PESTICIDE USAGE SURVEY REPORT 181

SOFT FRUIT
IN GREAT BRITAIN
2001

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P U S G

CONTENTS **Page**

ROUNDING

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

DEFINITIONS

a) 'Pesticide' is used throughout this report to include commercial formulations containing active substances of insecticides, acaricides, molluscicides, fungicides, herbicides, desiccants, soil sterilants, nematicides, and growth regulators.

b) 'Treated area' is the gross area treated with a pesticide, including all repeat applications, some of which may have been applied to the land in preparation for planting and thus may appear as an inappropriate use on that crop.

c) 'Reason for application' indicated in the text is the grower's stated reason for use of that particular pesticide on that crop and may not always seem entirely appropriate.

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

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

QUALITY CONTROL OF DATA

All data are collected by personal interview using fully qualified staff working to standard operating procedures. Paper records are held at Sand Hutton, but individual holdings cannot be identified. Data are entered onto a computer database which has extensive error checking routines associated with the input program. Each item of data is then checked after entry and subsequently, all forms are re-checked by someone other than the original operator. Prior to compilation of the tables, the data are further subjected to a range of computer checks to detect, amongst other things, any values, which, on agronomic grounds, appear suspect. Any thus revealed are further scrutinised, and, if necessary, referred back to the original source. All the tables are prepared by computer once the data set is considered correct, thus eliminating transcription and typographical errors.

SUMMARY

This report presents information on all aspects of pesticide usage during the 2000/2001 growing season on soft fruit crops comprising strawberries, blackcurrants, redcurrants and whitecurrants, gooseberries, raspberries, blackberries, hybridberries and grapevines. Experienced pesticide usage surveyors collected data during visits to 356 holdings growing soft fruit throughout Great Britain. The total area surveyed represented 35% of the total area of soft fruit grown in Great Britain, whilst the area sampled within each region was proportional to the area of soft fruit crops grown in that region. The data on the area of pesticide treatments and the amounts of active substances applied have been raised to give estimates of national pesticide usage.

The area of soft fruit grown in Great Britain had declined by 38% since 1990, but remained similar to that recorded in the last survey in 1998. With the exception of blackcurrants grown for processing, there have been reductions in the areas of all soft fruit crops grown since the last survey. Four crops accounted for over 90% of the total area of soft fruit grown: strawberries, (40%), blackcurrants, (28%), raspberries, (16%), and grapevines (8%). Approximately 28% of the total area of soft fruit crops was grown in South Eastern Region, 21% in Eastern Region, 19% in Scotland, 18% in Midlands and Western Region, 8% in South Western Region, 3% in Northern Region and 2% in Wales.

The total registered pesticide-treated area of soft fruit in Great Britain in 2001 was 35% less (62,931 ha) than in 1990, however there was a 38% decrease in the area of crops grown representing a relative increase in the number of treatments per unit of area. The total pesticide-treated area in 2001 was 4% less than that in 1998, despite the areas being grown in both years being very similar. The total weight of pesticides applied has decreased by 5% since 1990 and by 26% since 1998. This relatively large reduction since 1998 is due almost entirely to the reduction in use of soil sterilants as pre-planting treatments to a limited area of soft fruit crops, in particular strawberries.

Approximately 44% of the total pesticide-treated area was cropped with strawberries, 29% with blackcurrants, 12% with raspberries and 12% with vines.

Fungicides accounted for 54% of the total pesticide-treated area of soft fruit grown in Great Britain in 2001, herbicides 22%, insecticides 7%, sulphur 7%, acaricides 7%, molluscicides and repellents 2%, biological control agents one percent and tar oil, soil sterilants and urea all less than one percent. In contrast, soil sterilants accounted for 45% of the total weight of pesticide active substances applied, fungicides 22%, sulphur 12%, herbicides 11%, tar oil 7%, insecticides 2%, molluscicides one percent and acaricides, biological control agents and urea all less than one percent.

The most extensively-used fungicide formulations applied were dichlofluanid, myclobutanil, tolylfluanid, fenhexamid, chlorothalonil and pyrimethanil. Usage of sulphur was mainly on vines and blackcurrants for processing.

The most extensively-used herbicide formulations were simazine, diquat/paraquat, napropamide, paraquat, glyphosate and dichlobenil.

The organophosphates were the most extensively-used insecticides, accounting for 62% of the insecticide treated area, followed by the carbamates (27%) and the pyrethroids (8%). Two insecticides accounted for approximately 83% of the total insecticide treated area of all soft fruit crops: chlorpyrifos (56%) and pirimicarb (27%).

Two acaricides, fenpropathrin (62%) and bifenthrin (18%), comprised 80% of the total quantity of acaricides applied.

Metaldehyde (56%) and methiocarb (41%) accounted for almost all of the molluscicides recorded.

Usage of biological control agents was minimal, with *Phytoseiulus persimilis* accounting for 51% of the area treated with biological control agents.

The only soil sterilants recorded were methyl bromide, chloropicrin and dazomet.

INTRODUCTION

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

As part of the ongoing process for obtaining data, the Pesticide Usage Survey teams of the Central Science Laboratory, an executive agency of the Department for Environment, Food & Rural Affairs and the Scottish Agricultural Science Agency, an agency of the Scottish Executive Environment and Rural Affairs Department, conducted a survey of pesticide usage on soft fruit crops in 2000/01 by visiting holdings throughout Great Britain during the winter of 2001/02.

This was the third fully coordinated survey of pesticide usage on soft fruit crops throughout Great Britain, but was the tenth survey of pesticide usage on soft fruit in England & Wales. The first pesticide usage survey of soft fruit crops in Great Britain was reported by Garthwaite & Thomas (1996), and the second by Garthwaite & Thomas (2000). Previous surveys of England and Wales have been reported by Sly (1975), Steed *et al*. (1978), Sly (1982), Wilder *et al*. (1987) and Davis *et al*. (1992). Surveys on pesticide usage on soft fruit in Scotland have been reported by Bowen *et al.* (1983), Bowen *et al.* (1990) and Bowen & Dixon. (1992).

Information on all aspects of pesticide usage in Great Britain plus the DEFRA regions of England & Wales can be obtained from the Pesticide Usage Survey team at the Central Science Laboratory, Sand Hutton. Further data related specifically to Scotland can be obtained from the Pesticide Usage Survey team at the Scottish Agricultural Science Agency, Edinburgh.

A list of the most recently published survey reports is shown in the Appendix. Copies of reports on pesticide usage may be purchased from DEFRA Publications, London SE99 7TP (Tel. 01645 556000).

Further information relating to the pesticide usage surveys, including a full list of published reports; reports in a PDF format and future programmes can be found on the team's web site at www.csl.gov.uk/liaison.

METHODS

The samples of holdings to be surveyed were selected using data from the Agricultural Census Returns, June 2000 for England & Wales (Anon., 2001a) and for Scotland (Anon., 2001b).

The samples were drawn from the census returns so as to represent the area of all soft fruit crops grown throughout England, Scotland and Wales. For England & Wales the sample was selected within each of the six old DEFRA regions (Fig. 1), while in Scotland the country was divided into 11 land-use regions (Wood, 1931). The samples were stratified according to the total area of all soft fruit crops grown in each region and by size group based on the total area of soft fruit crops grown on each holding. The area of soft fruit crops sampled in each size group and each region was proportional to the total area of soft fruit crops grown on holdings of each size group in each region.

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

An introductory letter was sent to the occupiers of the selected holdings explaining the purpose of the survey. A total of 356 holdings were visited during the winter of 2001/02 and data collected during a personal interview with the grower conducted by an experienced pesticide usage surveyor. Where a holding listed in the original sample was not able to provide data it was replaced with another from the same size group and region, held on a reserve list.

Raising factors

The pesticide usage data collected from each holding were raised by two factors to give an estimate of regional usage; the first factor being dependent on farm size group and region and the second dependent on crop area and region. The data were further adjusted by a third factor to give estimates of total pesticide usage related to the national cropping areas in Great Britain.

The raising factors were based on the areas of soft fruit crops grown and harvested in 2001 as recorded in the June Agricultural Census Returns both for England & Wales (Anon., 2002a) and Scotland (Anon., 2002b).

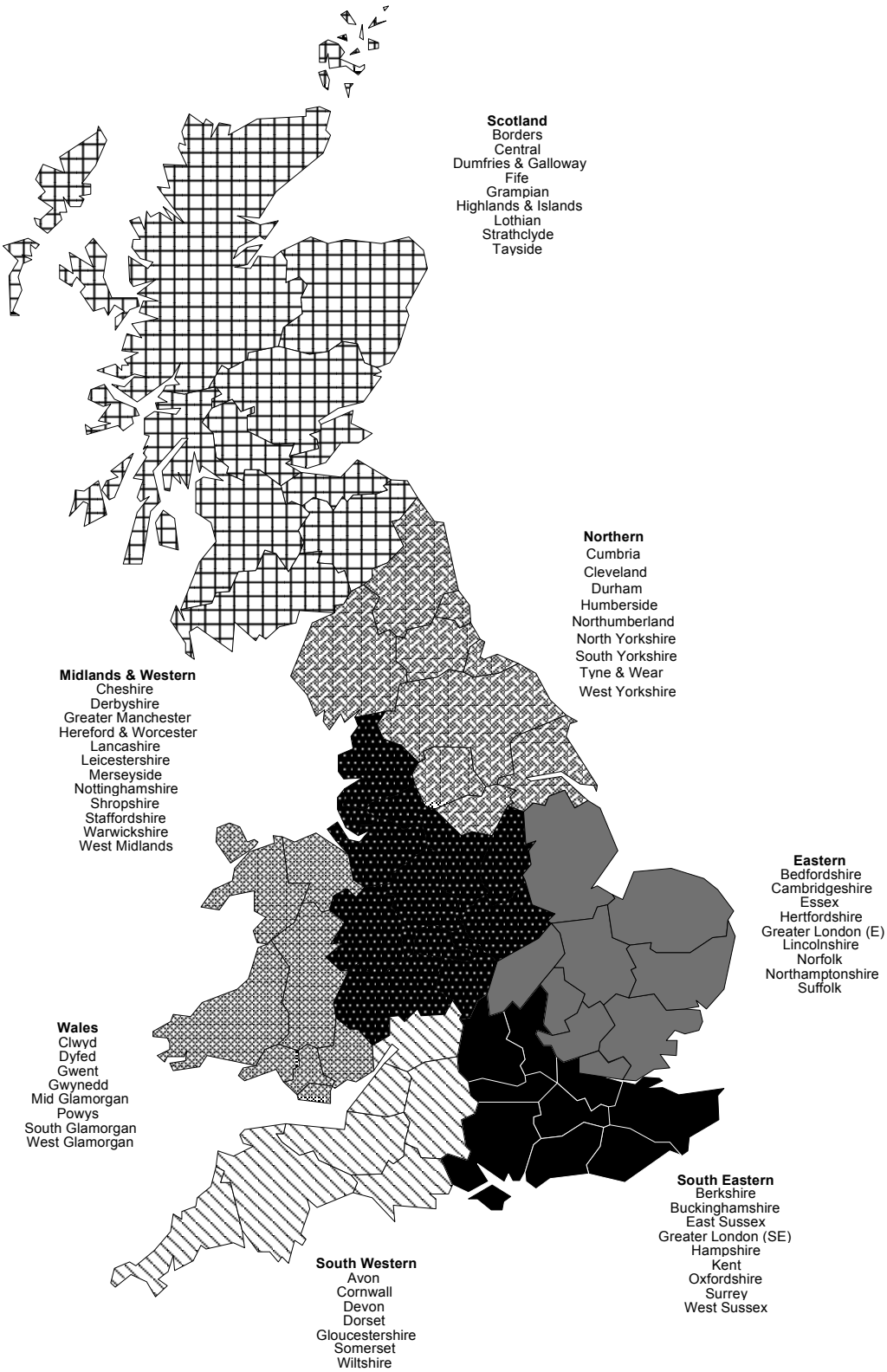
The Questionnaire

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

Form 1 summarised the areas of soft fruit crops grown on the designated holding during the 2000/01 season.

Form 2 dealt with all aspects of pesticide usage on the individual crops grown on the holding and harvested in 2001, a separate form being used for each field. This included chemicals applied prior to planting and as these are subsequently associated with that crop they may appear as inappropriate uses. Certain agronomic details that may have influenced pesticide usage (including mulching, growing systems, intended market, age of plants, use of adjuvants and the volume of spray applied) were also recorded on form 2.

Fig. 1 *Counties in old DEFRA regions of England & Wales and regions covered by SEERAD Scotland*



RESULTS AND DISCUSSION

CROPS

Information concerning eight main types of soft fruit crops and data on pesticide usage were collected from 1,853 examples grown on 356 holdings throughout Great Britain. Crops included in the survey were strawberries; blackcurrants (for fresh market and processing); redcurrants and whitecurrants; gooseberries; raspberries; blackberries; hybrid berries (which included tayberry, loganberry, sunberry, boysenberry, tummelberry, jostaberry and worcesterberry); blueberries and grapevines. The sample accounted for 35% of the total area of soft fruit crops grown in Great Britain during the 2000/01 season.

The areas of each crop grown in the six old MAFF regions of England & Wales plus Scotland are shown in Table 1. Four crops accounted for over 90% of the total area of soft fruit grown: strawberries, (40%), blackcurrants, (28%), raspberries, (16%), and grapevines (8%). Approximately 28% of the total area of soft fruit crops was grown in South Eastern Region, 21% in Eastern Region, 19% in Scotland, 18% in Midlands and Western Region, 8% in South Western Region, 3% in Northern Region and 2% in Wales.

The distribution of most of the crops was similar, although 65% of vines were grown in South Eastern region, 44% of raspberries grown in Scotland and 29% of blackcurrants for processing in Eastern region.

Table 1 *Area of soft fruit crops grown in Great Britain 2001 (hectares)*

	Northern	**Midlands & Western**	**Eastern**	**South Eastern**	**South Western**	**Wales**	**Scotland**	**Great Britain**
Strawberry	231	753	784	1,058	246	64	630	3,765
Blackcurrant - market	21	14	22	67	24	78	28	254
Blackcurrant – for processing	0	520	707	560	228	0	414	2,429
Redcurrant & whitecurrant	6	14	17	103	9	1	20	169
Gooseberry	11	66	48	65	22	3	43	258
Raspberry	53	212	217	252	108	17	672	1,530
Blackberry	2	29	34	30	5	2	4	107
Hybridberries	2	35	46	28	52	1	10	175
Vine	2	32	107	481	100	22	0	745
All soft fruit crops	328	1,675	1,982	2,644	794	188	1,821	9,432

OVERALL USAGE OF PESTICIDES

Regional pesticide usage

Regional pesticide usage very closely approximated to the areas of soft fruit grown, although usage, especially of soil sterilants, was relatively higher in South Eastern Region. Approximately 29% of the pesticide-treated area was in South Eastern Region (28% of the area grown), 20% in Eastern Region (21% of the area grown), 19% in Midlands & Western Region (18% of the area grown), 19% in Scotland (19% of the area grown) and 9% in South Western Region (8% of the area grown).

Pesticide usage on crops

Pesticide usage generally reflected the area of crops grown, although usage was relatively higher on strawberries, vines and blackcurrants than on other soft fruit, especially when compared with raspberries (Table 2). Approximately 44% of the total pesticide-treated area was cropped with strawberries (40% of the area grown), 29% with blackcurrants (28% of the area grown), 12% with raspberries (16% of the area grown) and 12% with vines (8% of the area grown).

Proportion of crops treated

The percentage areas of each crop treated with the different pesticide groups are shown in Table 3 whilst the mean number of spray rounds, products and active substances applied are shown in Tables 4a-c.

Many fungicides and herbicides were applied as products containing more than one active substance, or as product mixtures in the same spray tank, whereas most insecticides were not applied together with other insecticides, though they may well have been applied at the same time as a fungicide or herbicide.

Fungicides were applied to a mean of 85% of the total area of all soft fruit crops, with a mean of 4 applications using 6 products and 6 active substances. Sulphur was applied to a mean of 26% of the soft fruit crops; however, applications were most intensive on vines and blackcurrants for processing. Almost all vines were treated with fungicides and on average received 8 applications with 12 products and 14 active substances. In addition, vines received 5 sulphur applications. Strawberries were the next most intensively treated crop receiving 5 fungicide applications using 8 products and active substances. Blackcurrants for processing were almost as intensively treated, with 5 applications of 6 products and 6 active substances. They additionally received a single sulphur application. In contrast, gooseberries, blackberries and blackcurrants for fresh market received on average only 3 applications, 4 fungicide products and 4 active substances.

Herbicides were applied to a mean of 83% of the total area of soft fruit crops, with an average of two applications using four products and four active substances. However, there was considerable variation within the different crops. Less than 50% of redcurrants and whitecurrants received a herbicide application, whereas over 90% of blackcurrants for processing were treated. Blackcurrants for processing, the crop most extensively treated with herbicides, received on average two applications with three products and three active substances.

On average 56% of soft fruit crops received an insecticide treatment. Usage was most extensive on raspberries, with over 75% of the crop being treated, and least extensive on vines, on which no insecticides were recorded. Most insecticide products used on soft fruit had only one active substance.

Acaricides were used on 41% of the total area of soft fruit crops, with one spray, one product and one active substance being the average amount used. However, because of the problem with big bud mite, 91% of blackcurrants grown for processing received an acaricide, as did 45% of blackcurrants grown for the fresh market. Blackcurrants for processing received two applications of acaricide, with two products and two active substances. Of the remaining crops, less than 36% received an acaricide.

Molluscicides and repellents were applied to 23% of the area of all crops and were proportionately most extensively-used on strawberries.

Other pesticides, including biological control agents, tar oils, soil sterilants and urea accounted for 8% of all applications. Usage of soil sterilants was confined mainly to strawberries prior to planting, while tar oil usage was predominantly on vines and bush fruit. The use of biological control agents, in particular *Phytoseiulus persimilis* and *Amblyseius spp*. was confined mainly to strawberries and raspberries grown in French or Spanish tunnels.

Three percent of all crops grown remained untreated, with almost all blackcurrants grown for processing being treated. The most intensively treated crops were vines, with eleven spray applications, twenty products and twenty-one active substances. Strawberries were less intensively treated receiving on average nine spray applications, fourteen products and fourteen active substances. Over 10% of all blackcurrants for the fresh market and hybridberries remained untreated.

Table 2 *Treated area of soft fruit crops in Great Britain 2001 by crop group (spray hectares)*

Chemical group	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Insecticides & nematicides	3,668	45	2,185	35	136	2,237	127	70	.	8,504
Fungicides	29,744	561	15,914	413	1,201	7,514	458	344	8,754	64,904
Herbicides	12,848	384	6,596	165	467	4,159	247	258	968	26,092
Molluscicides & repellents	2,307	37	267	.	.	24	4	.	11	2,650
Acaricides	2,393	171	5,051	19	5	53	5	3	162	7,862
Biological control agents	807	.	.	.	.	47	.	.	.	854
Soil sterilants	158	.	.	.	.	2	.	.	.	160
Tar oils/acids	.	2	.	.	30	3	.	.	262	298
Sulphur	598	36	3,238	19	4	142	4	.	3,956	7,997
Urea	15	5	119	1	.	17	.	.	.	158
All pesticides	52,538	1,240	33,370	653	1,844	14,198	845	677	14,113	119,477

Table 3 *Usage of pesticides on soft fruit crops in Great Britain 2001 - percentage area of crops treated with pesticides*

Crop	Insecticides	Fungicides	Sulphur	Herbicides	Acaricides	Molluscicides & repellents	Other pesticides	Not treated
Strawberry	61.1	88.3	5.6	82.0	36.0	49.3	13.4	1.5
Blackcurrant - market	16.7	42.9	14.2	62.9	44.9	14.8	0.6	20.3
Blackcurrant – for processing	61.8	89.4	62.2	92.4	90.8	8.3	.	0.4
Redcurrant & whitecurrant	20.4	39.2	6.3	46.3	7.7	0.1	.	6.6
Gooseberry	42.7	83.5	1.6	80.6	1.9	.	11.9	9.2
Raspberry	75.6	86.0	2.6	87.0	3.8	1.7	2.0	4.8
Blackberry	62.8	82.8	3.4	76.1	4.4	3.9	.	4.7
Hybridberries	28.8	48.5	.	68.9	1.8	0.1	0.2	12.4
Vine	.	92.2	90.8	63.7	10.6	1.6	27.5	4.2
All crops	56.0	85.3	26.3	82.6	41.2	22.6	8.0	3.0

Table 4a *Usage of pesticides on soft fruit crops in Great Britain 2001 - number of spray rounds applied to crops*

Crop	Insecticides	Fungicides	Sulphur	Herbicides	Acaricides	Molluscicides & repellents	Other pesticides	All pesticides
Strawberry	1.0	5.3	0.1	2.3	0.5	0.6	0.3	9.2
Blackcurrant - market	0.3	2.7	< 0.1	1.7	0.8	< 0.1	< 0.1	4.9
Blackcurrant – for processing	0.9	4.5	1.3	2.1	1.8	0.1	.	8.0
Redcurrant & whitecurrant	0.4	2.5	< 0.1	1.6	0.3	< 0.1	.	4.4
Gooseberry	0.4	3.3	< 0.1	1.7	< 0.1	.	< 0.1	5.2
Raspberry	1.3	3.6	< 0.1	1.8	< 0.1	< 0.1	0.1	6.2
Blackberry	0.8	3.3	0.1	1.5	0.1	0.1	.	5.5
Hybridberries	0.6	2.7	.	1.5	< 0.1	< 0.1	< 0.1	4.6
Vine	.	7.8	5.2	1.2	0.2	< 0.1	0.3	10.5
All crops	0.9	4.3	0.4	1.9	0.5	0.2	0.2	7.3

Table 4b *Usage of pesticides on soft fruit crops in Great Britain 2001 - number of products applied to crops*

Crop	Insecticides	Fungicides	Sulphur	Herbicides	Acaricides	Molluscicides & repellents	Other pesticides	All pesticides
Strawberry	1.0	7.9	0.1	3.5	0.6	0.6	0.3	14.0
Blackcurrant - market	0.3	3.7	< 0.1	2.5	0.8	< 0.1	< 0.1	7.3
Blackcurrant – for processing	0.9	6.3	1.3	3.1	1.9	0.1	.	13.5
Redcurrant & whitecurrant	0.4	3.3	< 0.1	2.3	0.3	< 0.1	.	6.4
Gooseberry	0.4	4.2	< 0.1	2.5	< 0.1	.	< 0.1	7.2
Raspberry	1.3	4.2	< 0.1	2.9	< 0.1	< 0.1	0.1	8.7
Blackberry	0.8	3.7	0.1	2.4	0.1	0.1	.	7.1
Hybridberries	0.6	3.1	.	2.2	< 0.1	< 0.1	< 0.1	5.9
Vine	.	12.4	5.2	1.3	0.2	< 0.1	0.3	19.5
All crops	0.9	6.0	0.4	2.9	0.5	0.2	0.2	11.1

Table 4c *Usage of pesticides on soft fruit crops in Great Britain 2001 - number of active substances applied to crops*

Crop	Insecticides	Fungicides	Sulphur	Herbicides	Acaricides	Molluscicides & repellents	Other pesticides	All pesticides
Strawberry	1.0	8.0	0.1	3.8	0.6	0.6	0.3	14.3
Blackcurrant - market	0.3	3.7	< 0.1	2.8	0.8	< 0.1	< 0.1	7.6
Blackcurrant – for processing	0.9	6.3	1.3	3.4	1.9	0.1	.	13.9
Redcurrant & whitecurrant	0.4	3.3	< 0.1	2.6	0.3	< 0.1	.	6.6
Gooseberry	0.4	4.2	< 0.1	2.8	< 0.1	.	< 0.1	7.6
Raspberry	1.3	4.7	< 0.1	3.4	< 0.1	< 0.1	0.1	9.6
Blackberry	0.8	3.7	0.1	2.8	0.1	0.1	.	7.5
Hybridberries	0.6	3.2	.	2.5	< 0.1	< 0.1	< 0.1	6.3
Vine	.	13.7	5.2	1.4	0.2	< 0.1	0.3	20.8
All crops	0.9	6.1	0.4	3.3	0.5	0.2	0.2	11.6

EXTENT AND QUANTITIES OF PESTICIDE FORMULATIONS USED

The estimated total areas of each crop treated in Great Britain with each pesticide formulation are illustrated in Table 5, whilst the estimated total quantities of pesticide active substances used in each formulation are shown in Table 6.

Fungicides accounted for 54% of the total pesticide-treated area of soft fruit grown in Great Britain in 2001, herbicides 22%, insecticides 7%, sulphur 7%, acaricides 7%, molluscicides and repellents 2%, biological control agents one percent and tar oil, soil sterilants and urea all less than one percent. In contrast, soil sterilants accounted for 45% of the total weight of pesticide active substances applied, fungicides 22%, sulphur 12%, herbicides 11%, tar oil 7%, insecticides 2%, molluscicides one percent and acaricides, biological control agents and urea all less than one percent.

The most extensively-used fungicide formulations applied as sprays were dichlofluanid (used principally on strawberries, raspberries and blackcurrants for processing), myclobutanil (used on all crops with the exception of vines, with 60% being used on strawberries), tolylfluanid (used predominantly on strawberries, blackcurrants for processing and raspberries), fenhexamid (again used on all crops with the exception of vines, but with over 70% of usage on strawberries), chlorothalonil (with over 76% of usage being on blackcurrants for processing) and pyrimethanil (used on all crops with the exception of gooseberries, with over 58% being used on strawberries).

Usage of sulphur was mainly on vines and blackcurrants for processing, accounting for 49% and 40% of the total respectively.

The most extensively-used herbicide formulation, simazine (accounting for 16% of all herbicide applications), was used principally on strawberries and blackcurrants for processing. Diquat/paraquat, was again used principally on strawberries and blackcurrants. Napropamide and paraquat were used mainly on strawberries. The use of the granular applied herbicide, dichlobenil, was confined mainly to blackcurrants for processing where 83% of all usage was recorded. Together, strawberries and blackcurrants for processing accounted for 75% of the total herbicide usage.

The organophosphates were the most extensively-used insecticides, accounting for 62% of the insecticide treated area, followed by the carbamates (27%) and the pyrethroids (8%). Two insecticides accounted for approximately 83% of the total insecticide treated area of all soft fruit crops: chlorpyrifos (56%) and pirimicarb (27%). Other extensively-used insecticides included deltamethrin, fenitrothion and cypermethrin.

Two acaricides, fenpropathrin, (62%) and bifenthrin (18%), comprised 80% of the total quantity of acaricides applied. Usage on blackcurrants for processing accounted for 64% of the total acaricide treated area, with a further 30% being used on strawberries. Tebufenpyrad, clofentezine and endosulfan were also extensively-used.

Usage of molluscicides was confined mainly to strawberries with some usage on blackcurrants for processing. Metaldehyde (56%) and methiocarb (41%) accounted for almost all of the molluscicides recorded.

Usage of biological control agents was minimal, with *Phytoseiulus persimilis* accounting for 51% of the area treated with biological control agents.

The only soil sterilants recorded were methyl bromide, chloropicrin and dazomet. Together these accounted for less than one percent of the area treated but for 45% of the weight of all pesticides applied.

Table 5 *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (spray hectares)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Fungicides										
Bupirimate	2,857	25	226	12	161	343	1	2	19	3,645
Chlorothalonil	246	111	3,199	30	50	482	51	2	10	4,182
Copper oxychloride	12	.	66	.	.	3	66	9	693	849
Copper oxychloride/metalaxyl	119	.	.	.	.	48	.	.	803	970
Dichlofluanid	3,617	66	1,991	67	193	2,790	108	138	783	9,752
Dinocap	4	1	.	1	.	.	.	.	1,972	1,978
Dodine	.	11	411	5	2	.	.	.	.	429
Fenarimol	472	57	942	16	46	131	.	.	273	1,938
Fenhexamid	3,207	17	430	30	32	304	24	8	332	4,384
Fenpropimorph	2,169	20	1,123	32	106	65	6	6	.	3,526
Fosetyl-aluminium	1,613	.	.	.	.	4	4	.	79	1,701
Iprodione	2,857	4	.	2	27	299	.	3	412	3,605
Kresoxim-methyl	173	.	.	.	.	.	.	.	.	173
Mancozeb	.	7	1,363	9	2	.	.	.	1,563	2,944
Mancozeb/oxadixyl	.	.	.	.	.	631	1	6	.	638
Mancozeb/zoxamide	.	.	.	.	.	.	.	.	197	197
Myclobutanil	5,771	138	2,840	115	424	323	22	13	.	9,644
Penconazole	7	47	679	3	20	6	.	.	.	763
Pyrifenox	1,492	6	636	10	11	52	.	.	.	2,207
Pyrimethanil	2,324	4	619	32	.	124	12	4	915	4,034
Thiram	600	1	.	.	.	131	1	23	.	755
Tolylfluanid	1,750	40	1,374	47	102	1,197	157	117	251	5,037
Triadimefon	230	.	.	1	5	426	1	10	442	1,114
Other fungicides[1]	225	6	16	.	21	153	5	5	10	440
All fungicides	29,744	561	15,914	413	1,201	7,514	458	344	8,754	64,904
Sulphur										
Sulphur	598	36	3,238	19	4	142	4	.	3,956	7,997

[1]Other fungicides include azoxystrobin, benomyl, Bordeaux mixture, bupirimate/triforine, captan, carbendazim, cupric ammonium carbonate, fenhexamid/tolylfluanid, mepanipyrim, metalaxyl-M, triadimenol, triforine, unspecified fungicides, vinclozolin and zineb.

Table 5 (cont.) *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (spray hectares)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Herbicides										
Bromacil	19	4	.	1	.	194	28	30	.	277
Chlorthal-dimethyl	119	.	.	.	.	17	.	1	.	137
Clopyralid	789	1	.	.	7	68	.	.	.	866
Dichlobenil	.	43	1,393	32	74	112	7	25	.	1,685
Diquat/paraquat	1,173	36	782	11	38	794	53	31	.	2,918
Diuron	28	3	443	4	19	.	.	.	19	516
Fluazifop-P-butyl	661	9	54	10	10	55	4	4	.	806
Glufosinate-ammonium	559	10	381	6	8	205	9	4	146	1,328
Glyphosate	346	18	714	6	22	78	3	32	566	1,784
Isoxaben	1,063	22	156	20	57	206	8	14	.	1,547
Lenacil	216	.	.	.	.	8	.	2	.	226
MCPB	6	4	140	.	5	13	.	1	.	169
Napropamide	1,353	19	103	4	9	503	47	28	.	2,068
Oxadiazon	15	27	464	6	16	170	2	8	26	734
Paraquat	954	39	221	17	48	531	20	23	178	2,031
Pendimethalin	1,212	20	99	14	43	148	28	18	.	1,582
Phenmedipham	643	.	.	.	.	.	.	.	.	643
Propachlor	900	3	.	1	4	18	.	.	.	926
Propyzamide	573	52	172	9	24	109	10	7	.	954
Simazine	1,869	65	1,370	21	52	661	26	27	21	4,113
Sodium monochloroacetate	.	.	10	.	.	168	1	2	.	181
Other herbicides[1]	351	9	96	.	30	99	1	1	13	601
All herbicides	12,848	384	6,596	165	467	4,159	247	258	968	26,092

[1]Other herbicides include 2,4-D, 2,4-D/dicamba/mecoprop, 2,4-D/dichlorprop/MCPA/mecoprop, amitrole, asulam, atrazine, bromoxynil/ioxynil, clopyralid/triclopyr, cycloxydim, dicamba/MCPA/mecoprop-P, diquat, ethofumesate, fluroxypyr, MCPA, mecoprop, metsulfuron-methyl, propaquizafop, sethoxydim, tepraloxydim, trifluralin and unspecified herbicides.

Table 5 (cont.) *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (spray hectares*)

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Insecticides & nematicides										
Carbamate										
Pirimicarb	819	6	1,026	3	5	409	6	3	.	2,277
Natural										
Nicotine	69	.	.	.	1	78	.	.	.	148
Organophosphate										
Chlorpyrifos	2,402	35	1,010	30	76	1,076	65	52	.	4,747
Dimethoate	193	.	.	.	14	.	.	.	.	207
Fenitrothion	7	1	.	.	.	251	1	4	.	264
Pyrethroid										
Cypermethrin	77	1	148	.	17	10	2	1	.	255
Deltamethrin	.	.	.	.	.	350	40	7	.	398
Other insecticides & nematicides[1]	100	3	.	2	23	63	12	4	.	207
All insecticides & nematicides	3,668	45	2,185	35	136	2,237	127	70	.	8,504
Acaricides										
Bifenthrin	1,140	2	54	.	1	34	.	.	162	1,393
Clofentezine	365	2	2	1	.	13	.	.	.	383
Endosulfan	3	13	267	9	2	.	3	.	.	297
Fenpropathrin	15	154	4,688	9	3	.	2	3	.	4,873
Tebufenpyrad	621	.	.	.	.	.	.	.	.	621
Tetradifon	197	.	41	.	.	.	.	.	.	237
Other acaricides[2]	53	.	.	.	.	6	.	.	.	59
All acaricides	2,393	171	5,051	19	5	53	5	3	162	7,862

[1]Other insecticides and nematicides include heptenophos, lambda-cyhalothrin, malathion, petroleum oil and rotenone.

[2]Other acaricides include dicofol, dicofol/tetradifon and fenbutatin oxide.

Table 5 (cont.) *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (spray hectares)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Biological controls and pollinators										
Amblyseius spp.	175	.	.	.	.	5	.	.	.	181
Phytoseiulus persimilis	398	.	.	.	.	37	.	.	.	435
Other biological controls and pollinators[1]	234	.	.	.	.	5	.	.	.	239
All biological controls and pollinators	807	.	.	.	.	47	.	.	.	854
Soil sterilants										
Other soil sterilants[2]	158	.	.	.	.	2	.	.	.	160
Tar oil/acids										
Tar oil	.	2	.	.	30	3	.	.	262	298
Urea										
Urea	15	5	119	1	.	17	.	.	.	158
Molluscicides										
Metaldehyde	1,196	37	245	.	.	11	4	.	.	1,493
Methiocarb	1,063	.	22	.	.	13	.	.	.	1,097
Other molluscicides[3]	48	.	.	.	.	.	.	.	11	59
All molluscicides	2,307	37	267	.	.	24	4	.	11	2,650

[1] Other biological controls and pollinators include *Amblyseius cucumeris*, *Aphidius colemani*, *Bacillus thuringiensis*, bumble bee, *Heterorhabditis megidis*, *Steinernema carpocapsae* and *Steinernema feltiae*.

[2] Other soil sterilants include chloropicrin, dazomet and methyl bromide.

[3] Other molluscicides include thiodicarb and unspecified molluscicides.

Table 6 *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (kg active substance applied)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Fungicides										
Bupirimate	928	9	56	4	40	112	.	.	10	1,160
Chlorothalonil	287	257	3,324	59	115	502	113	3	7	4,669
Copper oxychloride	3	.	29	.	.	8	95	16	695	845
Copper oxychloride/metalaxyl	429	.	.	.	.	99	.	.	391	919
Dichlofluanid	5,811	72	1,450	86	148	4,025	177	236	438	12,442
Dinocap	2	.	.	.	.	.	.	.	684	687
Dodine	.	4	122	2	.	.	.	.	.	128
Fenarimol	18	2	37	1	2	5	.	.	14	79
Fenhexamid	2,252	9	310	23	22	187	17	6	283	3,109
Fenpropimorph	1,524	11	545	23	77	44	4	4	.	2,232
Fosetyl-aluminium	4,571	.	.	.	.	13	12	.	149	4,746
Iprodione	1,923	1	.	1	17	180	.	2	226	2,349
Kresoxim-methyl	24	0	.	.	.	.	.	.	.	24
Mancozeb	.	8	1,538	10	4	.	.	.	3,546	5,105
Mancozeb/oxadixyl	.	.	.	.	.	2,566	3	28	.	2,597
Mancozeb/zoxamide	.	.	.	.	.	.	.	.	203	203
Myclobutanil	408	11	241	10	33	19	2	1	.	724
Penconazole	.	2	22	.	1	.	.	.	.	27
Pyrifenox	117	.	51	1	1	4	.	.	.	174
Pyrimethanil	1,459	3	424	24	.	69	10	3	659	2,651
Thiram	948	1	.	.	.	164	1	40	.	1,154
Tolylfluanid	2,426	52	996	45	99	1,690	243	192	288	6,032
Triadimefon	11	.	.	.	1	19	.	.	22	52
Other fungicides[1]	169	2	2	.	4	100	3	2	7	288
All fungicides	23,310	445	9,147	288	562	9,807	680	535	7,620	52,396
Sulphur										
Sulphur	798	175	19,426	83	4	220	22	.	8,839	29,566

[1] Other fungicides include azoxystrobin, benomyl, Bordeaux mixture, bupirimate/triforine, captan, carbendazim, cupric ammonium carbonate, fenhexamid/tolylfluanid, mepanipyrim, metalaxyl-M, triadimenol, triforine, vinclozolin and zineb.

Table 6 (cont.) *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (kg active substance applied)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Herbicides										
Bromacil	8	5	.	2	.	218	22	32	.	287
Chlorthal-dimethyl	408	.	.	.	3	39	.	2	.	452
Clopyralid	92	.	.	.	1	9	.	.	.	102
Dichlobenil	.	141	4,419	119	245	483	35	107	.	5,549
Diquat/paraquat	614	21	329	5	19	400	36	22	.	1,447
Diuron	14	2	210	1	12	.	.	.	42	281
Fluazifop-P-butyl	155	3	7	3	3	10	1	1	.	182
Glufosinate-ammonium	172	4	143	2	3	84	4	1	51	465
Glyphosate	370	20	573	8	21	95	3	25	553	1,668
Isoxaben	250	6	40	4	8	32	1	4	.	345
Lenacil	129	.	.	.	.	3	.	2	.	134
MCPB	7	7	310	.	7	30	.	1	.	363
Napropamide	2,486	53	93	13	23	929	101	67	.	3,766
Oxadiazon	5	27	394	9	15	81	2	7	20	560
Paraquat	472	23	107	9	20	226	9	13	131	1,012
Pendimethalin	1,733	37	95	25	48	170	25	21	.	2,154
Phenmedipham	272	.	.	.	.	.	.	.	.	272
Propachlor	2,700	6	.	3	12	54	.	.	.	2,775
Propyzamide	336	35	80	8	20	57	8	5	.	548
Simazine	1,150	56	1,154	18	45	597	31	26	11	3,088
Sodium monochloroacetate	.	.	222	.	.	1,357	7	18	.	1,604
Other herbicides[1]	159	6	69	1	16	130	1	1	1	383
All herbicides	11,532	452	8,245	233	521	5,005	286	355	808	27,437

[1]Other herbicides include 2,4-D, 2,4-D/dicamba/mecoprop, 2,4-D/dichlorprop/MCPA/mecoprop, amitrole, asulam, atrazine, bromoxynil/ioxynil, clopyralid/triclopyr, cycloxydim, dicamba/MCPA/mecoprop-P, diquat, ethofumesate, fluroxypyr, MCPA, mecoprop, metsulfuron-methyl, propaquizafop, sethoxydim, tepraloxydim and trifluralin.

Table 6 (cont.) *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (kg active substance applied)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Insecticides & nematicides										
Carbamate										
Pirimicarb	186	1	141	1	1	61	1	1	.	393
Natural										
Nicotine	24	.	.	.	1	34	.	.	.	59
Organophosphate										
Chlorpyrifos	1,532	20	493	17	45	524	31	25	.	2,686
Dimethoate	50	.	.	.	4	.	.	.	.	54
Fenitrothion	7	1	.	.	.	103	1	3	.	114
Pyrethroid										
Cypermethrin	2	.	4	.	.	.	.	.	.	7
Deltamethrin	.	.	.	.	.	5	1	.	.	6
Other insecticides & nematicides[1]	55	.	.	.	.	4	1	6	.	67
All insecticides & nematicides	1,856	22	638	18	52	732	34	34	.	3,386
Acaricides										
Bifenthrin	42	.	2	.	.	1	.	.	3	49
Clofentezine	69	.	.	.	.	3	.	.	.	72
Endosulfan	1	7	58	5	1	.	1	.	.	73
Fenpropathrin	1	13	320	1	.	.	.	.	.	335
Tebufenpyrad	84	.	.	.	.	.	.	.	.	84
Tetradifon	53	.	11	.	.	.	.	.	.	65
Other acaricides[2]	42	.	.	.	.	2	.	.	.	44
All acaricides	292	20	393	6	1	6	1	.	3	723

[1] Other insecticides & nematicides include heptenophos, lambda-cyhalothrin, malathion, petroleum oil and rotenone.

[2] Other acaricides include dicofol, dicofol/tetradifon and fenbutatin oxide.

Table 6 (cont.) *Usage of pesticides on soft fruit crops grown in Great Britain, 2001 (kg active substance applied)*

	Strawberry	Blackcurrant fresh market	Blackcurrant processing	Redcurrant & whitecurrant	Gooseberry	Raspberry	Blackberry	Hybridberries	Vine	All crops
Biological controls and pollinators										
Other biological controls and pollinators [1]	6	.	.	.	.	.	.	.	.	6
Soil sterilants										
Other soil sterilants[2]	106,643	.	.	.	.	2,071	.	.	.	108,714
Tar oil/acids										
Tar oil	.	181	.	.	1,880	37	.	5	15,361	17,465
Urea										
Urea	28	7	217	2	.	30	.	.	.	283
Molluscicides										
Metaldehyde	824	7	146	.	.	6	4	.	.	987
Methiocarb	208	.	1	.	.	4	.	.	.	213
Other molluscicides[3]	13	.	.	.	.	.	.	.	2	16
All molluscicides	1,045	7	147	.	.	10	4	.	2	1,215

[1] Other biological controls and pollinators include *Amblyseius cucumeris*, *Aphidius colemani*, *Bacillus thuringiensis*, bumble bee, *Heterorhabditis megidis*, *Steinernema carpocapsae* and *Steinernema feltiae*.

[2] Other soil sterilants include chloropicrin, dazomet and methyl bromide.

[3] Other molluscicides include thiodicarb and unspecified molluscicides.

EXTENT AND QUANTITIES OF ACTIVE SUBSTANCES USED

The 50 most extensively-used pesticide active substances on all soft fruit crops in Great Britain in 2001 are listed in descending order of area treated in Table 7. A similar list showing the 50 most used active substances in descending order of amount applied is presented in Table 8. The rating of active substances varies in each list depending upon their extent of usage, rate of application, relative activity per unit weight and their relative proportions in formulated products, especially for those products which contain more than one active substance.

Relatively new active substances showing major increases in area treated since 1998 included fenhexamid, tebufenpyrad and tolylfluanid. Other, more established, active substances showing an increase since 1998 included dinocap, dichlobenil, fenpropathrin, mancozeb, dodine, sulphur and fosetyl-aluminium. Significant reductions in use were seen in endosulfan (down 82%), fenarimol (56%), dichlofluanid (55%), oxadixyl (53%), triadimefon (48%), copper oxychloride (43%), tetradifon (42%) and iprodione (41%).

The ten most extensively-used active substances included five fungicides, two herbicides, sulphur, one acaricide and one insecticide. Tolylfluanid, fenpropathrin, chlorpyrifos and fenhexamid were the only active substances not included in the first ten in 1998. Usage of dichlofluanid, the most widely used fungicide, showed a decrease in its total treated area of 55% since 1998, with its weight falling by 58%. As has already been stated the use of the fungicides tolylfluanid and fenhexamid, both only new introductions in 1998, increased dramatically since the last survey. The two major herbicides paraquat and simazine both showed reductions in the areas treated and weight applied. Usage of the acaricide, fenpropathrin, more than doubled since 1998, whereas the use of the insecticide chlorpyrifos increased by 39%.

The use of sulphur, number 3 in terms of area treated, number 2 by weight, increased by 83% in terms of area treated, but by 90% in terms of the weight applied, reflecting its increased use in vines and blackcurrants for processing and the relatively high rates used on these crops.

The most extensively-used fungicide active substances by area treated were: dichlofluanid, recorded on all crops; myclobutanil, increasing by 35% since 1998; tolylfluanid; fenhexamid; chlorothalonil, increasing in usage by 3% since 1998 and being used predominantly on blackcurrants for processing; pyrimethanil, the usage of which remained relatively unchanged and mancozeb, mainly used on blackcurrants for processing and vines with the area treated more than doubling since the last survey. In terms of amount applied, dichlofluanid was still the most commonly used fungicide, with mancozeb (used at high rates of application on raspberries) and tolylfluanid also being included in the top ten.

Paraquat was the most extensively-used herbicide on soft fruit crops, being used in particular on both strawberries and raspberries for inter-row weed control. Simazine was the second most extensively-used herbicide active substance, principally on strawberries, blackcurrants for processing and raspberries. Both active substances showed declines in both the areas treated and weight applied. Other extensively-used active substances were: diquat, used mainly in formulated mixtures with paraquat as an inter-row application on strawberries, blackcurrants for processing and raspberries and decreasing by 17% since the last survey; napropamide, used mainly on strawberries, with its use increasing by 9% since 1998; glyphosate, which was used on all crops, but particularly on blackcurrants for processing, vines and strawberries, normally pre-planting, inter-row or when the crop was dormant. By weight, dichlobenil, with its high rate of application, was the major herbicide used (Table 8) appearing at number 9. Other extensively-used herbicides by weight were napropamide, simazine and propachlor.

Of the insecticides only chlorpyrifos appeared in the top ten by area treated, however pirimicarb and deltamethrin were recorded in the top 50 at 17and 46 respectively. Both chlorpyrifos and deltamethrin showed increases of 39% and 45% respectively, whereas use of pirimicarb decreased by 9%. Usage of both chlorpyrifos and pirimicarb was predominantly on strawberries, raspberries and blackcurrants for processing, whereas deltamethrin usage was confined mainly to raspberries. By weight applied, chlorpyrifos appeared at number 16, increasing by 8% since 1998 with pirimicarb at number 36, decreasing by 12% over the same period.

The most extensively-used acaricide, fenpropathrin, appeared at number 6 by area treated, and was used mainly for the control of big bud mite on blackcurrants for processing, but showed a 145% increase since 1998. The use of bifenthrin, used mainly for the control of two-spotted spider mite on strawberries, increased by 9% since 1998. Endosulfan, again used for the control of big bud mite on blackcurrants and tarsonemid mite on strawberries, continued to decline and its use was 82% less than that recorded in 1998. The use of tebufenpyrad increased by almost 50 times since 1998 whilst that of clofentezine increased by 24% over the same period. By weight fenpropathrin was the only acaricide in the top 50.

The soil sterilants, methyl bromide, dazomet and chloropicrin, used on only 160 hectares in total and not occurring in the top 50 by area treated, appeared at numbers 1, 5 and 7 respectively by weight, again reflecting their high rates of application. Most usage, 99%, was confined to pre-planting treatments to maiden strawberry crops.

Tar oil, the use of which was confined mainly to vines and raspberries as a winter wash, appeared at number 48 in the top 50 in terms of area treated, but appeared at number 3 in terms of weight applied.

Table 7 *Estimated area (ha) of application of the fifty most extensively-used active substances on all soft fruit crops surveyed in 2001 in Great Britain*

	Active substance	Area treated (ha)	Area treated 1998 (ha)	% change on 1998	Movement
1	Dichlofluanid	9,752	21,628	-55	↓
2	Myclobutanil	9,644	7,143	35	↑
3	Sulphur	7,997	4,369	83	↑
4	Tolylfluanid	5,060	127	3,876	↑
5	Paraquat	4,949	6,268	-21	↓
6	Fenpropathrin	4,873	1,993	145	↑
7	Chlorpyrifos	4,747	3,412	39	↑
8	Fenhexamid	4,407	56	7,796	↑
9	Chlorothalonil	4,182	4,051	3	↑
10	Simazine	4,113	4,605	-11	↓
11	Pyrimethanil	4,034	3,996	1	↑
12	Mancozeb	3,779	1,858	103	↑
13	Bupirimate	3,686	4,718	-22	↓
14	Iprodione	3,605	6,097	-41	↓
15	Fenpropimorph	3,526	3,183	11	↑
16	Diquat	2,920	3,513	-17	↓
17	Pirimicarb	2,277	2,498	-9	↓
18	Pyrifenox	2,207	1,673	32	↑
19	Napropamide	2,068	1,888	9	↑
20	Dinocap	1,978	50	3,894	↑
21	Fenarimol	1,938	4,364	-56	↓
22	Copper oxychloride	1,819	3,169	-43	↓
23	Glyphosate	1,784	1,660	8	↑
24	Fosetyl-aluminium	1,701	1,028	65	↑
25	Dichlobenil	1,685	683	147	↑
26	Pendimethalin	1,582	1,722	-8	↓
27	Isoxaben	1,547	1,947	-21	↓
28	Metaldehyde	1,537	1,415	9	↑
29	Bifenthrin	1,393	1,274	9	↑
30	Glufosinate-ammonium	1,328	1,487	-11	↓
31	Triadimefon	1,114	2,126	-48	↓
32	Methiocarb	1,097	1,244	-12	↓
33	Metalaxyl	970	1,430	-32	↓
34	Propyzamide	954	1,368	-30	↓
35	Propachlor	926	1,326	-30	↓
36	Clopyralid	869	1,169	-26	↓
37	Fluazifop-P-butyl	806	674	20	↑
38	Penconazole	763	822	-7	↓
39	Thiram	755	1,162	-35	↓
40	Oxadiazon	734	495	48	↑
41	Phenmedipham	643	582	10	↑
42	Oxadixyl	638	1,370	-53	↓
43	Tebufenpyrad	621	13	4,509	↑
44	Diuron	516	407	27	↑
45	Dodine	429	226	90	↑
46	Deltamethrin	398	275	45	↑
47	Clofentezine	383	308	24	↑
48	Tar oil	298	244	22	↑
49	Endosulfan	297	1,624	-82	↓
50	Tetradifon	280	480	-42	↓

Table 8 *Estimated amount (kg) of the fifty most extensively-used active substances on all soft fruit crops surveyed in 2001 in Great Britain*

	Active substance	Amount used (kg)	Amount used 1998 (kg)	% change on 1998	Movement
1	Methyl bromide	92,298	173,976	-47	↓
2	Sulphur	29,566	15,587	90	↑
3	Tar oil	17,465	7,950	120	↑
4	Dichlofluanid	12,442	29,346	-58	↓
5	Dazomet	9,271	9,443	-2	↓
6	Mancozeb	7,489	6,096	23	↑
7	Chloropicrin	7,145	9,938	-28	↓
8	Tolylfluanid	6,057	250	2,327	↑
9	Dichlobenil	5,549	1,329	318	↑
10	Fosetyl-aluminium	4,746	2,733	74	↑
11	Chlorothalonil	4,669	6,187	-25	↓
12	Napropamide	3,766	4,033	-7	↓
13	Fenhexamid	3,121	26	.	↑
14	Simazine	3,088	3,900	-21	↓
15	Propachlor	2,775	5,267	-47	↓
16	Chlorpyrifos	2,686	2,490	8	↑
17	Pyrimethanil	2,651	2,376	12	↑
18	Iprodione	2,349	3,755	-37	↓
19	Fenpropimorph	2,232	2,124	5	↑
20	Pendimethalin	2,154	2,772	-22	↓
21	Paraquat	1,876	2,261	-17	↓
22	Glyphosate	1,668	1,558	7	↑
23	Sodium monochloroacetate	1,604	5,369	-70	↓
24	Copper oxychloride	1,488	3,197	-53	↓
25	Bupirimate	1,164	1,473	-21	↓
26	Thiram	1,154	2,478	-53	↓
27	Metaldehyde	1,000	868	15	↑
28	Myclobutanil	724	452	60	↑
29	Dinocap	687	7	9,105	↑
30	Diquat	582	817	-29	↓
31	Oxadiazon	560	451	24	↑
32	Propyzamide	547	947	-42	↓
33	Glufosinate-ammonium	465	540	-14	↓
34	Chlorthal-dimethyl	452	1,150	-61	↓
35	Oxadixyl	394	935	-58	↓
36	Pirimicarb	393	448	-12	↓
37	MCPB	363	191	90	↑
38	Isoxaben	345	389	-11	↓
39	Fenpropathrin	335	152	121	↑
40	Bromacil	287	1,023	-72	↓
41	Urea	283	425	-33	↓
42	Diuron	281	302	-7	↓
43	Metalaxyl	276	412	-33	↓
44	Phenmedipham	272	330	-17	↓
45	Methiocarb	213	251	-15	↓
46	Fluazifop-P-butyl	182	190	-4	↓
47	Pyrifenox	174	133	31	↑
48	Lenacil	134	269	-50	↓
49	Captan	132	.		↑
50	Dodine	128	79	62	↑

PESTICIDE USAGE ON STRAWBERRIES

Strawberries received, on average, 5 fungicide sprays, 2 herbicides, 1 insecticide, 1 acaricide and 1 molluscicide. Fungicides accounted for 57% of the pesticide-treated area, herbicides 24%, insecticides 7%, acaricides 5%, molluscicides 4%, biological control agents 2%, sulphur one percent and soil sterilants and urea less than one percent. However, whilst soil sterilants were only used on 158 hectares of land prior to planting strawberries they accounted for 73% of the total weight of active substances applied. Fungicides accounted for a further 16%, herbicides 8%, insecticides one percent, molluscicides one percent, sulphur one percent and acaricides, biological control agents and urea less than one percent each.

Where a reason for use was specified, sprays applied to control *Botrytis* fruit rot accounted for 49% of the area treated with fungicides. Sprays to control powdery mildew comprised a further 44%. Mildew and *Botrytis* combined accounted for over 95% of the specified reasons for use. Red core was the only other specified reason for use and accounted for a further 3%. The four most commonly-used fungicide active substances were myclobutanil, primarily for powdery mildew control and used on 19% of the fungicide treated area, dichlofluanid 12%, used mainly for *Botrytis* control, fenhexamid 11%, again used mainly for *Botrytis* control, bupirimate 10% (mildew), iprodione 10%, pyrimethanil 8% and fenpropimorph 7% (mildew).

The majority of herbicide applications were for general weed control (79%), broad-leaved weeds (6%), grass weeds, particularly couch, (8%), thistles (5%) and runner control (2%). The most commonly used herbicide formulations were simazine, (15% of the herbicide treated area), napropamide (11%), pendimethalin (9%), diquat/paraquat (9%), isoxaben (8%), and paraquat (7%).

Aphids were the main reason given for insecticide application, accounting for 58% of all specified applications, strawberry blossom weevil comprised a further 4%, vine weevil 3%, tortrix moth caterpillars 2% and two-spotted spider mite one percent. Two active substances accounted for almost 80% of all insecticide applications, chlorpyrifos (65%) and pirimicarb (22%).

The usage of acaricides was predominantly for two-spotted spider mite, (81% of the area treated where a reason was specified), vine weevil control for another 8% and aphids for 7%. The main acaricides used were bifenthrin, (48% of the acaricide treated area), tebufenpyrad (26%), clofentezine (15%) and tetradifon (8%). The use of the biological control agent *Phytoseiulus persimilis,* to control two-spotted spider mite, accounted for 49% of the total area treated of strawberries with biological control agents.

Molluscicides, used to prevent slugs grazing on ripening fruit, were confined mainly to metaldehyde (52%), and methiocarb (46%). The only other molluscicide recorded was thiodicarb.

The soil sterilants methyl bromide, chloropicrin and dazomet were all used prior to planting maiden strawberries, with methyl bromide accounting for just over two thirds of the treated area.

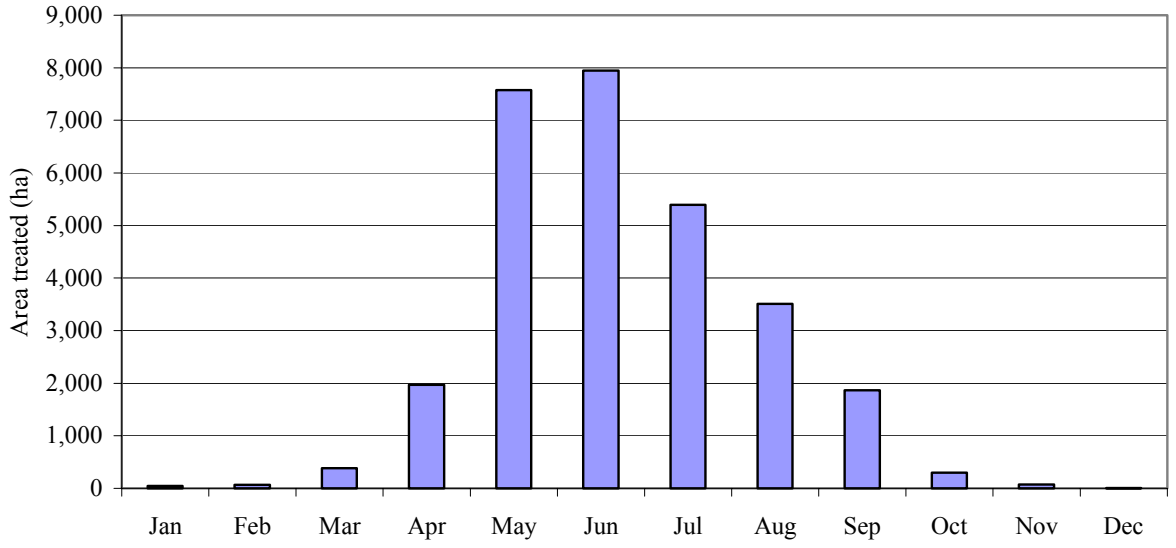
Approximately 35% of strawberries encountered in the survey were in their maiden year, 63% were two to five years old and two percent were over five years old. Since the last survey novel production systems, including growing bags and French/Spanish tunnels, continued to be adopted, particularly by the larger soft fruit holdings. Bag systems accounted for 7% of the area grown. Of these 81% were raised, either on wire supports or straw bales, to enable easier picking. Approximately 43% of strawberries were planted through polythene, normally opaque, mulch.

The use of walk-in Spanish (15%) or French tunnels (7%) was applied to approximately 22% of the area grown. An additional 7% of the area used a floating mulch, either polythene or woven fleece, to advance harvesting. The use of deep straw to retard crops for late season harvest was recorded on 2% of the area grown. Over two thirds, 73%, of all strawberries, excluding maidens, were grown for the fresh market, 26% for pick your own and the remainder for processing.

Detailed information on strawberry varieties was collected for almost 90% of the area grown. In line with 1998 survey results the most frequently encountered variety was Elsanta, accounting for 46% of the area grown where a variety was specified. Other important varieties included Symphony, (11% of the area grown), Florence (9%), Everest (8%), Honeoye (4%), Pegasus (3%), Bolero (3%) and Cambridge Favourite (2%).

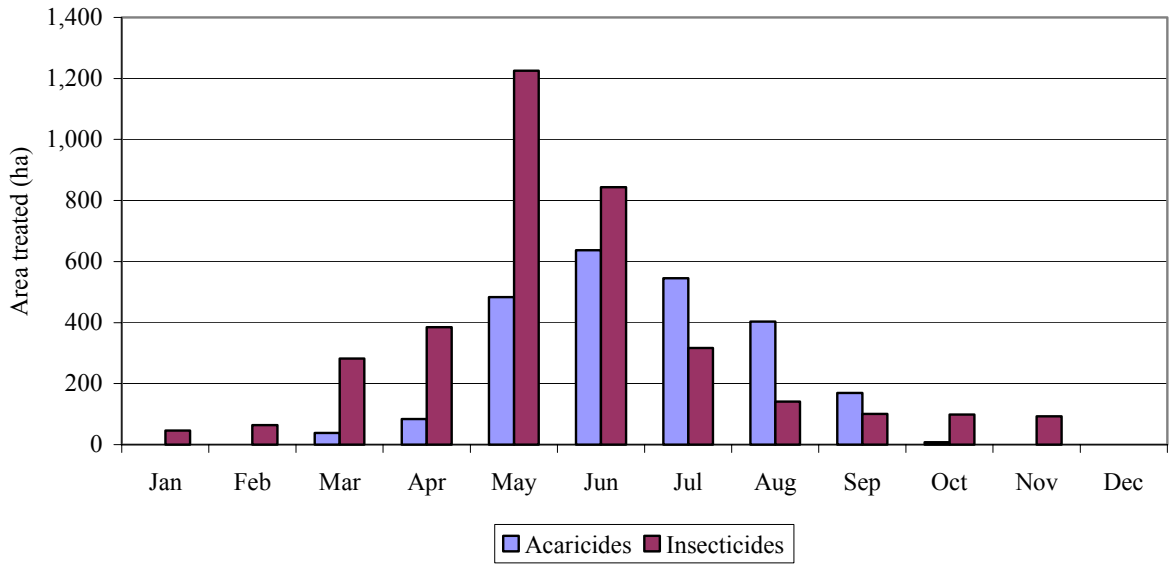
Although the first treatments were made in late February and during March, most fungicide applications were made in May, June and July when the risk from *Botrytis* was greatest. Fungicide usage, although minimal, continued into September and early October, reflecting the extended harvest season and the use of both ever-bearer varieties such as Everest and the manipulation of more conventional varieties using mulches, including deep straw, bags and tunnels.

Fig. 2 *Timing of fungicide applications made to strawberries in 2001*



Usage of herbicides showed two distinct peaks, the first and major one when the crop was dormant in January and February, the second in May which would coincide both with new plantings and grass weed control. Usage of herbicides during August was predominantly for runner control. Usage of insecticides, mainly to control aphids, peaked in May and June, prior to the harvest of early crops. Molluscicides would have been applied at the time of strawing-down, with the greatest usage occurring between May and June. Acaricide usage showed a single peak, increasing in use during May and into June with the area treated steadily falling throughout the year and applications being completed by early September.

Fig. 3 *Timing of acaricidal and insecticidal applications made to strawberries in 2001*



PESTICIDE USAGE ON BUSH FRUIT

Blackcurrants

Although information regarding the age and harvesting status of crops was collected for this survey no distinction has been made in Tables 5 or 6 on the age of the blackcurrants or whether or not they were harvested. It must be emphasised that a number of pesticides only have approval for use on maiden or non-harvested crops and data within these tables do not therefore necessarily indicate inappropriate uses on fruiting crops.

Blackcurrants grown for the fresh market received on average 3 fungicide sprays, 2 herbicides and an acaricide. Fungicides accounted for 45% of the total pesticide-treated area, herbicides 31%, acaricides 14% and insecticides 4%. Those grown for processing received 5 fungicide sprays, 2 herbicides, 2 acaricides, an application of sulphur and an insecticide. Forty-eight percent of the total treated area consisted of fungicides, herbicides a further 20%, acaricides 15%, sulphur 10% and insecticides 7%. In terms of weight applied, sulphur accounted for 51% of the total, fungicides 24%, herbicides 22% and insecticides one percent.

The major diseases of blackcurrants for processing were *Botrytis*, (accounting for 37% of the treated area where a reason was given), powdery mildew (35%), leaf spot (23%) and leaf spot and mildew combined (4%). The major diseases of blackcurrants for processing were similar, although mildew accounted for 48% of the treated area where a reason was specified, *Botrytis* 36% and leaf spot 9%. The most extensively-used fungicides on all blackcurrants were chlorothalonil, (20% of the fungicide treated area), myclobutanil (18%) and dichlofluanid (12%). Sulphur was used extensively both for disease control and against the blackcurrant gall mite.

Herbicides were used mainly for general weed control, the major active substances being dichlobenil, simazine, paraquat, diquat and glyphosate.

Blackcurrant gall mite, the cause of big bud disorder, was the main reason cited for acaricide usage, accounting for 60% of the acaricide treated area of blackcurrants for both fresh market and processing. Fenpropathrin and endosulfan accounted for 93% and 5% respectively, of the total acaricide treated area of all blackcurrants. Aphids and vine weevil were the two major reasons specified for the use of insecticides. Chlorpyrifos accounted for 47% of the insecticide treated area, pirimicarb for a further 46%.

Of the blackcurrants grown for the fresh market, 65% were over five years old, 29% two to five years old and the remainder less than a year old. Blackcurrants grown for processing showed a different age structure with 44% being over five years old, 40% between two and five years old and the remainder being less than one year old reflecting new investment in this crop. Approximately 8% of all blackcurrants were planted through polythene mulch, again reflecting their recent planting. Of the blackcurrants grown for the fresh market, 55% went for the fresh market trade, including farm and other shops, 43% for pick your own sales, with the remainder being processed. Approximately 96% of blackcurrants grown for fresh market were harvested, whereas only 72% of those grown for processing were, again emphasising the recent plantings of this crop.

Information on the varieties of blackcurrants grown on 94% of the total area for both processing and the fresh market was available. Ben Lomond, which accounted for 31% of the area where a variety was specified, Ben Alder (18%), Ben Tirran (17%) and Ben Hope (17%) were the four major varieties of blackcurrant encountered.

Most sprays were applied early in the season reflecting the strict management controls over large areas of this crop and the importance placed on avoiding pesticide residues. Usage of fungicides peaked in May and June with only a small proportion of the total, 17%, being applied after this time. The use of sulphur for both big bud mite and disease control was confined mainly to April, with the acaricide peak occurring a month later and extending into June. Insecticide usage peaked in June with only minimal usage, 15%, after this date. Herbicides, mainly broad spectrum, were predominantly applied during the early part of the year, from January to May, when the crop was either dormant or just starting to grow.

Fig. 4 *Timing of fungicidal and sulphur applications made to blackcurrants in 2001*

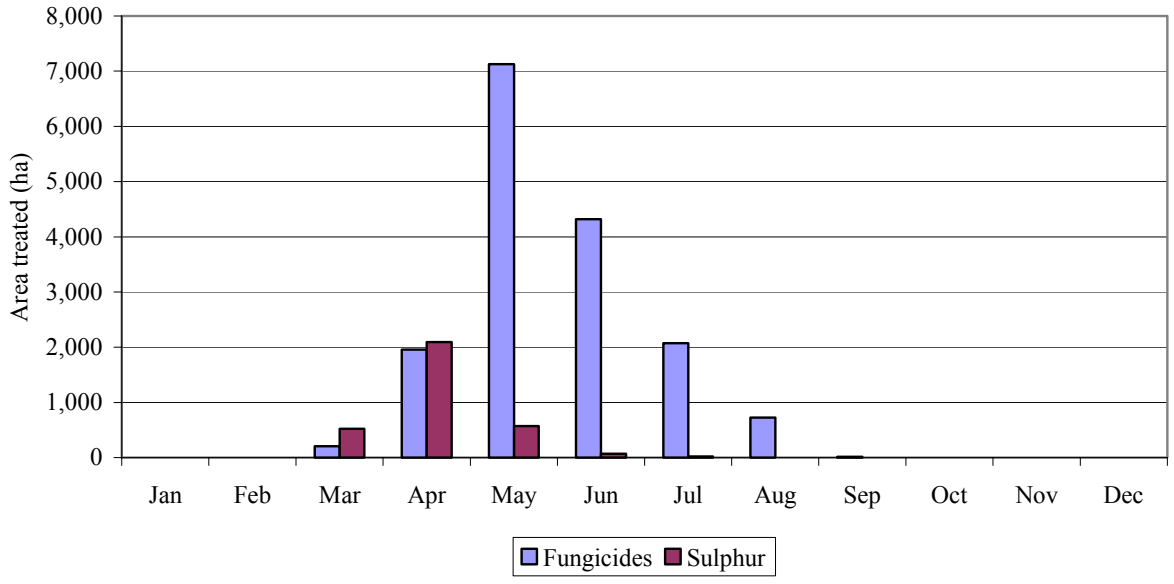
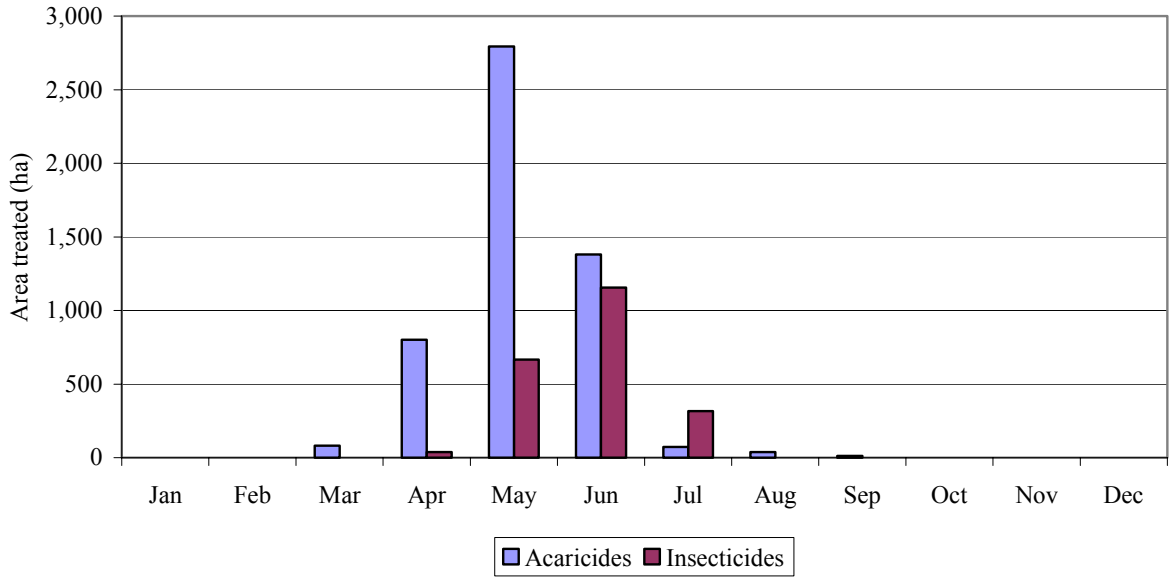


Fig. 5 *Timing of acaricidal and insecticidal applications made to blackcurrants in 2001*



Redcurrants and whitecurrants

An estimated total of 169 hectares of redcurrants and whitecurrants were grown in Great Britain during 2001. On average, they received 3 fungicide sprays and 2 herbicides. Fungicides accounted for 63% of the total pesticide-treated area, herbicides 25%, insecticides 5%, sulphur 3% and acaricides 4%.

Myclobutanil (28%), dichlofluanid (16%) and tolylfluanid (11%) were the most extensively-used fungicide active substances, together accounting for 55% of the fungicide-treated area. Dichlobenil, simazine, isoxaben and paraquat were the most commonly-used herbicides accounting for 55% of the herbicide treated area. Chlorpyrifos was the most extensively-used insecticide, endosulfan and fenpropathrin the most extensively-used acaricides.

Over 80% of all redcurrants and whitecurrants encountered were over five years old, 8% were between two and five years old, with 9% being plantings made during the last year. Sixty-seven percent of redcurrants and whitecurrants were grown for the pick-your-own market, 26% for fresh market with the remainder being used for processing. Rovada, Red Lake and Jonkeer van Tets were the most commonly recorded redcurrant varieties, with White Versailles being the most frequently encountered whitecurrant.

The timing of sprays applied to redcurrants and whitecurrants closely followed those applied to blackcurrants, with both the fungicide and insecticide peaks appearing in May and June and the herbicide peak in March.

Gooseberries

Only 258 hectares of gooseberries were grown in Great Britain during 2001. On average, they received 3 fungicides and 2 herbicides. Fungicides accounted for 65% of the total pesticide-treated area, herbicides 25%, insecticides 7%, tar oil 2% and acaricides and sulphur less than one percent.

Mildew, alone or combined with *Botrytis* or leaf spot, was reported as the single most troublesome disease, accounting for 56% of the fungicide-treated area where a reason was specified. Other important diseases were *Botrytis*, (40% of the area) and leaf spot (3% of the area). The most extensively-used fungicides were myclobutanil, (used on 35% of the fungicide treated area), dichlofluanid (16%), bupirimate (13%), fenpropimorph (9%) and tolylfluanid (8%).

The most widely-used herbicides, mainly for general weed control, were dichlobenil, isoxaben, simazine, paraquat, pendimethalin and diquat/paraquat.

Gooseberry sawfly and aphids were quoted as the most troublesome pests and chlorpyrifos, along with lambda-cyhalothrin, cypermethrin, and dimethoate was the most extensively-used insecticide.

Although tar oil accounted for only 2% of the treated area of gooseberries, it actually comprised 62% of the weight of pesticides applied, reflecting its relatively high rate of use as a winter wash.

In common with both blackcurrants for the fresh market, redcurrants and whitecurrants, most, (75%) gooseberries encountered were over five years old. However, in contrast to redcurrants and whitecurrants, only 2% were less than a year old. Approximately 4% of all gooseberries were planted through mulch, reflecting their recent planting and the need for weed control. Almost two thirds, 58%, of all gooseberries were grown for the fresh market trade, 36% for the fresh market with 6% of those sampled in this survey going for processing.

Careless, Invicta, and Leveller were the main varieties of gooseberry recorded accounting for 90% of the area grown where a variety was specified. In line with usage on other bush fruit, most herbicides were applied during the winter months, in particular January to March, with insecticide and fungicide peaks in May.

PESTICIDE USAGE ON CANE FRUIT

Raspberries

Raspberries received on average 4 fungicide sprays, 2 herbicides and 1 insecticide. Fungicides accounted for 53% of the total pesticide-treated area of raspberries, herbicides 29%, insecticides 16%, sulphur one percent, acaricides, biological control agents, molluscicides, urea, tar oil, and soil sterilants all for less than one percent. In terms of weight applied, fungicides accounted for 55% of the total, herbicides 28%, soil sterilants 12%, insecticides 4% and sulphur one percent.

Botrytis was the single most important disease of raspberries, accounting for 68% of the fungicide treated area where a reason was specified. Mildew, both powdery and downy, were the reasons for a further 17% of treatments, root rot 8% and other cane diseases 2%. Dichlofluanid accounted for 37% of the fungicide-treated area, tolylfluanid 16%, mancozeb/oxadixyl, almost entirely for root rot control, for 8%, chlorothalonil for 6% and triadimefon for 6%.

Most herbicide usage, 87%, was for general weed control and broad-leaved weed control accounted for a further 4% of the total area treated where a reason was specified. Spawn control comprised a further 4%. Diquat/paraquat was the most extensively-used herbicide formulation, accounting for 19% of the herbicide treated area, simazine 16%, paraquat alone 13% and napropamide 12%. Sodium monochloroacetate accounted for 4% of the treated area and 27% of the weight of herbicides applied.

Raspberry beetle was the reason given for 39% of all specified insecticide applications, aphids accounted for a further 25% and raspberry cane midge 13%. The most extensively-used insecticide was chlorpyrifos comprising 48% of the total. Applications of pirimicarb and deltamethrin made up a further 18% and 16% respectively.

Bifenthrin, clofentezine and dicofol were the only recorded acaricides used, principally for the control of two-spotted spider mite.

Approximately 11% of all raspberries encountered were less than a year old, 43% were between two and five years old with the remaining 46% being over five years old. Polythene mulches, to control weed growth, were used on 10% of the total area of raspberries grown. There was limited use of clear polythene to advance harvest dates or provide protection from disease or pest attack but 5% of raspberries were grown under French or Spanish tunnels. Around 42% of raspberries were grown to supply fresh market outlets; a further 32% were grown for processing, with the remaining 26% going for the pick-your-own market.

Variety information was available from 78% of the area of raspberry crops grown. The varieties, Glen Ample, Glen Prosen, Glen Moy, Tulameen and Glen Clova accounted for virtually all of the summer fruiting area, with Autumn Bliss being the most important autumn-fruiting variety recorded.

The most important time for fungicide applications was June although applications started in March and continued into August. A much smaller peak occurred in September and October when fungicides were used in part to control *Phytophthora* root rots. Most herbicides were applied during the months of January, February, March and April. On raspberries most insecticide treatments were applied in May, June and July, mainly for the control of raspberry beetle and aphids.

Fig. 6 *Timing of fungicidal applications made to raspberries in 2001*

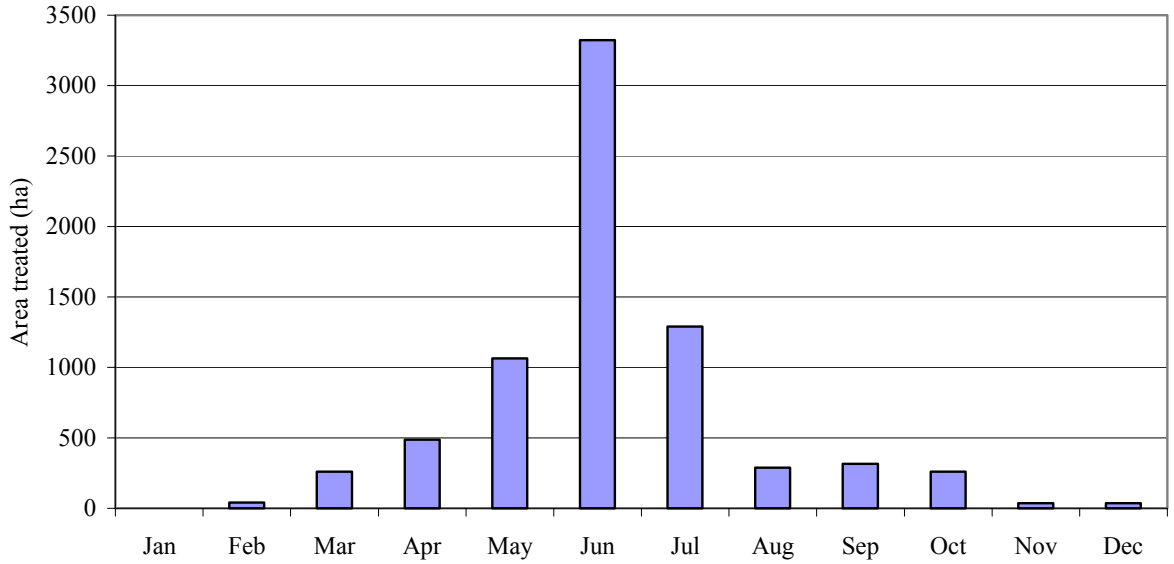
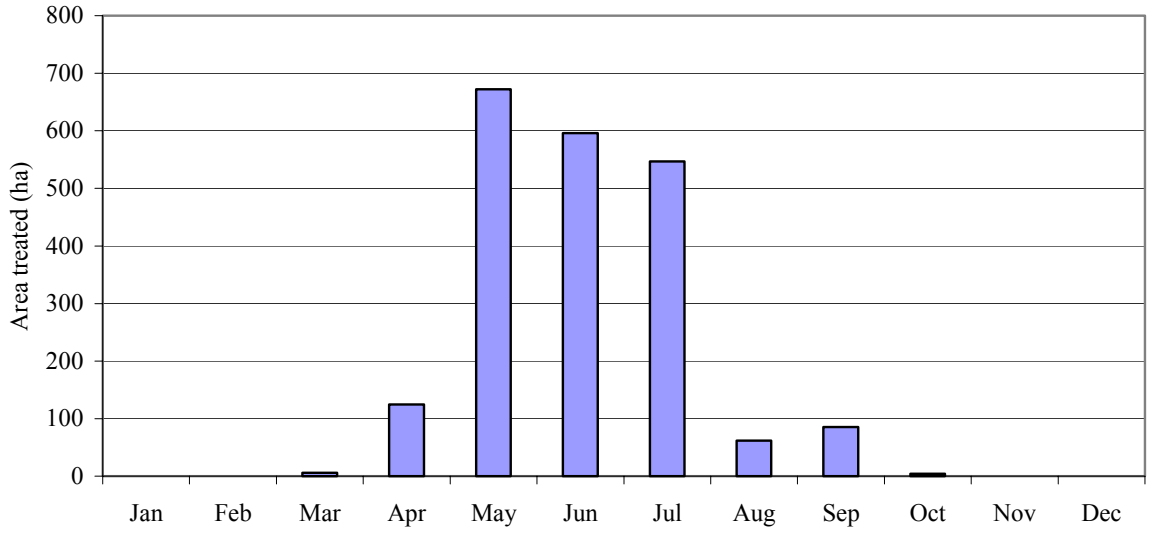


Fig. 7 *Timing of insecticidal applications made to raspberries in 2001*



Blackberries

Only 107 hectares of blackberries were grown commercially in Great Britain during 2001. Each crop was treated on average with 3 fungicides, 2 herbicides and 1 insecticide. Fifty four percent of the total pesticide-treated area was treated with fungicides, 29% with herbicides, 15% with insecticides and 1% with acaricides.

Two thirds of fungicide usage was to control *Botrytis*, 26% for cane disease/purple blotch and 5% for downy mildew control. The most-commonly used fungicide active substance, tolylfluanid, accounted for 34% of the total fungicide-treated area. Other commonly-used fungicides were dichlofluanid (24%), copper oxychloride (14%) and chlorothalonil (11%).

Paraquat, diquat, napropamide, pendimethalin, bromacil and simazine were the most commonly-used herbicide active substances.

Chlorpyrifos and deltamethrin were the most extensively-used insecticides whilst endosulfan and fenpropathrin were the only acaricides recorded.

Sixty one percent of all blackberries encountered in the survey were over five years old, 36% between two and five years old and the remaining 2% less than one year old. A small proportion of blackberries surveyed, 2%, were grown under French tunnels. Most blackberries, 63%, were grown for the fresh market, with 27% being grown for pick your own. Only 11% of the total production was used for processing.

Variety information was available for 72% of the area of blackberries grown with the varieties Loch Ness, Bedford Giant, Chester, Silvan and Kotata accounting for 84% of this area.

Hybridberries

An estimated 175 hectares of hybridberries were grown in Great Britain during 2001. Pesticide usage on hybridberries was similar to blackberries with, on average, each crop treated with 3 fungicides, 2 herbicides and an insecticide. Fungicides accounted for 51% of the total pesticide-treated area, herbicides 38% and insecticides 10%. Dichlofluanid and tolylfluanid were the most extensively-used fungicides, accounting for 40% and 34% respectively of the fungicide treated area. Glyphosate, diquat/paraquat, bromacil, napropamide and simazine were the most extensively-used herbicides. Chlorpyrifos was the most extensively-used insecticide accounting for 74% of the insecticide treated area.

Over three quarters of all hybridberries encountered were over five years old, 18% between two and five years and the remaining 5% being less than one year old. Polythene plant-through mulches were recorded on 16% of the area but no crops encountered in the survey were covered with French or Spanish tunnels. The pick-your-own market accounted for 49% of the total area of hybridberries grown, 41% supplied the fresh market, including farm or other shops, and the remaining 10% were used for processing. Tayberries and loganberries were the most important hybridberries recorded.

PESTICIDE USAGE ON VINES

Although the area of vines grown had increased between 1990 and 1998, peaking at 865 ha, it has since fallen, with 745 hectares being grown in 2001. On average each crop was treated with 8 fungicides, 5 applications of sulphur and one herbicide. Fungicides accounted for 62% of the total pesticide-treated area of vines, sulphur 28%, herbicides 7%, tar oil 2% and acaricides one percent. By weight, tar oil comprised 47% of the total, sulphur 27%, fungicides 23% and herbicides 2%.

Mildew, both powdery and downy, accounted for 55% of the total fungicide treated area where a reason was specified. Of the two mildews, downy mildew was considered to be the more important, comprising 55% of the area treated for powdery and downy mildew. The control of *Botrytis* accounted for a further 31% of the fungicide-treated area. Dinocap was the most frequently used fungicide active substance, accounting for 23% of the total fungicide-treated area, mancozeb for 18%, pyrimethanil for 10%, copper oxychloride/metalaxyl for 9% and dichlofluanid for 9%. Sulphur was primarily used for the control of mildew, mainly powdery mildew. Its usage on vines had increased by 83% since 1998.

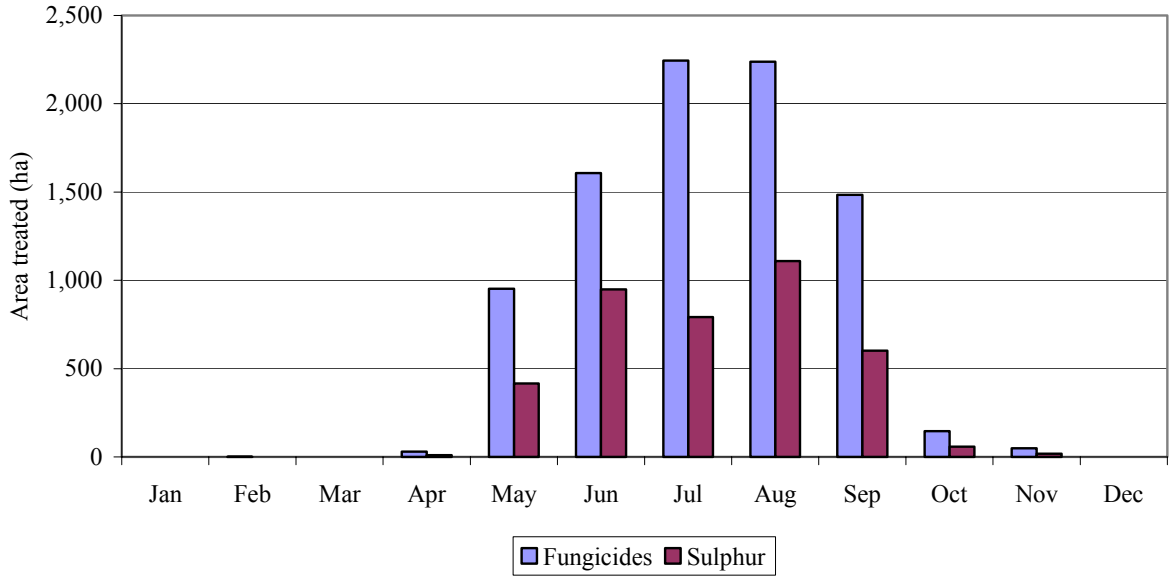
Glyphosate was the most extensively-used herbicide, accounting for 58% of the herbicide treated area; paraquat and glufosinate-ammonium comprised a further 18% and 15% respectively.

On vines, bifenthrin was the only acaricide recorded. Tar oil was used as a winter wash for *Botrytis* and pest control on 2% of the grapevine area in Great Britain.

Most vines, 95%, were established crops over five years old, 4% were between two and five years old and one percent was less than one year old. The most commonly encountered varieties included Seyval Blanc, Muller Thurgau, Reichensteiner, Schonburger, Pinot Noir and Bacchus.

Fungicides were applied mainly between the months of May and November with a peak being reached in July and August. Herbicide usage peaked in April and May before the vines were in full leaf. Similarly tar oil winter washes were confined to February, March and November when the vine was dormant. Sulphur was used throughout the same period as fungicides, being used between May and November, with maximum usage in August.

Fig. 8 *Timing of fungicidal and sulphur applications made to vines in 2001*



COMPARISON WITH PREVIOUS SURVEYS

Areas of crops grown (Table 9)

The total area of soft fruit crops grown in Great Britain in 2001, 9,432 ha, was virtually unchanged since 1998, an increase of only two hectares. This was 38% (5,670 ha) less than in 1990. Much of the decline since 1990 is due to a reduction in the desire of the general public for pick-your-own fruit and an increase in the quantities of lower priced fruit imported into Great Britain. Despite the overall area of crops grown in Great Britain being relatively unchanged since the last survey, the areas of individual crops grown had changed markedly.

Despite recent changes in the production systems for strawberries, the area grown in 2001 was 37%, (2,236 ha) less than in 1990. However, since 1998, the area grown had remained relatively stable declining by only 3%, (122 ha).

Blackcurrants, including those for fresh market and processing, have shown an overall decrease of (574 ha) since 1990. However, since the last survey in 1998 there has been a 96% increase (1,315 ha), in the area of blackcurrants grown. This reflects recent changes in the processing industry and figures relating both to crop age and harvest status have already been mentioned earlier in the report.

The area of gooseberries grown in 2001 is 47%, (233 ha), less than in 1990, but has declined by only one percent since the last survey.

The area of raspberries grown in 2001 was 39% less (958 ha) than in 1998 and 61% less (2,345 ha) than in 1990. The decline in raspberries is reflected by a 71% reduction of the main production area in Scotland between 1990 and 2001. In addition, waterlogging during periods of sustained rainfall over recent winters damaged many of the raspberry crops in England.

The area of other soft fruit, which included blackberries, hybridberries, redcurrants and whitecurrants, is 30%, (189 ha), less than in 1990 and has declined by 20% (110 ha), since the last survey. The area of grapevines, which increased between 1990 and 1994, has since fallen and is now 11% less (93 ha) than in 1990.

Table 9 *Comparison of the area of soft fruit crops grown in Great Britain, 1990 - 2001*

Crop	**1990**	**1998**	**2001**
Strawberry	6,001	3,887	3,765
Blackcurrant	3,257	1,368	2,683
Gooseberry	491	261	258
Raspberry	3,875	2,488	1,530
Vine	838	865	745
Other soft fruit	640	561	451
Total - all soft fruit	15,102	9,430	9,432

Pesticide usage on soft fruit (Tables 10 & 11)

There has been a 35% reduction (62,931 ha) in the pesticide-treated area and a 38% reduction in the crop area in Great Britain between 1990 and 2001, producing a small net increase in the number of treatments per unit of area. The total pesticide-treated area in 2001 was 4% less than that in 1998 despite the areas being grown in both years being very similar. These data are presented in Tables 10 & 11.

The total weight of pesticides applied decreased by 5% since 1990 and by 26% since 1998. This relatively large decrease since 1998 is due almost entirely to the reduction in use of soil sterilants as pre-planting treatments to a limited area of soft fruit crops, particularly strawberries. When soil sterilants are excluded, the total weight applied has decreased by 35% since 1990, but increased by 2% since 1998. The fact that the changes in areas treated are lower than changes in the weight applied, between 1990 and 2001, reflect a trend towards the use of reduced rates of application, together with the adoption of newer molecules, active at lower rates of application.

The fungicide treated area of soft fruit was 33% less (32,289 ha) than in 1990, and 7% less (4,655 ha) than in 1998. There was a slight reduction, 8%, in rates of application in the period between the two recent surveys illustrating a further trend towards the use of reduced rates by growers. In addition, the number of applications of fungicides fell in the same period. The total weight of fungicides applied decreased by 18%, confirming the reduced rates of application.

A 60% decrease (12,656 ha) in the area treated with insecticides accounted for some of the decline in total pesticide usage between 1990 and 2001. Insecticide usage also fell, by 22% (2,427 ha), between 1998 and 2001. With the exception of the group "Other insecticides" which more than doubled, all other insecticide groups decreased in usage between 1998 and 2001. This decrease in insecticide groups was repeated between 1990 and 2001, except for however carbamates whose usage by area treated have increased by 7% over the last eleven years. The average rate of application, in terms of kg/l applied per hectare decreased by 25% between 1998 and 2001, much of this decrease being due to reductions in the use of carbamates and organophosphates. The total weight of insecticide active substances applied decreased by 70% since 1990 and by 40% since 1998.

In 2001, he acaricide treated area had decreased by 45% (6,467 ha) since 1990, but had increased by 37% (2,135 ha) since 1998. The increase in acaricide usage since the last survey is due mainly to the requirement for the control of blackcurrant gall mite on the increased area of blackcurrants for processing. The rates of application per unit area reduced by 88% between 1990 and 2001, resulting in a 93% decrease in the weight of acaricides applied. Endosulfan, the most extensively-used acaricide in 1990 and applied at relatively high rates, decreased in usage by 96% between 1990 and 2001, whereas usage of fenpropathrin, the principal acaricide in 2001 and applied at lower rates than endosulfan, increased almost seven times.

The herbicide-treated area showed a decrease of 39% (15,023 ha) since 1990, whereas the weight applied decreased by 50%, again reflecting a move towards lower rates of application. Between 1998 and 2001 the herbicide-treated area decreased by 10% (3,056 ha) with the weight decreasing by 19%. Between the last two surveys the average rates of application decreased by 4%, from 1.13 kg/ha in 1998 to 1.08 kg/ha in 2001.

The usage of sulphur, particularly on blackcurrants for processing and grapevines, has more than doubled since 1990 and increased by 83% since 1998. The weight applied almost tripled between 1990 and 2001, and increased by 90% between 1998 and 2001, reflecting its increased rate of use from 2.9 kg/ha in 1990 to 3.43 kg/ha in 1998 and to 3.63 kg/ha currently.

Between 1990 and 2001, usage of molluscicides and repellents increased by 32% in terms of area treated and more than doubled in terms of weight applied. Since the last survey the area treated has decreased by one percent, but the weight applied increased by 9%.

The use of biological control agents, and in particular *Phytoseiulus persimilis* for two-spotted spider mite control in strawberries, was 14% greater than in 1990 and 4% greater than in 1998. Biological control agents were used on 5% of the area grown in 1990 and 9% in both 1998 and 2001.

The area treated with soil sterilants in 2001 had increased by 95% compared with 1990, but had decreased by 47% since 1998. The weight of soil sterilants applied more than doubled compared with 1990, but decreased by 45% since the last survey.

There was only minimal usage of tar oil in 2001, although the area treated had increased by 59% since 1990 and by 22% since 1998.

Table 10 *Comparison of pesticide usage on soft fruit, 1994 - 2001, area treated (ha) and amount used (kg)*

	1990		1998		2001	
	ha	**kg**	**ha**	**kg**	**ha**	**kg**
Acaricides	14,329	10,322	5,727	1,743	7,862	723
Insecticides						
Benzoylureas	33	2	43	9	.	.
Carbamates	2,153	1,553	2,489	464	2,277	393
Organochlorines	269	69	267	285	.	.
Organophosphates	16,469	9,456	7,251	4,898	5,302	2,916
Pyrethroids	2,132	48	760	20	675	13
Other insecticides	104	114	121	10	250	64
Total - all insecticides	21,160	11,241	10,931	5,686	8,504	3,386
Registered biological control agents	17	< 1	18	3	27	6
Fungicides	97,351	105,251	69,717	64,403	65,062	52,679
Sulphur	3,943	11,418	4,369	15,587	7,997	29,566
Growth regulators	45	16	.	.	.	.
Herbicides	42,460	55,287	29,148	33,829	26,092	27,437
Molluscicides& repellents	2,008	563	2,684	1,119	2,650	1,215
Soil sterilants	82	51,312	302	197,462	160	108,714
Tar oil/acids	188	9,779	244	7,950	298	17,465
Total - all registered pesticides	181,583	255,187	123,140	327,852	118,652	241,191
Non-registered biological control agents & pollinators	733	.	808	107	828	.
Area grown	**15,102**		**9,430**		**9,432**	

Table 11 *Comparison of pesticide usage on soft fruit, 1994 - 2001, area treated as % of area grown and rate of active susbstance use (kg/ha)*

	1990		1998		2001	
	Area treated as % of area grown	**Rate (kg/ha)**	**Area treated as % of area grown**	**Rate (kg/ha)**	**Area treated as % of area grown**	**Rate (kg/ha)**
Acaricides	89	0.72	46	0.32	65	0.09
Insecticides						
Benzoylureas	< 1	0.06	< 1	0.21	.	.
Carbamates	13	0.64	21	0.19	19	0.17
Organochlorines	2	0.26	2	1.28	.	.
Organophosphates	88	0.58	47	0.77	44	0.59
Pyrethroids	14	0.02	6	0.03	5	0.02
Other insecticides	< 1	1.59	1	0.09	3	0.26
Total - all insecticides	118	0.52	79	0.56	71	0.42
Registered biological control agents	.	.	< 1	0.14	< 1	0.22
Fungicides	564	1.01	546	0.90	531	0.83
Sulphur	26	2.90	39	3.43	82	3.63
Growth regulators	< 1	0.35	.	.	.	.
Herbicides	230	1.42	234	1.13	233	1.08
Molluscicides& repellents	12	0.29	22	3.24	24	0.47
Soil sterilants	1	634.18	3	662.19	2	679.61
Tar oil/acids	1	57.65	1	34.49	3	58.70
Total - all registered pesticides	1,046	1.41	980	3.13	1,020	2.34
Non-registered biological control agents & pollinators	5	.	9	.	9	.

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