

Pesticide Usage in Scotland



Protected Edible Crops 2011

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G. Reay, L. Thomas & J. Watson

Science and Advice for Scottish Agriculture (SASA)
Roddinglaw Road, Edinburgh, Scotland, EH12 9FJ

psu@sasa.gsi.gov.uk
www.sasa.gov.uk/pesticides



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Summary

This report presents information from a survey of pesticide use on protected edible crops in Scotland during the 2010/2011 growing season. The crop groups surveyed were tomatoes, strawberries, raspberries, other fruit and vegetables which were permanently covered by glass or polytunnel. Crops grown under temporary structures such as French or Spanish tunnels were excluded from this survey.

Data were collected from 26 holdings, and the area surveyed represented 57% of the total estimated area of protected edible crops grown. The sampled data have been raised to give estimates of national pesticide usage.

The estimated area of protected edible crops grown in Scotland in 2011 was 1,430,696 m² representing an increase of 114% since the previous survey in 2007. The estimated areas of all crops increased with the exception of tomatoes which declined by 6%.

The area of edible crops treated with a pesticide formulation increased by 75% to 32,582,048 m² since the previous survey. However this is less than the increase in the area of crop grown. Approximately 84% of the total pesticide-treated area was cropped with strawberries, 10% with raspberries, 5% with vegetables, 2% with other fruit and less than 0.5% with tomatoes.

Fungicides accounted for 53% of the total pesticide treated area, insecticides 24%, biological control agents 16% and herbicides 7%. Molluscicides, soil sterilants, seed treatments and physical control agents each accounted for less than 0.5%.

In contrast, fungicides accounted for 62% of the total weight of all active ingredients applied, soil sterilants 25%, herbicides 10% and insecticides 3%, with all other pesticide groups less than 0.5% each.

Fungicides were applied to a total area of 17,287,312 m², an increase of 55% from 2007. Fenhexamid, applied mainly to strawberries, was the most extensively used fungicide. In contrast the recorded herbicide treated area decreased by 37% to 2,252,972 m². However this decrease was mainly due to a change in the way herbicide data was collected. In 2011 herbicide data was collected only on use within the glasshouse/polytunnel. In previous surveys it was also collected for the area immediately around the outside of the glasshouse.

The use of insecticides and acaricides, measured by area of formulations applied, increased by 146% to 7,735,505 m² in 2011. Abamectin was the most commonly used insecticide. Use of biological control agents also increased significantly since the previous survey (747%), more than six times the increase in crop area. *Bacillus subtilis* was the principal biological agent recorded. There was also greater molluscicide use, with 119,815 m² treated in 2011, 248% more than in 2007.

Introduction

The Scottish Government is required by legislation¹ to carry out post-approval surveillance of pesticide use. This is conducted by the Pesticide Survey Unit at Science and Advice for Scottish Agriculture (SASA), a division of the Scottish Government's Agriculture, Food and Rural Communities Directorate. As part of this programme a survey of pesticide usage in protected edible crops harvested in 2011 was conducted. This is the ninth survey of pesticide usage on protected edible crops in Scotland. The survey covered tomatoes, raspberries, strawberries, other fruit and vegetables. This report series had previously been produced every 4 years and included non-edible crops such as hardy nursery stock and bedding & pot plants; however as of 2011 non-edible crops are no longer surveyed and the report is completed every 2 years.

This survey is part of a series of annual reports which are produced to detail pesticide usage in Scotland for arable, vegetable, soft fruit and protected edible 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 the Food & Environment Research Agency, Sand Hutton, York. Also available at:

<http://www.fera.defra.gov.uk/scienceResearch/science/lus/pesticideUsageFullReports.s.cfm>

Definitions and Notes

'Pesticide' is used throughout this report to include commercial formulations containing active ingredients (a.i.) used as herbicides, fungicides, growth regulators, insecticides, molluscicides, biological control agents, soil sterilants, seed treatments and physical control agents. Disinfectants, although not a pesticide, are also included in this report. Disinfectants are not applied directly to the crop; however they are used in the protected area as glasshouse washes and for the sterilisation of equipment, trays and pots etc.

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 (or m² 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.

In this report the term 'formulation(s)' is used to describe the pesticide active ingredient or mixture of active ingredients in a product(s).

In this report each pesticide is reported in two formats as both a formulation (mixture of active ingredients in a product) and as individual active ingredients. See tables 4 to 7 for formulation data and tables 8 to 11 for active ingredient data. Quantities of active ingredient are reported in tables 12 to 15.

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 the ground beneath crops grown on table tops, or the pathways between crops.

The areas of crop grown include successional sowings during the same season; therefore the areas of crops grown can be larger than the total area of glasshouses and polytunnels. This is referred to throughout the report as multi-cropping.

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

Data from the 2003² and 2007³ surveys are provided for comparison purposes in some of the tables, 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.

There has been a change in the method used to collect census area data between the 2007 and 2011 survey reports (see method section for use of census data). Prior to 2011 census areas were solely obtained from holdings collected through the June Census forms. However In 2011, this data was combined with data from holdings claiming single farm payments. This has led to an improvement in the quality of census crop area statistics. This means that trends in crop area between 2007 and 2011 may not solely represent genuine changes in land use but include differences in the way crop data has been reported.

Method

Using the June 2011 Agricultural Census⁴ a sample was drawn from growers of protected edible crops, these being any edible crop grown within a glasshouse or permanent polytunnel. For the purpose of sampling, the country was divided into 11 land-use regions as shown in figure 1⁵. The sample was stratified by region and size group, and sampling within size groups was based on area rather than numbers of holdings, so that smaller size groups did not dominate the sample.

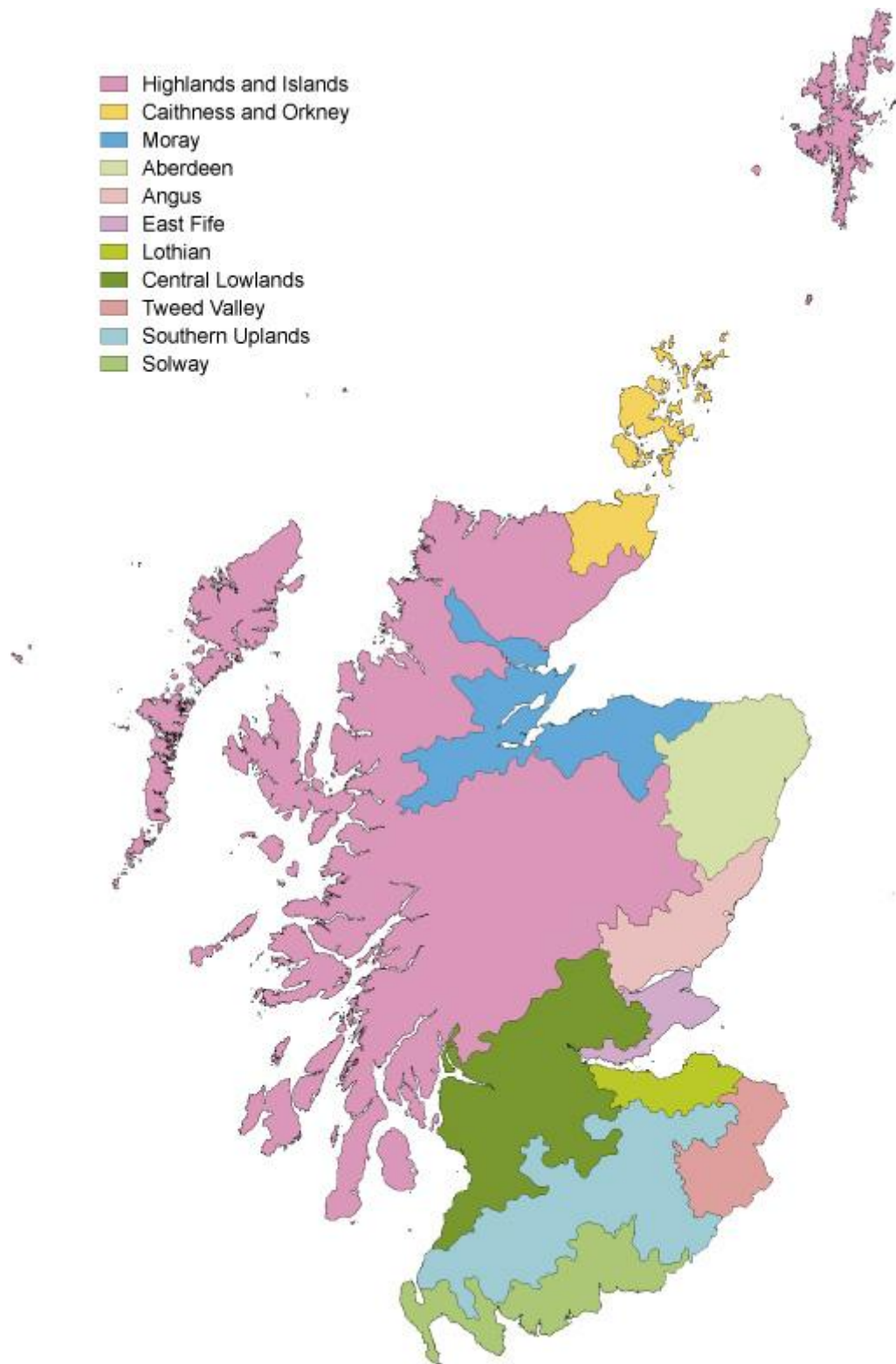
The survey period covered pesticide applications to crops during the 12 month period October 2010 to September 2011. Following an introductory letter and telephone call, data were collected by either personal interview during a visit to the holding or via a telephone interview. In total, information was collected from 26 holdings (Table 2).

The method used in the current survey differs slightly from earlier surveys. The current report includes only edible crops whereas previous reports covered all protected crops including non-edibles such as hardy nursery stock and bedding and pot plants. Whilst previously the sample was based on the total area of glass and polythene structures in each region and size group, the current sample is based on total edible crops grown. In addition, the Scottish agricultural census form was amended in 2011 to include a new strawberry and raspberry category in the protected section of the census. This has led some farmers to change the way they record their crop areas on the census form, recording their fruit grown under polytunnels as protected crops rather than under the soft fruit categories. It should be noted that this report only includes permanently protected crops. Soft fruit crops which are covered for only part of the year with French or Spanish tunnels are included in the soft fruit report.

For all crops, national pesticide use was estimated by multiplying the sample data by raising factors. The raising factors were based on the sampled area of each crop grown in two size groups compared to the crop areas from the 2011 Scottish Agricultural Census⁴ (Table 20). The protected census areas for raspberries, strawberries and other fruit included crops which were grown under both permanent and semi-permanent poly tunnels. As only permanently-protected crops are included in this survey a correction factor was applied to the census data to remove the proportion of the crop grown in temporary polytunnels. In the absence of any other information the correction factor was based on the relative proportion of crops grown under temporary and permanent structures that were encountered during the survey. The sample data were raised to these adjusted census areas.

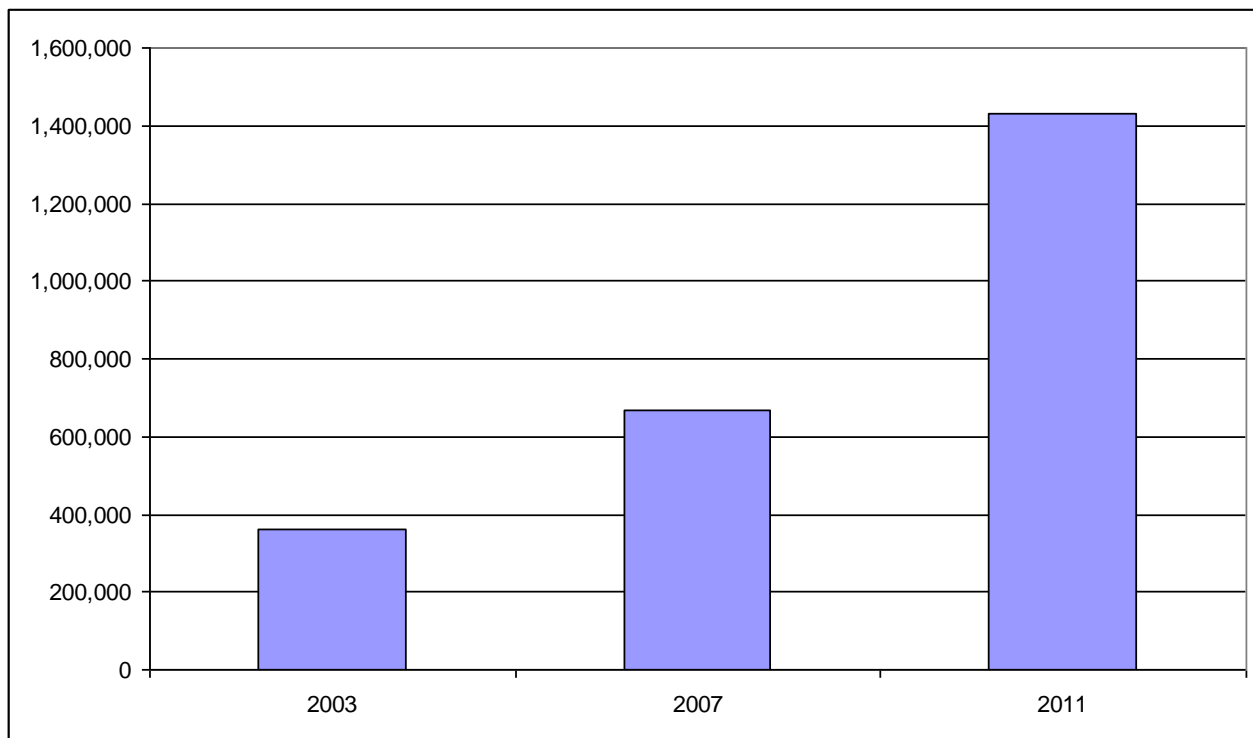
Standard errors associated with overall estimated pesticide use are included in the report for the first time (Table 21). Standard errors were estimated using the raising factors. An overall variance was calculated by summing the variance estimates for individual strata (region and size group) multiplied 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. Implementation of this method of standard error estimation is relatively straightforward and has advantages over ratio estimator methods when within-strata sample sizes are small.

Figure 1: Land-use regions of Scotland



Trends

Figure 2: Area of protected edible crops grown in Scotland 2003-2011 (m²)



Note: Prior to 2011 the protected crop survey was only conducted every 4 years.

Figure 3: Area of protected edible crops treated with the major pesticide groups in Scotland 2003-2011 (formulations m²)

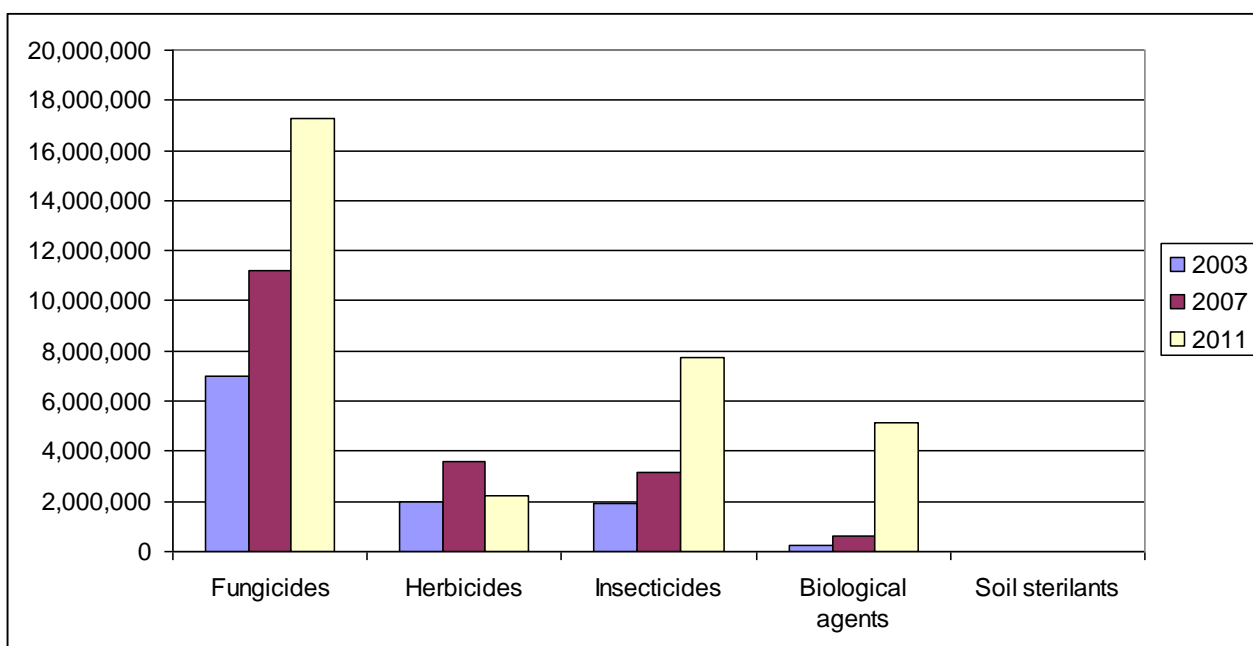
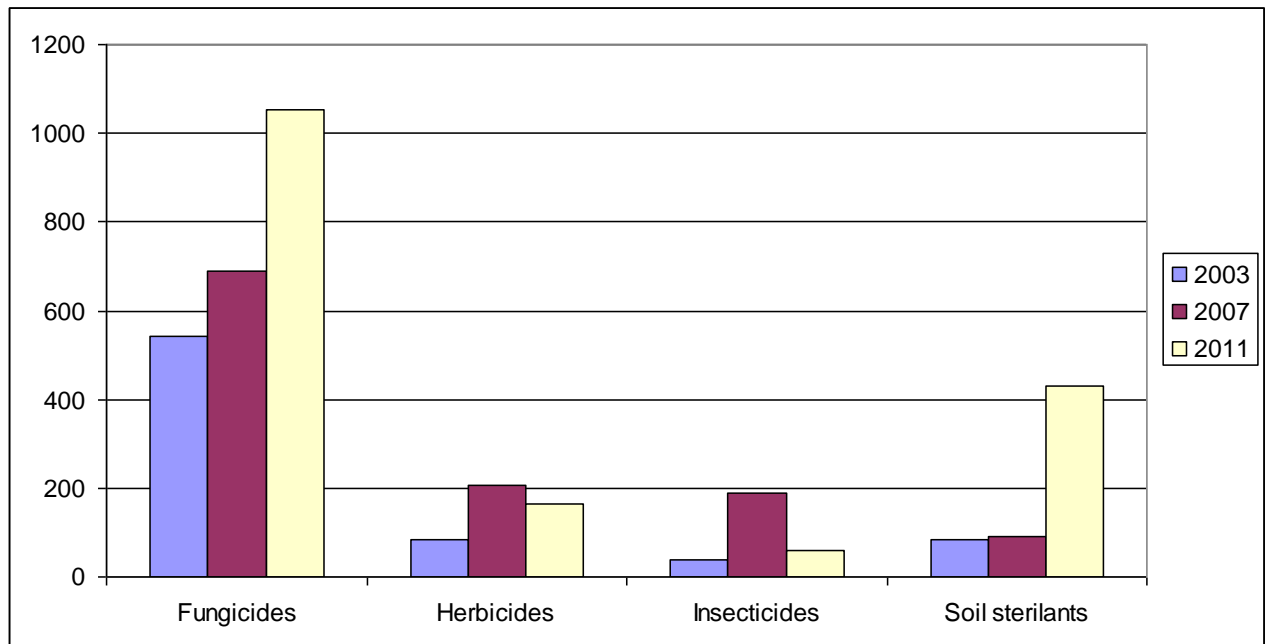


Figure 4: Quantity of the major pesticide groups applied to protected edible crops in Scotland 2003-2011(kg)



Crops & Pesticide Usage 2011

Figure 5: Protected edible crop areas 2011 (% of total area)

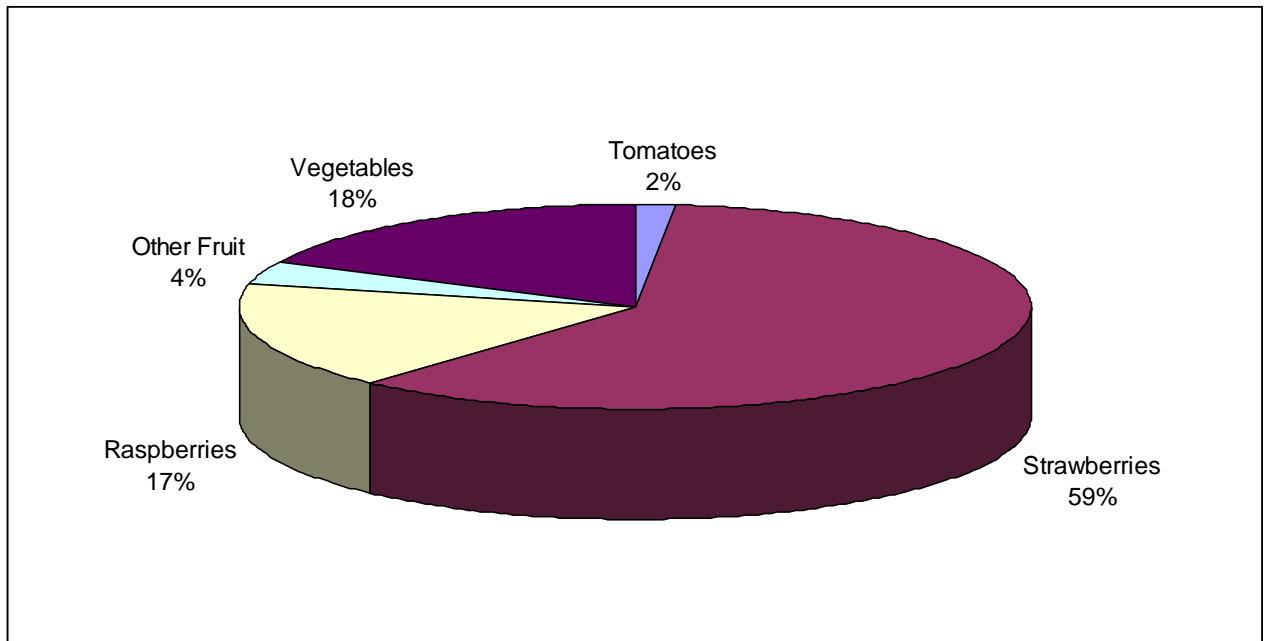
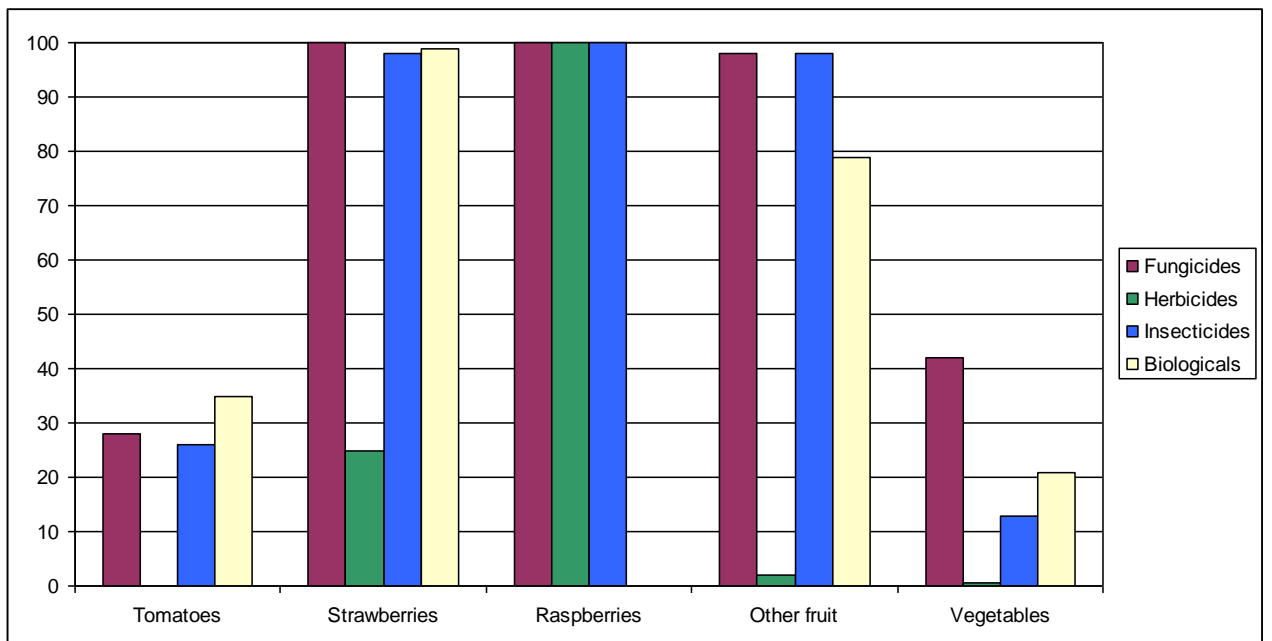


Figure 6: Percentage of crops treated with pesticides 2011

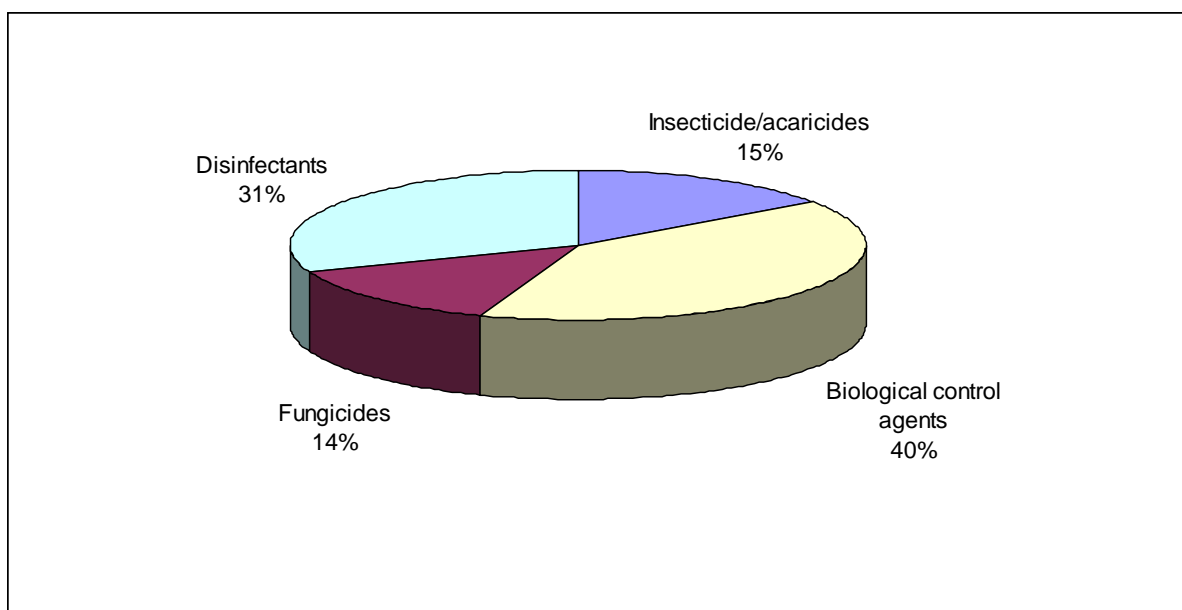


Tomatoes

- 25,179 m² of tomatoes grown in Scotland, down 6% from 2007
- 60,933 m² treated area with pesticide formulations (excluding disinfectants)
- 45% of tomato area was treated with a pesticide (excluding disinfectants)
- 1 kg pesticide applied (excluding disinfectants)
- Summary of pesticide use on tomatoes:

Pesticide group	Formulation area treated (m ²)	Weight applied (kg)	% of crop area treated	Most used formulation
Insecticide/ acaricides	13,344	0.1	26	Spiromesifen (10,825 m ²)
Biological control agents	35,592	NA	35	<i>Trichoderma harzianum</i> (22,199 m ²)
Fungicides	11,997	0.9	28	Iprodione (5,038 m ²)
Herbicides	0	0	0	
Disinfectants/ surface cleaners	27,036	33	44	Hydrogen peroxide/ peracetic acid (8,431m ²)

Figure 7: Use of pesticides & disinfectants on tomatoes (% of total area treated with formulations) – 2011

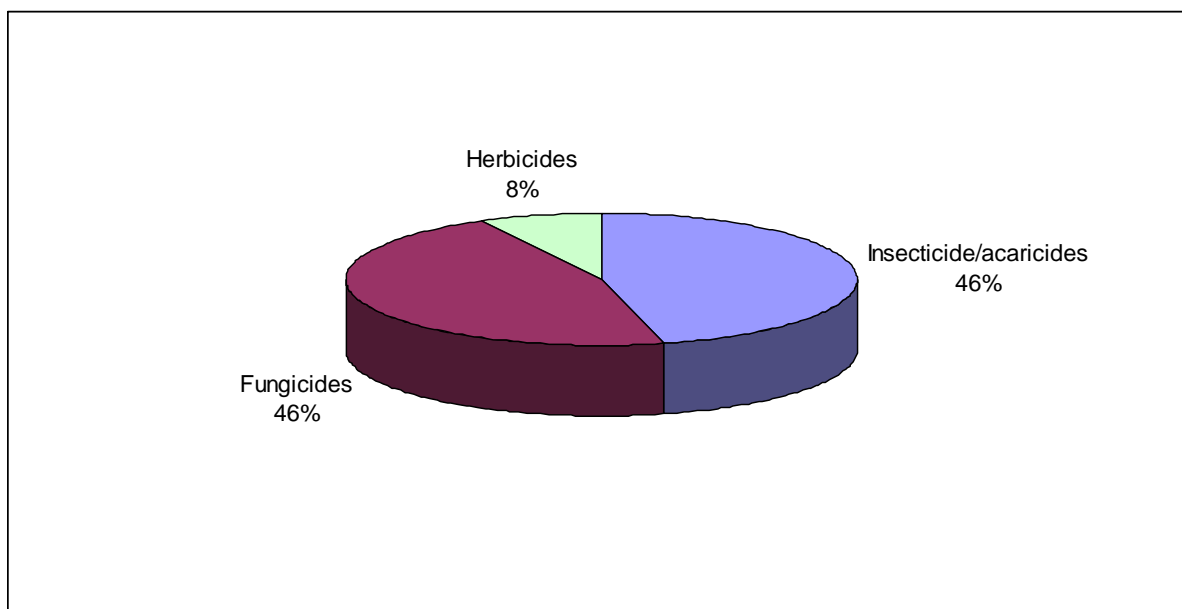


Raspberries

- 242,974 m² of raspberries grown under permanent protection in Scotland
- 3,158,664 m² treated area with pesticide formulations
- 100% of the raspberry crop received a pesticide treatment
- 126.4 kg pesticide applied
- Summary of pesticide use on raspberries:

Pesticide group	Formulation area treated (m ²)	Weight applied (kg)	% of crop area treated	Most used formulation
Insecticide/ acaricides	1,457,845	25.2	100	Abamectin & clofentezine (both 485,948 m ²)
Fungicides	1,457,845	100	100	Cyprodinil/ fludioxonil (485,948 m ²)
Herbicides	242,974	1.2	100	Carfentrazone-ethyl (242,974 m ²)

Figure 8: Use of pesticides on raspberries (% of total area treated with formulations) – 2011

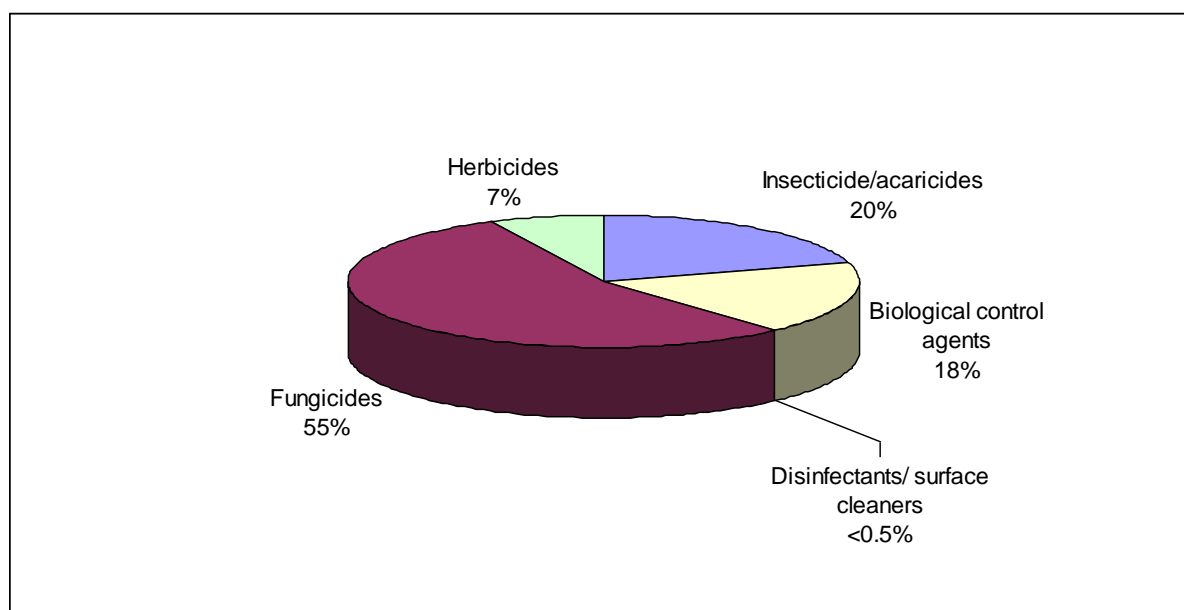


Strawberries

- 857,094 m² of strawberries grown under permanent protection (including multi-cropping). A further 10,872m² was recorded in the 'other fruit' census category (see page 12)
- 27,284,831 m² treated area with formulations (excluding disinfectants)
- 100% of the strawberry crop was treated with a pesticide
- 1,125 kg applied of which fungicides accounted for 81% (excluding disinfectants)
- Summary of pesticide use on strawberries:

Pesticide group	Formulation area treated (m ²)	Weight applied (kg)	% of crop area treated	Most used formulation
Insecticide/ acaricides	5,523,895	54.5	98	Abamectin & pyrethrins (both 1,246,931 m ²)
Biological control agents	4,969,134	NA	99	<i>Bacillus subtilis</i> (3,886,236 m ²)
Fungicides	14,784,192	909.6	100	Fenhexamid (2,766,584 m ²)
Herbicides	2,007,610	161.2	25	Diquat (1,316,819 m ²)
Disinfectants/ surface cleaners	2,480	1.8	<0.5%	Hydrogen peroxide/ peracetic acid (2434 m ²)

Figure 9: Use of pesticides & disinfectants on strawberries (% of total area treated with formulations) – 2011

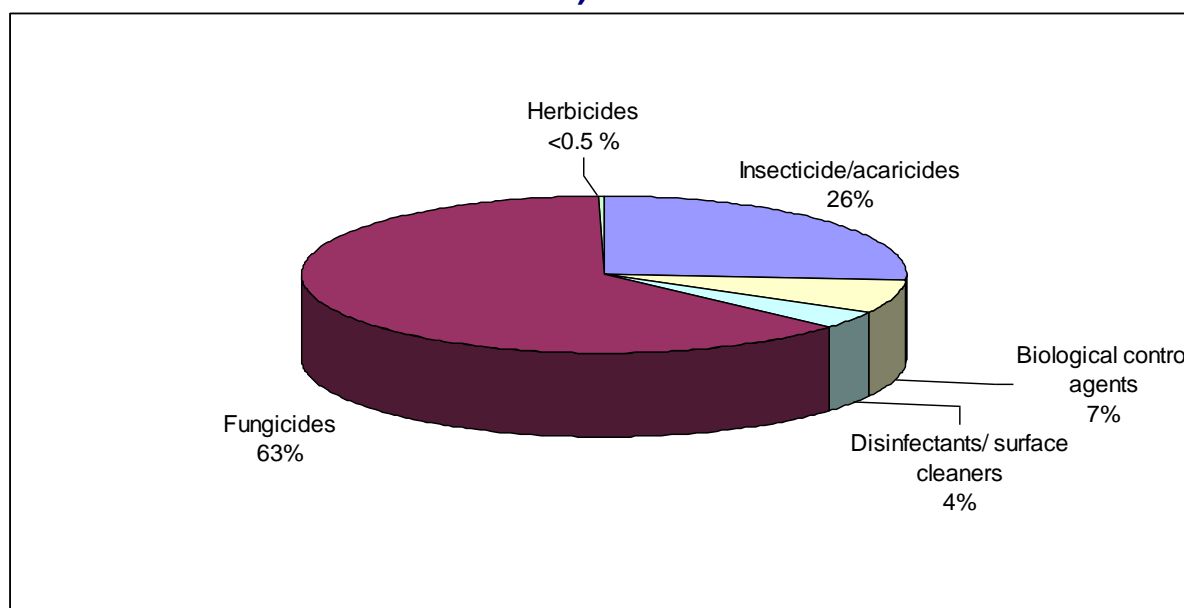


Other Fruit

- 52,104 m² of crops were grown under the 'other fruit' census category (including multi-cropping)
- 557,044 m² area treated with formulations (excluding disinfectants)
- The entire 'other fruit' crop was treated with a pesticide
- 26.5 kg of active ingredients were applied (excluding disinfectants)
- Strawberries and blackberries were the only crops encountered under the other fruit census category. Due to the small sample size, data relating to each of these crops have not been reported separately to prevent disclosure of information about individual holdings
- Summary of pesticide use on other crops:

Pesticide group	Formulation area treated (m ²)	Weight applied (kg)	% of crop area treated	Most used formulation
Insecticide/ acaricides	150,113	1.5	98	Pyrethrins (82,465 m ²)
Biological control agents	41,233	NA	79	<i>Bacillus subtilis</i> (41,233 m ²)
Fungicides	364,490	24.8	98	Fenhexamid (108,236 m ²)
Herbicides	1,208	0.2	2	Glyphosate (1,208 m ²)
Disinfectants/ surface cleaners	20,536	5.8	21	Hydrogen peroxide/ peracetic acid (19,328 m ²)

Figure 10: Use of pesticides & disinfectants on other fruit (% of total area treated with formulations) – 2011

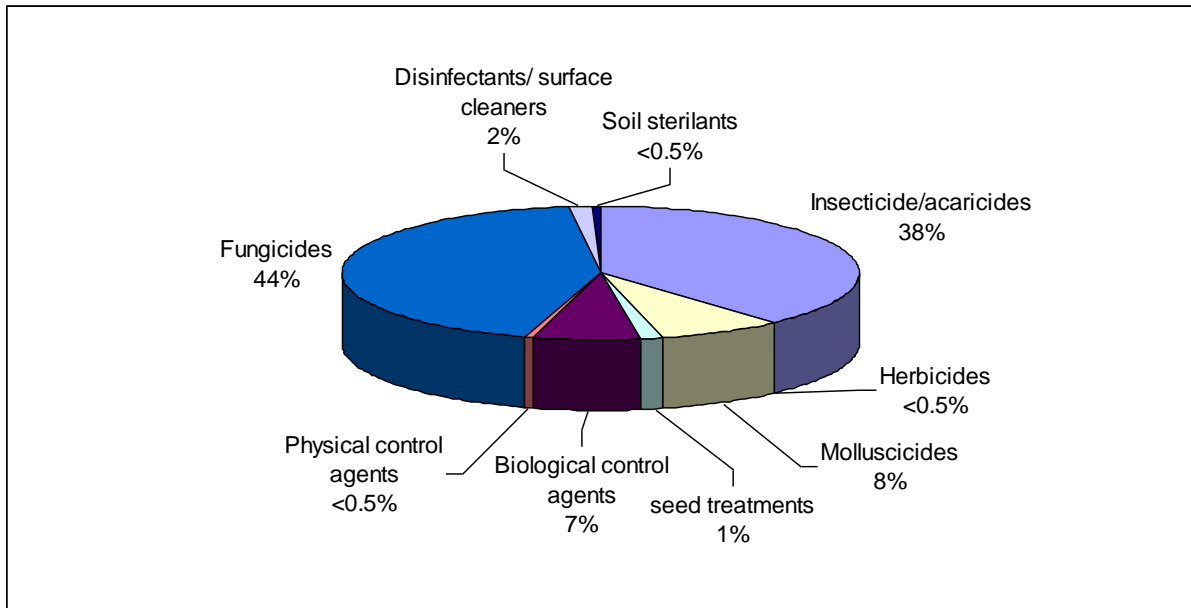


Vegetables

- 253,345 m² of vegetable crops were grown under permanent protection in Scotland, up 216% since 2007 (including multi-cropping)
- 1,520,576 m² area treated with formulations (excluding disinfectants)
- 86% of crop area was treated with a pesticide
- 6% of crop area was treated with a seed treatment. Thiram, iprodione and cymoxanil/fludioxonil/metalaxl-M were the only formulations recorded
- 457 kg of active ingredients were applied, of which soil sterilants accounted for 94%
- Crops encountered included micropropagated potatoes, various salad crops, beans, brassicas, herbs, vegetable seedlings and a wide range of minor vegetables
- Due to the small sample size, data relating to individual crop types have not been published to prevent disclosure of information about individual holdings
- Summary of pesticide use on vegetable crops:

Pesticide group	Formulations area treated (m ²)	Weight applied (kg)	% of crop area treated	Most used formulations
Insecticide/ acaricides	590,307	3.8	13	Lambda-cyhalothrin (289,012 m ²)
Molluscicides	119,815	2.2	47	Ferric phosphate (109,339 m ²)
Biological control agents	104,759	NA	21	<i>Phytoseiulus persimilis</i> (22,138 m ²)
Fungicides	668,788	18.9	42	Cymoxanil (289,012 m ²)
Herbicides	1,181	0.1	<0.5%	Glyphosate (1,181 m ²)
Soil sterilants	7,378	429.4	3	Dazomet (7,378 m ²)
Seed treatments	21,706	0.05	6	Thiram (11,037 m ²)
Physical control agents	6,642	2.6	1	Carbonic acid diamide/urea (6,642 m ²)
Disinfectants/ surface cleaners	24,527	263.7	10	Hydrogen peroxide/ peracetic acid (24,084 m ²)

Figure 11: Use of pesticides & disinfectants on vegetables (% of total area treated with formulations)– 2011



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Table 1 Estimated crop area

Estimated area (m²) of permanently-protected crops grown in Scotland

Crop	2011	2007	% change
Tomato	25,179	26,664	-6
Raspberry	242,973	*548,533	*108
Strawberry	846,325		
Other fruit	52,105		
Vegetables	99,899	78,734	27

Note: *In 2007 raspberries and strawberries were included in the 'Other fruit' census category. All areas exclude multi-cropping. The 2011 census figures have been adjusted to remove the proportion of crops grown in temporary/spanish tunnels (refer to method).

Table 2 Distribution of sample

Number of holdings sampled in each region

Highlands & Islands	Caithness & Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Southern Uplands	Solway	Scotland
5	1	2	3	8	0	1	6	0	0	0	26

Table 3 Percentage of each crop treated with pesticide

	<i>Tomatoes</i>	<i>Strawberries</i>	<i>Raspberries</i>	<i>Other fruit</i>	<i>Vegetables</i>
Fungicides	28	100	100	98	42
Herbicides	0	25	100	2	+
Insecticides & acaricides	26	98	100	98	13
Molluscicides	0	0	0	0	47
Biological agents	35	99	0	79	21
Soil sterilants	0	0	0	0	3
Seed treatments	0	0	0	0	6
Any pesticide	45	100	100	100	86
Disinfectants	44	+	0	21	10

‘+’ = <0.5%

Table 4 Insecticide/acaricide, biological and molluscicide formulations

Area (m²) and percentage of crop treated

Insecticides & acaricides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Abamectin	0	0	1,246,931	95	485,948	100	9,664	19	0	0	1,742,543	203,684
Acetamiprid	0	0	0	0	0	0	0	0	148	0	148	0
Chlorpyrifos	0	0	599,315	70	242,974	100	0	0	0	0	842,289	227,864
Clofentezine	0	0	215,872	25	485,948	100	19,328	19	0	0	721,148	188,075
Deltamethrin	0	0	0	0	0	0	0	0	11,805	4	11,805	0
Lambda-cyhalothrin	0	0	431,744	25	0	0	0	0	289,012	10	720,756	5,753
Pirimicarb	0	0	703,743	28	242,974	100	28,992	19	295	+	976,004	734,398
Pymetrozine	0	0	215,872	25	0	0	0	0	144,506	10	360,378	305,889
Pyrethrins	0	0	1,246,931	95	0	0	82,465	79	0	0	1,329,396	0
Spinosad	2,519	10	215,872	25	0	0	0	0	0	0	218,391	24,185
Spiromesifen	10,825	26	431,744	25	0	0	9,664	19	0	0	452,233	0
Thiacloprid	0	0	215,873	25	0	0	0	0	144,542	10	360,415	60,739
All insecticides	13,344	26	5,523,895	98	1,457,845	100	150,113	98	590,307	13	7,735,505	3,150,113
Biological control agents												
<i>Amblyseius (Neoseiulus spp.)</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	60,739
<i>Aphidius colemani</i>	0	0	21,587	3	0	0	0	0	0	0	21,587	46,233
<i>Aphidoletes aphidimyza</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Bacillus thuringiensis</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	118,763

'+'= <0.5%

Cont....

Table 4 Insecticide/acaricide, biological and molluscicide formulations continued

Area (m²) and percentage of crop treated

Biological control agents	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
<i>Bacillus subtilis</i>	0	0	3,886,236	97	0	0	41,233	79	0	0	3,927,468	0
<i>Beauveria bassiana</i> ATCC – 74040	0	0	431,744	25	0	0	0	0	14,759	6	446,503	0
<i>Feltiella acarisuga</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Hypoaspis miles</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Macrolophus caliginosus</i>	12,421	33	0	0	0	0	0	0	0	0	12,421	18,430
<i>Orius</i> spp.	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Phasmarhabditis hermaphrodita</i>	883	1	30	+	0	0	0	0	16,205	3	17,119	0
<i>Phytoseiulus persimilis</i>	89	+	15,111	2	0	0	0	0	22,138	9	37,338	7,582
<i>Steinernema feltiae</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Steinernema kraussei</i>	0	0	614,426	72	0	0	0	0	0	0	614,426	356,290
<i>Trichoderma harzianum</i>	22,199	18	0	0	0	0	0	0	0	0	22,199	0
All biological agents	35,592	35	4,969,134	99	0	0	41,233	79	104,759	21	5,150,718	608,038
Molluscicides												
Ferric phosphate	0	0	0	0	0	0	0	0	109,339	43	109,339	0
Metaldehyde	0	0	0	0	0	0	0	0	885	+	885	30,252
Methiocarb	0	0	0	0	0	0	0	0	9,591	4	9,591	4,132
All molluscicides	0	0	0	0	0	0	0	0	119,815	47	119,815	34,384
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Area grown includes multi-cropping. '+' = <0.5%

Table 5 Fungicide formulationsArea (m²) and percentage of crop treated

Fungicides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Azoxystrobin	0	0	1,908,223	97	0	0	28,992	19	0	0	1,937,215	20,703
Boscalid/pyraclostrobin	0	0	226,666	26	242,974	100	0	0	0	0	469,640	90,506
Bupirimate	0	0	1,675,706	97	0	0	9,664	19	0	0	1,685,370	1,783,025
Captan	0	0	215,872	25	0	0	9,664	19	0	0	225,536	193,229
Cyazofamid	0	0	0	0	0	0	0	0	120,422	10	120,422	25,837
Cymoxanil	0	0	0	0	0	0	0	0	289,012	10	289,012	0
Cyprodinil/fludioxonil	0	0	1,031,059	95	485,948	100	50,897	98	0	0	1,567,904	0
Dimethomorph	0	0	215,872	25	242,974	100	0	0	0	0	458,846	0
Fenamidone/propamocarb hydrochloride	0	0	0	0	0	0	0	0	24,084	10	24,084	0
Fenhexamid	0	0	2,766,584	100	242,974	100	108,236	98	0	0	3,117,794	1,786,333
Fluopicolide/propamocarb hydrochloride	0	0	0	0	0	0	0	0	72,253	10	72,253	0
Fosetyl-aluminium	0	0	215,872	25	0	0	9,664	19	9,591	4	235,127	270,795
Iprodione	5,038	10	1,651,960	98	0	0	57,983	19	7,378	3	1,722,360	1,979,034
Kresoxim-methyl	0	0	0	0	0	0	9,664	19	0	0	9,664	150,549
Mandipropamid	0	0	0	0	0	0	0	0	72,253	10	72,253	0

Cont....

Table 5 Fungicide formulations continued

Area (m²) and percentage of crop treated

Fungicides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Mepanipyrim	0	0	0	0	0	0	322	1	0	0	322	194,822
Myclobutanil	0	0	2,145,682	100	0	0	28,992	19	0	0	2,174,674	1,452,721
Potassium hydrogen carbonate	0	0	828,948	27	0	0	0	0	0	0	828,948	124,739
Propamocarb	4,440	18	0	0	0	0	0	0	0	0	4,440	6,050
Pyrimethanil	0	0	816,720	95	0	0	19,006	19	0	0	835,726	1,041,316
Quinoxifen	0	0	631,695	72	0	0	2,416	5	0	0	634,111	108,561
Sulphur	0	0	431,744	25	0	0	0	0	73,795	29	505,539	285,269
Tebuconazole	0	0	0	0	242,974	100	0	0	0	0	242,974	345,329
Thiram	0	0	21,587	3	0	0	28,992	19	0	0	50,579	229,773
Unspecified fungicides	2,519	10	0	0	0	0	0	0	0	0	2,519	0
All fungicides	11,997	28	14,784,192	100	1,457,845	100	364,490	98	668,788	42	17,287,312	11,188,672
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Area grown includes multi-cropping.

Table 6 Disinfectant, soil sterilant and physical control agent formulations

Area (m²) and percentage of crop treated

Disinfectants/ surface cleaners	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Formaldehyde	2,519	10	0	0	0	0	0	0	0	0	2,519	13,277
Hydrofluoric acid/ sulphuric acid	6,510	26	0	0	0	0	0	0	0	0	6,510	6,639
Hydrogen peroxide/ peracetic acid	8,431	33	2,434	+	0	0	19,328	19	24,084	10	54,277	345,356
Sodium hypochlorite	6,959	28	0	0	0	0	0	0	0	0	6,959	0
Unspecified disinfectant	2,617	10	46	+	0	0	1,208	2	443	0	4,313	30,564
All disinfectants	27,036	44	2,480	+	0	0	20,536	21	24,527	10	74,578	398,861
Soil sterilants												
Dazomet	0	0	0	0	0	0	0	0	7,378	3	7,378	3,351
All soil sterilants	0	0	0	0	0	0	0	0	7,378	3	7,378	3,351
Physical control agents												
Carbonic acid diamide/urea	0	0	0	0	0	0	0	0	6,642	1	6,642	0
All physical control agents	0	0	0	0	0	0	0	0	6,642	1	6,642	0
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Area grown includes multi-cropping. '+' = <0.5%

Table 7 Herbicide formulationsArea (m²) and percentage of crop treated

Herbicides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Carfentrazone-ethyl	0	0	0	0	242,974	100	0	0	0	0	242,974	0
Diquat	0	0	1,316,819	25	0	0	0	0	0	0	1,316,819	0
Glufosinate-ammonium	0	0	453,331	25	0	0	0	0	0	0	453,331	24,948
Glyphosate	0	0	0	0	0	0	1,208	2	1,181	+	2,388	392,008**
Lenacil	0	0	21,587	3	0	0	0	0	0	0	21,587	0
Metamitron	0	0	215,872	25	0	0	0	0	0	0	215,872	0
All herbicides	0	0	2,007,610	25	242,974	100	1,208	2	1,181	+	2,252,972	3,574,772
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Areas grown includes multi-cropping. '+'= <0.5%

** In 2007 glyphosate usage was collected indoors and for the area immediately around the outside of the glasshouse. In 2011 only indoor use was recorded therefore comparisons between survey years are not possible.

Table 8 Insecticide, biological and molluscicide active ingredients

Area (m²) and percentage of crop treated

Insecticides & acaricides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Pyrethroids												
Deltamethrin	0	0	0	0	0	0	0	0	11,805	4	11,805	0
Lambda-cyhalothrin	0	0	431,744	25	0	0	0	0	289,012	10	720,756	5,753
All pyrethroids	0		431,744		0		0		300,817		732,561	531,191
Carbamates												
Pirimicarb	0	0	703,743	28	242,974	100	28,992	19	295	+	976,004	734,398
All carbamates	0		703,743		242,974		28,992		295		976,004	734,398
Organophosphates												
Chlorpyrifos	0	0	599,315	70	242,974	100	0	0	0	0	842,289	227,864
All organophosphates	0		599,315		242,974		0		0		842,289	227,864
Neonicotinoids												
Acetamiprid	0	0	0	0	0	0	0	0	148	+	148	0
Thiacloprid	0	0	215,873	25	0	0	0	0	144,542	10	360,415	60,739
All neonicotinoids	0		215,873		0		0		144,690		360,562	60,739
Others												
Abamectin	0	0	1,246,931	95	485,948	100	9,664	19	0	0	1,742,543	203,684
Clofentezine	0	0	215,872	25	485,948	100	19,328	19	0	0	721,148	188,075
Pymetrozine	0	0	215,872	25	0	0	0	0	144,506	10	360,378	305,889

'+'= <0.5%

Cont....

Table 8 Insecticide, biological and molluscicide active ingredients continued

Area (m²) and percentage of crop treated

Insecticides & acaricides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Pyrethrins	0	0	1,246,931	95	0	0	82,465	79	0	0	1,329,396	0
Spinosad	2,519	10	215,872	25	0	0	0	0	0	0	218,391	24,185
Spiromesifen	10,825	26	431,744	25	0	0	9,664	19	0	0	452,233	0
All others	13,344		3,573,221		971,897		121,121		144,506		4,824,089	1,595,921
All insecticides	13,344	26	5,523,895	98	1,457,845	100	150,113	98	590,307	13	7,735,505	3,150,113
Biological control agents												
<i>Amblyseius (Neoseiulus spp.)</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	60,739
<i>Aphidius colemani</i>	0	0	21,587	3	0	0	0	0	0	0	21,587	46,233
<i>Aphidoletes aphidimyza</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Bacillus thuringiensis</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	118,763
<i>Bacillus subtilis</i>	0	0	3,886,236	97	0	0	41,233	79	0	0	3,927,468	0
<i>Beauveria bassiana</i> ATCC - 74040	0	0	431,744	25	0	0	0	0	14,759	6	446,503	0
<i>Feltiella acarisuga</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Hypoaspis miles</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Macrolophus caliginosus</i>	12,421	33	0	0	0	0	0	0	0	0	12,421	18,430
<i>Orius spp.</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0

Cont....

Table 8 Insecticide, biological and molluscicide active ingredients continued

Area (m²) and percentage of crop treated

Biological control agents	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
<i>Phasmarhabditis hermaphrodita</i>	883	1	30	0	0	0	0	0	16,205	3	17,119	0
<i>Phytoseiulus persimilis</i>	89	+	15,111	2	0	0	0	0	22,138	9	37,338	7,582
<i>Steinernema feltiae</i>	0	0	0	0	0	0	0	0	7,379	3	7,379	0
<i>Steinernema kraussei</i>	0	0	614,426	72	0	0	0	0	0	0	614,426	356,290
<i>Trichoderma harzianum</i>	22,199	18	0	0	0	0	0	0	0	0	22,199	0
All biological agents	35,592	35	4,969,134	99	0	0	41,233	79	104,759	21	5,150,718	608,038
Molluscicides												
Ferric phosphate	0	0	0	0	0	0	0	0	109,339	43	109,339	0
Metaldehyde	0	0	0	0	0	0	0	0	885	+	885	30,252
Methiocarb	0	0	0	0	0	0	0	0	9,591	4	9,591	4,132
All molluscicides	0	0	0	0	0	0	0	0	119,815	47	119,815	34,384
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Area grown includes multi-cropping. '+' = <0.5%

Table 9 Fungicide active ingredients
Area (m²) and percentage of crop treated

Fungicides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Azoxystrobin	0	0	1,908,223	97	0	0	28,992	19	0	0	1,937,215	20,703
Boscalid	0	0	226,666	26	242,974	100	0	0	0	0	469,640	90,506
Bupirimate	0	0	1,675,706	97	0	0	9,664	19	0	0	1,685,370	1,783,025
Captan	0	0	215,872	25	0	0	9,664	19	0	0	225,536	193,229
Cyazofamid	0	0	0	0	0	0	0	0	120,422	10	120,422	25,837
Cymoxanil	0	0	0	0	0	0	0	0	289,012	10	289,012	22,235
Cyprodinil	0	0	1,031,059	95	485,948	100	50,897	98	0	0	1,567,904	0
Dimethomorph	0	0	215,872	25	242,974	100	0	0	0	0	458,846	0
Fenamidone	0	0	0	0	0	0	0	0	24,084	10	24,084	0
Fenhexamid	0	0	2,766,584	100	242,974	100	108,236	98	0	0	3,117,794	1,786,333
Fludioxonil	0	0	1,031,059	95	485,948	100	50,897	98	0	0	1,567,904	0
Fluopicolide	0	0	0	0	0	0	0	0	72,253	10	72,253	11,578
Fosetyl-aluminium	0	0	215,872	25	0	0	9,664	19	9,591	4	235,127	270,795
Iprodione	5,038	10	1,651,960	98	0	0	57,983	19	7,378	3	1,722,360	1,979,034
Kresoxim-methyl	0	0	0	0	0	0	9,664	19	0	0	9,664	0
Mandipropamid	0	0	0	0	0	0	0	0	72,253	10	72,253	0
Mepanipyrim	0	0	0	0	0	0	322	1	0	0	322	194,822
Myclobutanil	0	0	2,145,682	100	0	0	28,992	19	0	0	2,174,674	1,452,721

Cont....

Table 9 Fungicide active ingredients continued

Area (m²) and percentage of crop treated

Fungicides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Potassium hydrogen carbonate	0	0	828,948	27	0	0	0	0	0	0	828,948	124,739
Propamocarb hydrochloride	4,440	18	0	0	0	0	0	0	96,337	10	100,777	17,628
Pyraclostrobin	0	0	226,666	26	242,974	100	0	0	0	0	469,640	90,506
Pyrimethanil	0	0	816,720	95	0	0	19,006	19	0	0	835,726	1,041,316
Quinoxifen	0	0	631,695	72	0	0	2,416	5	0	0	634,111	108,561
Sulphur	0	0	431,744	25	0	0	0	0	73,795	29	505,539	285,269
Tebuconazole	0	0	0	0	242,974	100	0	0	0	0	242,974	345,329
Thiram	0	0	21,587	3	0	0	28,992	19	0	0	50,579	229,773
Unspecified fungicides	2,519	10	0	0	0	0	0	0	0	0	2,519	
All fungicides	11,997	28	16,041,916	100	2,186,768	100	415,387	98	765,125	42	19,421,193	11,362,168
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Area grown includes multi-cropping.

Table 10 Disinfectant, soil sterilant and physical control agent active ingredients

Area (m²) and percentage of crop treated

Disinfectants/ surface cleaners	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Formaldehyde	2,519	10	0	0	0	0	0	0	0	0	2,519	13,277
Hydrofluoric acid	6,510	26	0	0	0	0	0	0	0	0	6,510	6,639
Hydrogen peroxide	8,431	33	2,434	+	0	0	19,328	19	24,084	10	54,277	345,356
Peracetic acid	8,431	33	2,434	+	0	0	19,328	19	24,084	10	54,277	345,356
Sodium hypochlorite	6,959	28	0	0	0	0	0	0	0	0	6,959	0
Sulphuric acid	6,510	26	0	0	0	0	0	0	0	0	6,510	6,639
Unspecified disinfectant	2,617	10	46	+	0	0	1,208	2	443	0	4,313	0
All disinfectants	41,977	44	4,914	0	0	0	39,863	21	48,611	10	135,365	750,856
Soil sterilants												
Dazomet	0	0	0	0	0	0	0	0	7,378	3	7,378	3,351
All soil sterilants	0	0	0	0	0	0	0	0	7,378	3	7,378	3,351
Physical control agents												
Carbonic acid diamide/urea	0	0	0	0	0	0	0	0	6,642	1	6,642	0
All physical control	0	0	0	0	0	0	0	0	6,642	1	6,642	0
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Area grown includes multi-cropping. '+' = <0.5%

Table 11 Herbicide active ingredients
Area (m²) and percentage of crop treated

Herbicides	Tomatoes		Strawberries		Raspberries		Other fruit		Vegetables		All edible crops	2007
	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(%)	(m ²)	(m ²)
Carfentrazone-ethyl	0	0	0	0	242,974	100	0	0	0	0	242,974	0
Diquat	0	0	1,316,819	25	0	0	0	0	0	0	1,316,819	114,004
Glufosinate-ammonium	0	0	453,331	25	0	0	0	0	0	0	453,331	24,948
Glyphosate	0	0	0	0	0	0	1,208	2	1,181	+	2,388	392,008**
Lenacil	0	0	21,587	3	0	0	0	0	0	0	21,587	0
Metamitron	0	0	215,872	25	0	0	0	0	0	0	215,872	0
All herbicides	0	0	2,007,610	25	242,974	100	1,208	2	1,181	+	2,252,972	4,163,829
Area grown*	25,179		857,094		242,974		52,104		253,345		1,430,696	669,171

* Areas grown includes multi-cropping. '+'= <0.5%

** In 2007 glyphosate usage was collected indoors and for the area immediately around the outside of the glasshouse. In 2011 only indoor use was recorded therefore comparisons between survey years are not possible.

Table 12 Quantities (kg) of insecticide/acaricide and molluscicide active ingredients

Insecticides & acaricides	Tomatoes	Strawberries	Raspberries	Other fruit	Vegetables	Total weight	2007
Pyrethroids							
Deltamethrin	0.0	0.0	0.0	0.0	+	+	0.0
Lambda-cyhalothrin	0.0	0.3	0.0	0.0	0.2	0.5	+
All pyrethroids	0.0	0.3	0.0	0.0	0.2	0.6	0.8
Carbamates							
Pirimicarb	0.0	7.6	3.4	0.7	+	11.7	8.9
All carbamates	0.0	7.6	3.4	0.7	+	11.7	8.9
Organophosphates							
Chlorpyrifos	0.0	28.8	11.7	0.0	0.0	40.4	161.6
All organophosphates	0.0	28.8	11.7	0.0	0.0	40.4	161.6
Neonicotinoids							
Acetamiprid	0.0	0.0	0.0	0.0	+	+	0.0
Thiacloprid	0.0	1.6	0.0	0.0	1.4	2.9	0.7
All neonicotinoids	0.0	1.6	0.0	0.0	1.4	2.9	0.7
Others							
Abamectin	0.0	0.9	0.4	+	0.0	1.3	0.1
Clofentezine	0.0	2.6	9.7	0.3	0.0	12.6	2.6
Pymetrozine	0.0	2.6	0.0	0.0	2.2	4.8	5.8
Pyrethrins	0.0	5.3	0.0	0.5	0.0	5.7	0.0

'+' = <0.05kg

Cont...

Table 12 Quantities (kg) of insecticide/acaricide and molluscicide active ingredients continued

Insecticides & acaricides	Tomatoes	Strawberries	Raspberries	Other fruit	Vegetables	Total weight	2007
Spinosad	0.1	1.8	0.0	0.0	0.0	1.9	0.3
Spiromesifen	0.1	3.1	0.0	+	0.0	3.2	0.0
All others	0.1	16.3	10.2	0.8	2.2	29.6	16.6
All insecticides	0.1	54.5	25.2	1.5	3.8	85.2	188.6
Molluscicides							
Ferric phosphate	0.0	0.0	0.0	0.0	2.0	2.0	0.0
Metaldehyde	0.0	0.0	0.0	0.0	0.1	0.1	1.8
Methiocarb	0.0	0.0	0.0	0.0	0.2	0.2	+
All molluscicides	0.0	0.0	0.0	0.0	2.2	2.2	1.8

'+' = <0.05kg

Table 13 Quantities (kg) of fungicide active ingredients

Fungicides	Tomatoes	Strawberries	Raspberries	Other fruit	Vegetables	Total weight	2007
Azoxystrobin	0.0	41.1	0.0	0.7	0.0	41.8	0.4
Boscalid	0.0	4.6	8.1	0.0	0.0	12.7	2.0
Bupirimate	0.0	55.2	0.0	0.3	0.0	55.6	48.3
Captan	0.0	17.3	0.0	0.5	0.0	17.8	22.1
Cyazofamid	0.0	0.0	0.0	0.0	1.0	1.0	0.2
Cymoxanil	0.0	0.0	0.0	0.0	2.6	2.6	0.2
Cyprodinil	0.0	31.4	18.2	1.7	0.0	51.3	0.0
Dimethomorph	0.0	32.4	36.4	0.0	0.0	68.8	0.0
Fenamidone	0.0	0.0	0.0	0.0	0.4	0.4	0.0
Fenhexamid	0.0	180.2	18.2	7.3	0.0	205.7	98.0
Fludioxonil	0.0	20.9	12.1	1.1	0.0	34.2	0.0
Fluopicolide	0.0	0.0	0.0	0.0	0.7	0.7	0.1
Fosetyl-aluminium	0.0	38.9	0.0	2.9	2.7	44.4	67.2
Iprodione	0.2	110.8	0.0	3.6	0.0	114.6	97.2
Kresoxim-methyl	0.0	0.0	0.0	0.1	0.0	0.1	1.9
Mandipropamid	0.0	0.0	0.0	0.0	1.1	1.1	0.0
Mepanipyrim	0.0	0.0	0.0	+	0.0	+	5.4
Myclobutanil	0.0	15.8	0.0	0.3	0.0	16.1	9.2

'+' = <0.05kg

Cont...

Table 13 Quantities (kg) of fungicide active ingredients continued

Fungicides	Tomatoes	Strawberries	Raspberries	Other fruit	Vegetables	Total weight	2007
Potassium hydrogen carbonate	0.0	250.4	0.0	0.0	0.0	250.4	72.4
Propamocarb hydrochloride	0.7	0.0	0.0	0.0	9.0	9.7	43.8
Pyraclostrobin	0.0	1.2	2.0	0.0	0.0	3.2	0.5
Pyrimethanil	0.0	58.4	0.0	1.5	0.0	60.0	47.2
Quinoxifen	0.0	7.9	0.0	+	0.0	7.9	1.2
Sulphur	0.0	41.4	0.0	0.0	1.5	42.9	30.3
Tebuconazole	0.0	0.0	4.9	0.0	0.0	4.9	3.9
Thiram	0.0	1.7	0.0	4.6	0.0	6.4	23.1
All fungicides	0.9	909.6	100.0	24.8	18.9	1,054.2	689.7

'+' = <0.05kg

Table 14 Quantities (kg) of disinfectant, soil sterilant and physical control agent active ingredients

Disinfectants/ surface cleaners	Tomatoes	Strawberries	Raspberries	Other fruit	Vegetables	Total weight	2007
Formaldehyde	10.1	0.0	0.0	0.0	0.0	10.1	26.8
Hydrofluoric acid	4.4	0.0	0.0	0.0	0.0	4.4	5.3
Hydrogen peroxide	9.9	1.5	0.0	4.8	219.8	236.1	27.7
Peracetic acid	2.0	0.3	0.0	1.0	44.0	47.2	5.5
Sodium hypochlorite	4.4	0.0	0.0	0.0	0.0	4.4	0.0
Sulphuric acid	2.2	0.0	0.0	0.0	0.0	2.2	2.7
All disinfectants	33.0	1.8	0.0	5.8	263.7	304.4	182.9
Soil sterilants							
Dazomet	0.0	0.0	0.0	0.0	429.4	429.4	90.5
All soil sterilants	0.0	0.0	0.0	0.0	429.4	429.4	90.5
Physical control agents							
Carbonic acid diamide/urea	0.0	0.0	0.0	0.0	2.6	2.6	0.0
All physical control agents	0.0	0.0	0.0	0.0	2.6	2.6	0.0

Table 15 Quantities (kg) of herbicide active ingredients

Herbicides	Tomatoes	Strawberries	Raspberries	Other fruit	Vegetables	Total weight	2007
Carfentrazone-ethyl	0.0	0.0	1.2	0.0	0.0	1.2	0.0
Diquat	0.0	62.5	0.0	0.0	0.0	62.5	4.1
Glufosinate-ammonium	0.0	20.3	0.0	0.0	0.0	20.3	1.6
Glyphosate	0.0	0.0	0.0	0.2	0.1	0.4	22.8**
Lenacil	0.0	3.0	0.0	0.0	0.0	3.0	0.0
Metamitron	0.0	75.6	0.0	0.0	0.0	75.6	0.0
All herbicides	0.0	161.3	1.2	0.2	0.1	162.8	206.4

** In 2007 glyphosate usage was collected indoors and for the area immediately around the outside of the glasshouse. In 2011 only indoor use was recorded therefore comparisons between survey years are not possible.

Table 16 Principal active ingredients by spray area

Area (total pesticide treated area, m² x 1000) treated with the 15 most used active ingredients on all edible crops

	Active ingredient	Type	2011	2007
1	<i>Bacillus subtilis</i>	B	3,927	0
2	Fenhexamid	F	3,118	1,786
3	Myclobutanil	F	2,175	1,453
4	Azoxystrobin	F	1,937	21
5	Abamectin	I	1,743	204
6	Iprodione	F/S	1,722	2,009
7	Bupirimate	F	1,685	1,783
8	Fludioxonil	F/S	1,620	0
9	Cyprodinil	F	1,568	0
10	Pyrethrins	I	1,329	0
11	Diquat	H	1,317	114
12	Pirimicarb	I	976	734
13	Chlorpyrifos	I/S	842	258
14	Pyrimethanil	F	836	1,041
15	Potassium hydrogen carbonate	F	829	125

Pesticide type = B: Biological Agent, F: Fungicide, H: Herbicide, I: Insecticide, S: Seed Treatment

Table 17 Principal active ingredients by weight

Quantity (kg) of the 15 most used active ingredients on all edible crops

	Active ingredient	Type	2011	2007
1	Dazomet	SS	429	90
2	Potassium hydrogen carbonate	F	250	72
3	Hydrogen peroxide	D	236	28
4	Fenhexamid	F	206	98
5	Iprodione	F/S	115	97
6	Metamitron	H	76	0
7	Dimethomorph	F	69	0
8	Diquat	H	63	4
9	Pyrimethanil	F	60	47
10	Bupirimate	F	56	48
11	Cyprodinil	F	51	0
12	Peracetic acid	D	47	6
13	Fosetyl-aluminium	F	44	67
14	Sulphur	F	43	30
15	Azoxystrobin	F	42	+

Pesticide type = D: Disinfectant, F: Fungicide, H: Herbicide, SS: Soil Sterilant, S: Seed treatment

'+' = <0.05kg

Table 18 Total edible crops comparison with previous years

Pesticide usage 2003-2011, total pesticide treated area (m²) of formulations, active ingredients and quantities used (kg)

	2003			2007			2011		
	Formulations (m ²)	a.i. (m ²)	Kg	Formulations (m ²)	a.i. (m ²)	Kg	Formulations (m ²)	a.i. (m ²)	Kg
Insecticides									
Pyrethroids	295,817	295,817	1.6	531,190	531,191	0.8	732,561	732,561	0.6
Carbamates	490,778	490,778	17.4	734,398	734,398	8.9	976,004	976,004	11.7
Organophosphates	0	0	0.0	227,864	227,864	161.6	842,289	842,289	40.4
Neonicotinoids	0	0	0.0	60,739	60,739	0.7	360,563	360,563	2.9
Other	1,142,322	1,142,323	20.7	1,595,920	1,595,921	16.6	4,824,089	4,824,089	29.6
All insecticides	1,928,919	1,928,919	39.7	3,150,113	3,150,113	188.6	7,735,505	7,735,505	58.2
Molluscicides	34,900	34,900	2.1	34,384	34,384	1.8	119,815	119,815	2.2
Fungicides	7,016,068	7,049,257	542.2	11,188,672	11,362,168	689.7	17,287,312	19,421,193	1054.2
Herbicides	1,952,572	2,189,032	82.6	3,574,772	4,163,829	206.4	2,252,972	2,252,972	162.8
Soil sterilants	1,560	1,560	84.1	3,351	3,351	90.5	7,378	7,378	429.4
Biological agents	228,618	228,618	NA	608,038	608,038	NA	5,150,718	5,150,718	NA
Seed treatments	0	0	0.0	89,577	180,333	30.5	21,706	28,287	0.05
Physical agents	0	0	0.0	0	0	0.0	6,642	6,642	2.6
All pesticides	11,162,637	11,432,286	751	18,648,907	19,502,216	1,208	32,582,048	34,722,510	1,709
Disinfectants	**	**	**	398,861	750,856	182.9	74,578	135,365	304.4
Area planted (m ²)*	359,755			669,171			1,430,696		

* Areas grown includes multi-cropping. ** Disinfectants were not collected in 2003. 'NA' not applicable

Note: There have been minor differences in crop range, crop areas and methods used for estimating pesticide use between surveys. Also in 2007 and 2003 glyphosate usage was collected indoors and for the area immediately around the outside of the glasshouse. In 2011 only indoor use was recorded therefore comparisons between herbicide use in these survey years is not possible.

Table 19 Sample and census areas of permanently-protected edible crops in Scotland (m²)

	Census areas	Sampled areas*
Tomatoes	25,179	11,265
Raspberries	242,973	58,100
Strawberries	846,325	625,730
Other fruit	52,105	15,836
Vegetables	99,899	11,879
All edible crops	1,266,481	722,810

* Areas exclude multi-cropping

The 2011 census figures have been adjusted to remove the proportion of crops grown in temporary/spanish tunnels (see method).

Table 20 Raising factors

Size (m ²)	Tomatoes	Raspberries	Strawberries	Other fruit	Vegetables
<2000	49.07	4.18	7.61	33.55	7.38
>2000	1.00	4.18	1.35	3.22	9.26

Table 21 Estimated Standard Errors

Estimated standard errors for the area treated (m²) with pesticide and for weight of active ingredient (kg) applied

Crop	Area SE (%)	Weight SE (%)
Tomatoes	*	*
Strawberries	32	37
Raspberries	32	32
Other fruit	32	18
Vegetables	19	96
All protected edible crops	32	40

Note: The total pesticide treated area and weight applied used to calculate the standard errors excludes biological control agents as no application rates were recorded and therefore the weights are unknown. Disinfectants are also excluded as they are not classed as pesticides.

* Standard errors could not be calculated for tomatoes due to there only being a few active ingredients remaining when biological control agents were removed.

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Correspondence, feedback and enquiries

Enquiries on this publication should be addressed to: Gillian Reay Science and Advice for Scottish Agriculture Pesticides and Wildlife Roddinglaw Rd Edinburgh, EH12 9FJ Telephone: 0131 244 8808; Fax: 0131 244 8926 e-mail: gillian.reay@sasa.gsi.gov.uk	General enquiries on Scottish Government statistics can be addressed to: Office of the Chief Statistician and Performance Scottish Government 4N.06, St Andrews House EDINBURGH EH1 3DG Telephone: (0131) 244 0442 e-mail: statistics.enquiries@scotland.gsi.gov.uk
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The Scottish Government
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