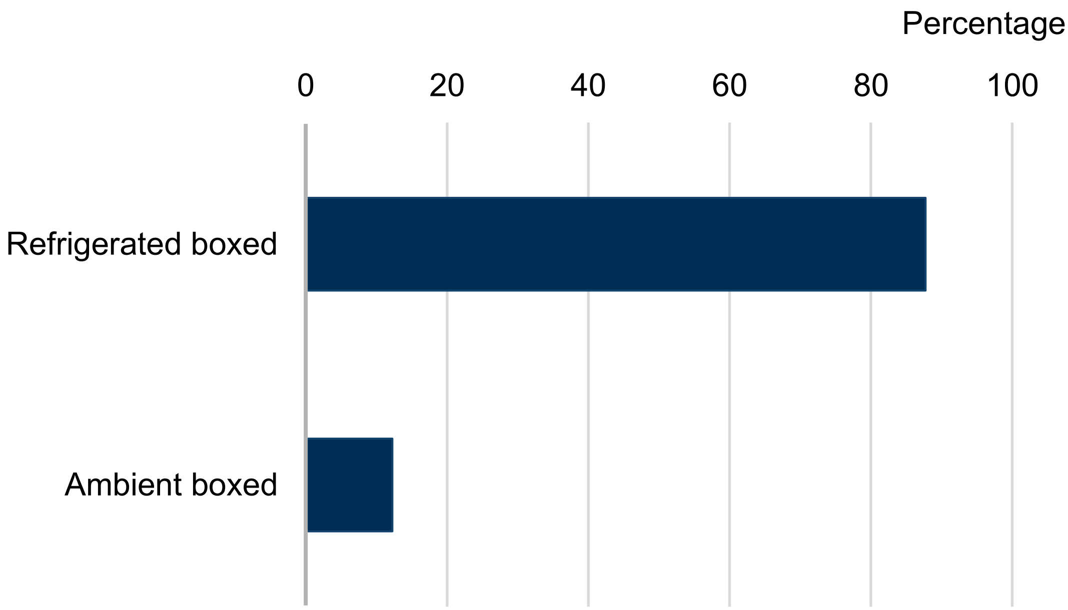
- An estimated 634,930 tonnes of ware potatoes were stored in Scotland in 2024, compared to the estimated 618,449 tonnes stored in 2022
- 88% of ware potatoes were stored in refrigerated stores and 12% in ambient ventilated stores
- All ware potatoes samples were stored in boxes
- 9% of ware potatoes received a pesticide treatment in store
- The percentage of ware potatoes receiving an in-store pesticide treatments was 10% in refrigerated stores and 0.3% in ambient ventilated stores
- Two fungicides (imazalil and thiabendazole) and three growth regulators (ethylene, spearmint oil and 1,4-dimethylnaphthalene) were encountered in ware potato stores (summary below)
- Imazalil and thiabendazole are applied as a spray to tubers. Ethylene is applied as a gas, spearmint oil and 1,4-dimethylnaphthalene are applied as a fog to stores
- No reasons were given for the use of fungicidal treatments
- Sprout suppression was the only reason supplied for use of growth regulators

Table B: Summary of estimated pesticide use on ware potatoes in store

Pesticide formulation	Total tonnes treated	Percentage treated	Weight of pesticide applied (kg)
1,4-Dimethylnaphthale	25,467	2	509
Ethylene	35,837	6	[z]
Imazalil	811	0.1	10
Spearmint oil	9,069	1	816
Thiabendazole	95	0.01	3
All pesticides	58,451	9	1,339

Some shorthand is used in this table: [z] = not applicable.
Imazalil is not approved as a plant protection product for stored ware potatoes.
Refer to Pesticide usage – Ware potatoes section for details.

Figure 6: Ware potato by storage type in 2024



Glossary and background notes

Pesticide information recorded in this survey relates to **any pesticide usage during potato storage** and to **post-harvest applications**, carried out in the field at lifting, prior to entry to the store. Pre-planting treatments with a fungicide intended to control disease post-planting e.g. black scurf, are not included, even if the fungicide had been applied in store. Use of pesticides in this situation is recorded in the seed treatment section of the preceding arable crop report.

'**Pesticide**' is used throughout this report to include commercial formulations containing active substances (a.s.) used as herbicides, fungicides, insecticides, molluscicides, biological control agents, growth regulators, seed treatments and physical control. A pesticide product consists of one or more active substances co-formulated with other materials. In this survey, only fungicides and sprout suppressants (growth regulators) were encountered.

An **active substance** is any substance or micro-organism which has a general or specific action against harmful organisms or on plants, parts of plants or plant products.

In this report the term '**formulation**(s)' is used to describe the pesticide active substance or mixture of active substances in a product(s). It does not refer to any of the solvents, pH modifiers or adjuvants also contained within a product that contribute to its efficacy.

A **fungicide** is a pesticide used to control fungal diseases in plants or potato tubers.

A **growth regulator** is a pesticide used to regulate the growth of the plant, for example to suppress the growth of sprouts by potato tubers in store.

A **seed treatment** is a pesticide applied to seed or potato tuber before planting to protect that plant against disease and pests from the earliest stage of development.

Basic tonnage is the quantity of potatoes treated with a pesticide, irrespective of the number of times they were treated or the number of pesticides used. This figure is used to calculate the percentage of potatoes treated with a given pesticide or pesticide group.

Tonnage treated is the basic tonnage of potatoes treated with a pesticide multiplied by the number of treatments applied to those potatoes. For example, if ten tonnes of potatoes are treated with a pesticide twice, the basic tonnage is five tonnes, and the tonnage treated is twenty tonnes.

Seed potatoes are crops grown for marketing or planting as seed for next season's crop. A fraction of the crop intended for seed production may not meet the necessary requirements and may be reclassified as ware potatoes post-harvest.

Ware potatoes are those grown for the ware (consumption) market, including those processed by a manufacturer. Ware potatoes may include a proportion of potatoes originally planned for seed production but later classified as ware.

Unventilated stores are defined as simple stores without fans that are naturally ventilated.

Ventilated stores can either be **adapted ambient** or **purpose built ambient ventilated stores**. These stores use forced air ventilation; they are not refrigerated.

Adapted ambient ventilated stores are basic stores with forced air ventilation. These stores commonly contain temporary fans and raised vents (normally wire hoops) on the floor of the store.

Purpose built ambient ventilated stores are purpose-built stores with forced air ventilation including open walled letterbox systems or suction wall systems. The potatoes are often stored to a depth of 3-5 metres; the floor is concrete and contains ventilation ducts. Pesticides can be applied by means of fogs and gases dispersed through the ventilation system.

Refrigerated stores are purpose-built stores which may also have mechanically assisted ventilation. Potatoes are stored at low temperatures which can help reduce the use of pesticides. Pesticides can be applied through the ventilation system.

Potatoes can be stored either in **bulk** (loose potatoes) or in **wooden boxes**. Potatoes stored in bags are excluded from this survey.

Ethanol is used as an **ethylene** generator to suppress tuber sprouting in stores. There is no standard recommended rate per tonne for the use of ethanol in potato stores and the quantity used varies according to store capacity, crop volume, type of store and duration of storage. In most cases the actual rate of application is not available and total quantity cannot be estimated. Therefore, estimated use of this pesticide is presented only as tonnes of potatoes treated.

In this report, summary data for estimated pesticide use including the tonnage treated and weight applied are discussed. Full detail and data tables are available in the Excel supporting document published alongside this report. In the supporting document, data is reported in various formats. Tonnes treated with pesticide formulations (mixture of active substances in a product) are reported in Table 2. The tonnes treated and the quantities applied for individual active substances are reported in Table 3. These different formats are provided to satisfy the needs of all data users and allow them to assess pesticide use trends. Some users may be interested in use of pesticide products which contain a number of active substances, thus formulation data would be required. Other users are interested in particular active substances which may be formulated on their own or in combination with other active substances. In addition, both weight and tonnes treated with pesticides are important indicators of changes in use over time. Only single active substance formulations were encountered in 2024.

The **June Agricultural Census** [5] is conducted annually by the Scottish Government's Rural and Environmental Science Analytical Services (RESAS). The June Agricultural Census collects data on land use, crop areas, livestock and the number of people working on agricultural holdings. For this report the June Agricultural Census was used to draw a sample of growers growing the relevant crops to participate in the survey.

Where quoted in the text or within figures, reasons for application are the grower's stated reasons for use of that particular pesticide on that crop and may not always seem appropriate. It should be noted that growers do not always provide reasons; therefore, those presented in the figures only reflect those specified and may not reflect overall reasons for use.

Due to rounding, there may be slight differences in totals both within and between tables.

Data from the 2022 [1] and 2020 [2] surveys are provided for comparison purposes in some of the tables and figures. It should be noted that there may be changes in areas of seed and ware potatoes grown between survey years. Also, when comparisons are made between surveys it is important to take into account that there may be changes in quantity of potatoes stored.

For notes on quality and sources of bias please refer to the notes and definitions section of the preceding arable report.

Data and methodology

Sampling and data collection

Using the June 2024 Agricultural Census [5] data, a sample was drawn representing arable cultivation in Scotland. The country was divided into 11 land-use regions (Figure 11, 2024 Arable survey). Each sample was stratified by these land-use regions and according to holding size. The holding size groups were based on the total area of arable crops grown. The sampling fractions used within both regions and size groups were based on the areas of relevant crops grown rather than number of holdings, so that smaller holdings would not dominate the sample.

Data relating to pesticide use in potato stores were collected from all potato growers encountered in the arable sample, either during an on-farm or telephone interview, or via e-mail. In instances where the potato land was let, and storage was on a separate holding, the potato grower was contacted individually to obtain storage details. Data were collected for all potatoes stored by these growers, not just for those crops grown on the holdings sampled. Therefore, the sample of stored potatoes relates to a greater area of potato cultivation than that for which field pesticide treatments were collected in the 2024 arable pesticide survey report. In total, data were collected from 69 growers. The crops grown by these growers represent 29% of the total 2024 potato crop area.

The data collected included the areas of seed and ware crops grown, quantities of potatoes sold and stored, storage type, storage method and post-harvest pesticide applications at crop lifting and during storage. Fungicidal seed treatments applied prior to planting are included in the arable crop report.

Raising factors

National pesticide use was estimated by ratio raising. This is a standard statistical technique for producing estimates from a sample. It is the same methodology used by the other UK survey teams and has been used for all historical datasets produced by the Pesticide Survey Unit, allowing comparability over time. The sample data were multiplied by raising factors (Table 10). These factors were calculated by comparing the sample area to the areas recorded in the June 2024 Agricultural Census data within each region and size group (please see changes from previous years section for further detail). An adjustment (Table 11) was made to the ware fraction to correct for the potatoes grown as seed that were then designated as ware. A second adjustment (Table 12) was made to align the survey estimates of total tonnes stored with the estimated tonnage of Scottish potato stocks held in store at the end of November provided by SASA Potato section. This represents a change in methodology from previous surveys (see next section).

Due to the low numbers of potatoes grown and sampled in some geographic regions, stored data were amalgamated into three regions to allow more robust estimation of pesticide use: the North & Central (Highlands & Islands, Caithness &

Orkney, Moray Firth and Aberdeen, East Fife, Lothian, and Central Lowlands), Angus (the main potato growing area in Scotland) and the South (Tweed Valley, Southern Uplands, and Solway).

Detailed data tables and data used to create the charts in this report are available in Excel format in the supporting document published separately.

Changes from previous years

There are a number of changes which should be noted when comparing the 2024 data with the previous survey.

For all potato store reports (with the exception of 2022), the June Agricultural Census was used to draw a sample of farmers growing the relevant crops to participate in the survey. National pesticide use was then estimated by ratio raising, by comparing the sample area to the areas recorded in the June Agricultural Census data. However, there was no June Agricultural Census in 2022. Instead the May 2022 Single Application Form data was used to draw the sample and estimate national pesticide use (see the 2022 report for full details). This should be taken into account when comparing 2024 data with the previous survey in 2022.

The same raising process was used in 2024 as the previous survey in 2022. However, there was a significant change in the raising process between 2020 and 2022 and prior to that between 2018 and 2020. Please refer to the 2022 report for a full explanation.

Financial burden to farmers

To minimise the burden on farmers, the survey team used non-visit methods of collection such as email, post, or telephone call.

To determine the total burden that the 2024 Potato Storage survey placed on those providing the information, the surveyors recorded the time that 69 respondents spent providing the data during the surveys. This sample represents 100% of growers surveyed. The median time taken to provide the information was 5 minutes.

The following formula was used to estimate the total cost of participating:

Burden (£) = No. surveyed x median time taken (hours) x typical hourly rate*

(* using median “Full Time Gross” hourly pay for Scotland of £19.26) [6]. The total financial burden to all growers resulting from participation in the 2024 Potato Storage survey was calculated to be £110.75.

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6. Earnings and hours worked, region by occupation by two-digit SOC: ASHE Table 3 - Office for National Statistics [Accessed 3 October 2025]

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