

*PESTICIDE USAGE IN SCOTLAND*

***PROTECTED CROPS 1995***



Scottish Agricultural Science Agency

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This report presents information from a survey of pesticide usage on protected crops in 1995. Compared with the previous survey on these crops in 1991, the overall area of edible crops, excluding mushrooms, declined by 37%. The area of tomatoes had more than halved and no lettuce crops were encountered in this survey. The area of mushrooms declined by 24% to below 200,000 m<sup>2</sup>. Overall, the non-edible crop area had increased by over 30% compared with the area grown in 1991, although the estimated area of flowers for cutting had dropped to only twenty-four percent of the 1991 crop area.

### ● *Edible crops*

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The area of edible crops treated with insecticides remained roughly similar to that recorded in 1991, when the decline in the area of crops grown is taken into account. Fenbutatin oxide, used mostly on tomatoes, was by far the most commonly used insecticide and accounted for more than half of the total area treated with insecticides. Usage of dicofol and tetradifon, which had been the principal insecticides in the previous survey, was much reduced in 1995. The large decline in the use of biological control agents was due mainly to the reduction in the number of introductions of *Encarsia* sp..

The overall decline in use of fungicides was in line with the reduction in area grown. As in 1991, iprodione was the most commonly used fungicide. Usage of benomyl experienced a considerable decrease due to increasing resistance by *Botrytis cinerea*. Glyphosate replaced paraquat as the principal herbicide.

Although the proportion of the area of mushroom crops treated with insecticides remained similar to that recorded in the previous survey, the total area treated more than halved. Diflubenzuron replaced diazinon as the most widely used active ingredient. As in 1991, all mushroom crops were treated with a fungicide, prochloraz remaining the most commonly used active.

The use of disinfectants was important in mushroom production for general hygiene of houses, equipment and for the control of spores when clearing houses. Sodium hypochlorite was the most common disinfectant used across the whole area of crop production.

### ● *Non-edible crops*

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The pattern of use of insecticides, molluscicides and herbicides on non-edible crops remained similar to that in 1991, whilst there had been an increase in the use of biological control agents and fungicides. Cypermethrin replaced pirimicarb as the principal insecticide. Few instances of the use of biological control agents were found in 1991, but in 1995 their use had increased to over 300,000 treated m<sup>2</sup>. By far the most commonly used was *Amblyseius* spp..

Iprodione remained the most widely used fungicide, whilst oxadiazon replaced paraquat as the most popular herbicide. The growth regulators, daminozide and paclobutrazol, were widely used.

## ***INTRODUCTION***

Pesticide usage surveys are carried out as part of the post-registration surveillance programme which fulfils a requirement under the Food and Environment Protection Act 1985. The information in these surveys is used to make estimates of the quantities of pesticides used nationally to aid the Advisory Committee on Pesticides in making recommendations to the Government. They may also be used by Government Departments and other fora to formulate policy and to support the compilation of environmental impact indices.

A survey on the types and quantities of pesticides used on crops grown within glasshouses, polytunnels and mushroom houses was undertaken by the Pesticide Usage Section of the Scottish Agricultural Science Agency during 1995. Previous surveys of this type were conducted in 1976<sup>(1)</sup>, 1981<sup>(2)</sup>, 1987<sup>(3)</sup> and 1991<sup>(4)</sup>, although the survey in 1987 did not include mushrooms or non-edible crops.

## ***DEFINITIONS AND NOTES***

1. The term 'pesticide' includes commercial formulations containing active substances of insecticides, acaricides, molluscicides, fungicides, herbicides, desiccants, soil sterilants, nematicides and growth regulators.
2. Active ingredient (ai) refers to an individual chemical which is active against a pest, disease or weed etc.
3. The term 'formulation' refers to one or more active ingredients included in a product or group of products.
4. 'Total pesticide treated area' is the area of a crop treated with a given pesticide multiplied by the number of treatments the area received. For example 100 m<sup>2</sup> of tomatoes which have been treated with a given pesticide once, twice or three times, would have a total treated area of 100, 200, or 300 m<sup>2</sup> respectively. Where biological agents were employed, 'total pesticide treated area' includes the re-introduction of insect or mite predators.
5. 'Basic area' is the area of a crop which was treated with a given pesticide, irrespective of the number of times it was applied to that area. In the example given in the definition 4 above, the basic area would be 100 m<sup>2</sup> in all 3 cases. The basic area is used to calculate the percentage of crop treated with an individual formulation or a group of pesticides.
6. 'Reason for use' shown in the tables is the grower's stated reason for use of that particular pesticide on that crop and may not always correspond to the approved use of the pesticide.
7. The areas of crops grown include successional sowings so that the total areas of crops grown can be larger than the total area of glasshouses and polytunnels.
8. Data from the 1991 survey are provided for comparison purposes in some of the tables, although it should be borne in mind that there may be minor differences in the range of crops surveyed, together with changes in areas of each of the crops grown.

Using the June 1994 Agricultural Census <sup>(5)</sup> a sample was drawn from growers of protected crops, these being any crops or plants grown within a glasshouse or polytunnel. The country was divided into 11 land-use regions as shown in figure 1. 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 would not dominate the sample.

Mushrooms are not included in the Census, and in consultation with the Horticultural Unit of SOAEFD, all the known commercial mushroom growers in Scotland were identified.

The period of the survey covered pesticide applications to crops during the 12 month period 1st October 1994 to 31st September 1995, except for mushrooms which was the 1995 calendar year. With the exception of a few growers which had to be interviewed by telephone, data were collected by personal interviews during visits to the holdings. In total, information was collected from 43 holdings (Table 2) and 13 mushroom growers.

On completion of the survey, some regions were amalgamated: Highland & Islands, Caithness & Orkney and Moray Firth (Northern Scotland); Lothian, Tweed Valley, Southern Uplands and Solway (Southern Scotland).

The data for the protected crops were raised to give national estimates of both the areas of crops grown and the use of pesticide by using raising factors based on the areas of holdings growing protected crops in the June 1995 Agricultural Census <sup>(6)</sup> within regions and size groups (Table 40). Estimates were adjusted to take into account those glasshouses where no crops were grown in 1995. An adjustment (Table 41) was made also for tomatoes within each region by applying the raising factors to the sample area and comparing this with the area from the Agricultural Census. This was not possible for the other crops as they are not listed specifically in the Census. Since all known mushroom growers were interviewed, raising of usage data for mushrooms was not necessary.

## EDIBLE CROPS

### TOMATOES

Since 1991 the area grown had more than halved to 100,934 m<sup>2</sup>.

#### ***Insecticides, biological agents and molluscicides (Table 4)***

The proportion of the crop treated with an insecticide was 95%, of which 84% was treated using biological methods. In the 1991 report, which did not distinguish between chemical and biological agents, 97% of the crop was recorded as being treated with 'all insecticides'.

Insecticides were used for the control of red spider mite and whitefly. Red spider mite was controlled mainly by the use of fenbutatin oxide (73% of the crop) and the formulated mixture of dicofol/tetradifon (19%). The biological control agent *Encarsia* sp. was used on 40% of the crop for the control of whitefly, whilst only 3% and 2% of the crop was treated with nicotine and the mixed active formulation heptenophos/permethrin respectively against this pest. As in 1991, *Bacillus thuringiensis* (40%) and *Phytoseiulus persimilis* (27%) were used against caterpillars and red spider mite respectively.

Of some significance was the fact that 72% of the crop was pollinated by bees which influenced the use of insecticides.

The only molluscicide recorded was metaldehyde, on 8% of the crop area.

#### ***Fungicides, soil sterilants and disinfectants (Table 5)***

Ninety-two percent of the crop was treated with fungicides mainly against *Botrytis*, a slight increase on the 87% recorded in the previous survey. As in 1991 iprodione was the main fungicide applied, to 67% of the crop, followed by dichlofluanid (40%). The use of benomyl fell from 49% of the crop treated in 1991 to only 2% in 1995. The reduction in the use of benomyl reflected the fact that strains of *Botrytis cinerea* have become resistant to benomyl, and that MBC fungicides are no longer recommended <sup>(7)</sup>.

The proportion of the crop treated with dazomet decreased from 10% in 1991, to 2% in the present survey, whilst the use of formaldehyde as a disinfectant in houses rose from 13% to 24%.

#### ***Herbicides***

Paraquat, for general weed control, was the only herbicide recorded in 1991, on 5% of the crop. No herbicide was recorded in the present survey.

An estimated 11,210 m<sup>2</sup> of vegetable seedlings (mostly brassicae) were grown in 1995, a 30% increase on 1991.

● *Insecticides and molluscicides (Table 6)*

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The area of crop treated with insecticides and molluscicides increased from 65% in 1991 to 85% in 1995. The only specified reasons given for the use of insecticides was against aphids. Chlorpyrifos, cypermethrin and pirimicarb were each used on 85% of the crop area.

Again, metaldehyde was the only molluscicide used, on 85% of the crop.

● *Fungicides and soil sterilants (Table 7)*

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The use of fungicides in 1995, applied to 89% of the crop, was a considerable increase from 1991 when only 27% was treated. They were mostly used for the control of *Botrytis* and as a general preventative spray. Dichlofluanid and the mancozeb/metalaxyl mixture were the principal chemicals used. The principal fungicide in the previous survey, tolclofos-methyl, was not recorded in 1995.

Although 24% of the crop in 1991 was treated with dazomet, no soil sterilisation was recorded in the present survey.

● *Herbicides (Table 7)*

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The herbicides paraquat (85% of the crop) and glyphosate (43%) were used for general weed control on the soil within the protected area. The use of herbicide had not been recorded in either of the two previous surveys.

This category of protected crops is an amalgamation of minor crops encountered in this survey, amounting to 49,719 m<sup>2</sup>, consisting mostly of leeks and strawberries, but because of large variations in the crops between the years surveyed it was not possible to make valid comparisons between the two surveys.

### ● *Insecticides, biological agents and molluscicides (Table 8)*

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Seventy-nine percent of the crop area was treated with an insecticide. The active ingredients deltamethrin (against caterpillars), fenbutatin oxide (against red spider mite) and pirimicarb (against aphids) were each used on approximately 20% of the crop area.

The biological control agents, *Heterorhabditis* sp. and *Phytoseiulus persimilis*, were used against vine weevil and red spider mite respectively, each on 10% of the crop.

Twenty-nine percent of the area was treated with the molluscicide, metaldehyde.

### ● *Fungicides (Table 9)*

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Forty-seven percent of the crop was treated with a fungicide. The main reasons given for the use of fungicides were for the control of *Botrytis* and mildew, with bupirimate (30% of the crop treated), iprodione (22%) and chlorothalonil (19%) being the most commonly used.

Benomyl was the principal fungicide in 1991, applied to 24% of the crop area, but was not recorded during the present survey. This reflected the fact that strains of *Botrytis cinerea* have become resistant to benomyl, and that MBC fungicides are no longer recommended<sup>(7)</sup>.

### ● *Herbicides (Table 9)*

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Forty-four percent of the crop area was treated with herbicide. Glyphosate, applied to 29% of the crop area, and aziprotryne (24%) were the principal herbicides used for general weed control within the houses.

The area of mushroom crops declined from 252,696 m<sup>2</sup> in 1991 to 191,584 m<sup>2</sup> in 1995.

● *Insecticides (Table 10)*

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Usage of insecticides (87% of the crop treated) was roughly similar to that in 1991 and again they were used predominantly for the control of sciarid and phorid flies. Diflubenzuron was the most commonly used (on 49% of the crop) replacing diazinon, the principal active in 1991.

● *Fungicides (Table 11)*

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As in 1991, all crops received a fungicide as a precaution against *Verticillium* and *Mycogone* sp., and again, prochloraz was the dominant active ingredient used on 96% of the crop. Benomyl was used on 48% of the crop in 1991, but approval was amended <sup>(7)</sup> for the use of MBC fungicides, because of their ineffectiveness against strains of *Verticillium fungicola* (dry bubble). Consequently no use of benomyl was recorded on the crop during 1995.

● *Disinfectants (Table 12)*

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Disinfectants were used in the general cleansing of the houses and equipment, and to give some control in the prevention of spore dispersal before emptying the houses. Sodium hypochlorite which was the most popular disinfectant, applied to 59% of the crop area, was also used directly on the crop for disease prevention and as a mushroom cleanser.

## **NON-EDIBLE CROPS**

## **BEDDING AND POT PLANTS**

The area of crops grown, including multi cropping, increased by more than a half from an estimated 360,452 m<sup>2</sup> in 1991 to 548,317 m<sup>2</sup> in 1995.

As in the previous survey, the proportion of crop treated with individual pesticides or pesticide groups is not reported as the continuous throughput of plants does not allow accurate recording of the appropriate data.

### ● *Insecticides, biological agents and molluscicides (Table 13)*

The main reasons given for the use of insecticides were for the control of aphids and whitefly. Cypermethrin, pirimicarb and oxydemeton-methyl were the principal aphicides, and buprofezin and deltamethrin were the main insecticides to control whitefly.

In 1991 few instances of the use of biological control agents were recorded, but in 1995 their use had increased to over 300,000 m<sup>2</sup>. The main biological control agents were *Amblyseius* spp. against thrips and *Verticillium lecanii* against whitefly.

Almost 200,000 m<sup>2</sup> were treated with molluscicides. As in 1991, metaldehyde was the main molluscicide used.

### ● *Fungicides (Table 14)*

*Botrytis*, damping off and mildew were the most frequently cited reasons for treatment and, as in the previous survey, iprodione was the most commonly used fungicide, followed closely by propamocarb hydrochloride and tolclofos-methyl; they were all applied to over 200,000 treated m<sup>2</sup>.

### ● *Herbicides and growth regulators (Table 15)*

Oxadiazon was the most popular herbicide used for general annual weed control within the houses, the total treated area being 58,186 m<sup>2</sup> compared with 14,481 m<sup>2</sup> in 1991.

Daminozide and paclobutrazol were the two most commonly used growth regulators in the present survey, compared with paclobutrazol and 4-indol-3-ylbutyric acid in 1991.

This category consisted predominantly of chrysanthemums, and the estimated area grown dropped from around 70,000 m<sup>2</sup> in 1991 to roughly 17,000 m<sup>2</sup> in 1995.

● ***Insecticides, molluscicides and fungicides (Table 16)***

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Very few pesticides were used on this crop. The only ones recorded were nicotine (22% of the crop) against whitefly, methiocarb (22%) against slugs, iprodione (22%) for *botrytis* control and propiconazole (100%) for white rust control. No herbicide use was recorded.

In 1991, 90% of the crop was treated with a wide range of insecticides whilst fungicides and herbicides were applied to around 50% of the crop area.

## COMPARISONS WITH PREVIOUS SURVEYS

### ● *Edible Crops*

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The area of edible crops had declined by 37% since 1991 to 161,863 m<sup>2</sup>. Tomatoes which dominate this group of crops, accounting for 62% of the area grown, have declined by 54% to 100,934 m<sup>2</sup>. No protected lettuce crops were encountered in this survey (estimated to be 15,500 m<sup>2</sup> in 1991).

Comparisons in the usage of pesticides in terms of weight and treated area of active ingredients applied between the current and previous surveys are presented in Table 35.

Usage of insecticides, as measured by the treated area of active ingredients, was similar to that recorded in 1991, when the decline in the area grown is taken into account. The weight of insecticides applied dropped by only 4%. This relative increase was partly due to the use of the insecticide/acaricide chlorpyrifos (28 kg) as a drench on vegetable seedlings, applied at a relatively high rate, although this was to some degree countered by fatty acids not being recorded on tomatoes in the present survey, which had accounted for 25 kg in 1991.

The area treated with biological agents fell to less than a quarter of that recorded in 1991. This was largely a result of a reduction in the use of *Encarsia* sp. against whitefly, partly from the decline in the area of tomatoes grown, but mostly from the reduction in the number of introductions from an average of 14 in 1991 to only 5 in 1995.

The reduction in the total spray area of fungicide active ingredients by 31% was slightly less than the reduction of crop area. The 3% fall in weight, indicating a relative increase, was in part due to the greater use of propamocarb hydrochloride on tomatoes, which is applied at a high dose rate.

The 82% increase in area treated with herbicide active ingredients arose through the increased usage on other edible crops, from 8,000 treated m<sup>2</sup> in the previous survey to over 34,000 treated m<sup>2</sup> in 1995 and the usage on vegetable seedlings, over 14,000 m<sup>2</sup> treated in 1995, whereas no herbicide treatments had been recorded in 1991.

## ● *Mushrooms*

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The area of mushrooms grown in 1995 had declined by 24% since 1991.

Comparisons in the usage of pesticides in terms of weight and treated area of active ingredients applied between the current and previous surveys are presented in Table 36.

The proportion of crop treated with insecticide, 89%, remained at a similar level to that in 1991, 81%, although the total area treated with active ingredients more than halved, even when the decline in area grown is taken into account. This is due mainly to the reduction of repeated treatments, in particular with diazinon, and the reduction in use of the formulated mixture of pyrethrins and resmethrin.

The total area treated with fungicide active ingredients declined by only 2% since 1991, indicating a relative increase when the drop in area grown is taken into account. The 38% decline in weight of fungicides recorded is due mainly to the lower dosage rates applied of the principal fungicide, prochloraz.

## ● *Non-edible crops*

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The area of bedding and pot plants had increased by over 30% since 1991 to 565,664 m<sup>2</sup>, although the area of flowers for cutting fell by 74% to an estimated 17,327 m<sup>2</sup>.

Comparisons in the usage of pesticides in terms of weight and treated area of active ingredients applied between the current and previous surveys are presented in Table 37.

Insecticide usage, as measured by the total treated area of active ingredients, rose by 11%, but declined by 18% in terms of weight applied. There was a large increase in the use of biological agents, from less than 1,700 treated m<sup>2</sup> to almost 340,000 treated m<sup>2</sup>, due mainly to the extensive use of *Amblyseius* spp against thrips.

The area treated with fungicide more than doubled since 1991 to 1.6 million m<sup>2</sup>, which was accounted for by the general increase in usage by a number of fungicides. The weight of fungicides increased almost 10-fold, due mainly to the use of propamocarb hydrochloride which is applied at relatively high dose rates. No soil sterilants were encountered in this survey; dazomet was used on approximately 38,000 m<sup>2</sup> in 1991.

Herbicide active ingredients decreased by only 4%, although their weight more than doubled. This was due mainly to the increased use of oxadiazon, which is applied at relatively high dose rates.

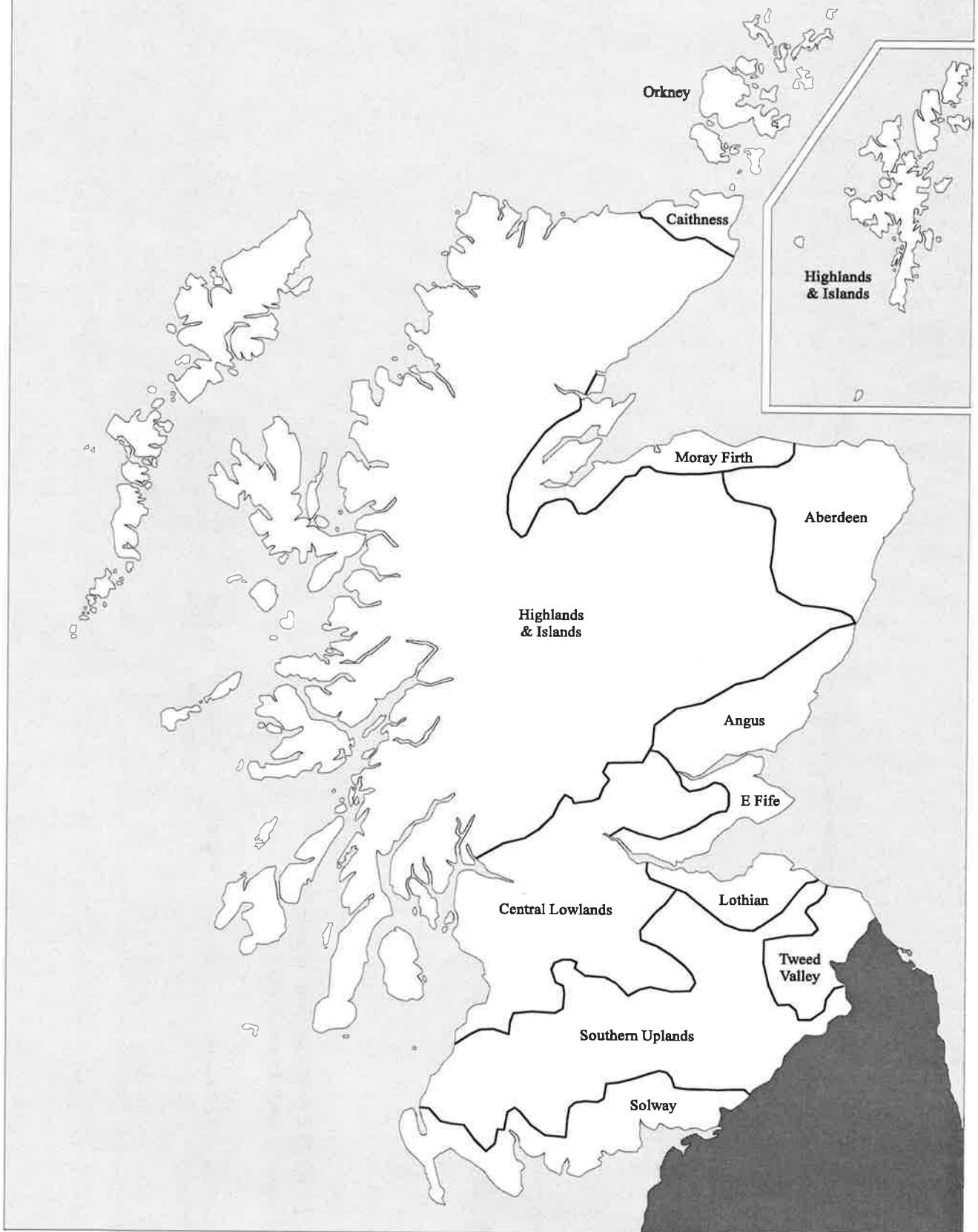
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● **Figure 1 Land-Use Regions of Scotland**



**TABLE 1 Crop areas***Estimated area, m<sup>2</sup>, of protected crops and mushrooms grown in Scotland*

<i>Crop</i>	<i>1995</i>	<i>1991</i>	<i>% change</i>
Tomatoes	100,934	217,264	-53
Vegetable seedlings	11,210	7,694	+46
Other edible crops	49,719	17,770	+180
Mushrooms	191,584	252,696	-24
Bedding & pot plants	548,317	360,452	+52
Flowers for cutting	17,327	72,298	-76
<b>All crops</b>	<b>727,507</b>	<b>928,174</b>	<b>-22</b>

**TABLE 2 Distribution of sample***Number of holdings sampled in each region*

<i>Northern Scotland</i>	<i>Aberdeen</i>	<i>Angus</i>	<i>East Fife</i>	<i>Central Lowlands</i>	<i>Southern Scotland</i>	<i>Total</i>
6	2	2	2	25	6	43

**TABLE 3 Proportion (%) of each crop treated with pesticides**

	Tomatoes	Vegetable seedlings	Other edible crops	Mushrooms	Flowers for cutting
Insecticides	95	85	79	89	22
Molluscicides	8	85	39		22
Biological agents	84		19		
Fungicides	92	89	47	100	100
Herbicides		85	44		
Any pesticide	100	89	84	100	100

Note : proportions were not calculated for bedding and pot plants (see text).

**TABLE 4 Tomatoes**

*Insecticides, biological agents and molluscicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Insecticides</b>	<b>Caterpillars</b>	<b>Red spider mite</b>	<b>Whitefly</b>	<b>Slugs</b>	<b>Total treated area</b>	<b>% crop treated</b>	<b>% crop treated 1991</b>
Dicofol/tetradifon		30,136			30,136	19	43
Fenbutatin oxide		213,634			213,634	73	39
Heptenophos/permethrin			2,977		2,977	2	1
Nicotine			4,005		4,005	3	+
<b>All insecticides</b>		<b>243,770</b>	<b>6,982</b>		<b>250,752</b>	<b>95</b>	
<b>Biological agents</b>							
Bacillus thuringiensis	80,594				80,594	40	39
Encarsia sp.			201,485		201,485	40	62
Phytoseiulus persimilis		200,368			200,368	27	28
<b>All biological agents</b>	<b>80,594</b>	<b>200,368</b>	<b>201,485</b>		<b>482,447</b>	<b>73</b>	
<b>Molluscicides</b>							
Metaldehyde				8,359	8,359	8	+
<b>Area planted (m<sup>2</sup>)</b>						<b>100,934</b>	

‘+’ = <0.5%

**TABLE 5 Tomatoes**

*Fungicides, soil sterilants and disinfectants, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

	Botrytis	Damping off	Phytophthora root rot	Stem rot	Soil hygiene	General hygiene	No reason given	Total treated area	% crop treated	% crop treated 1991
<b>Fungicides</b>										
Benomyl	4,465							4,465	2	49
Chlorothalonil	41,793							41,793	8	7
Copper oxychloride					8,359			8,359	8	
Dichlofluanid	80,594							80,594	40	17
Iprodione	146,681			6,710				153,391	67	28
Propamocarb hydrochloride		28,676	11,281				11,952	51,909	29	21
<b>All fungicides</b>	<b>273,533</b>	<b>28,676</b>	<b>11,281</b>	<b>6,710</b>	<b>8,359</b>		<b>11,952</b>	<b>340,511</b>	<b>92</b>	<b>87</b>
<b>Soil sterilants</b>										
Dazomet					3,473			3,473	2	10
<b>Disinfectants</b>										
Formaldehyde						24,087		24,087	24	13
Area planted (m <sup>2</sup> )								100,934		

**TABLE 6 Vegetable seedlings**

*Insecticides and molluscicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Insecticides</b>	<b>Aphids</b>	<b>Slugs</b>	<b>Precaution</b>	<b>Total treated area</b>	<b>% crop treated</b>	<b>% crop treated 1991</b>
Chlorpyrifos			9,551	9,551	85	
Cypermethrin	9,551			9,551	85	
Pirimicarb	9,551			9,551	85	28
Quinalphos/thiometon			9,551	9,551	43	
<b>All insecticides</b>	<b>19,102</b>		<b>19,102</b>	<b>38,204</b>	<b>85</b>	
<b>Molluscicides</b>						
Metaldehyde		9,551		9,551	85	32
Area planted (m <sup>2</sup> )						11,210

**TABLE 7 Vegetable seedlings**

*Fungicides and herbicides the reasons for their use, (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Fungicides</b>	<b>Botrytis</b>	<b>Damping off</b>	<b>Disease precaution</b>	<b>General weed control</b>	<b>Total treated area</b>	<b>% crop treated</b>	<b>% crop treated 1991</b>
Dichlofuanid	19,102				19,102	85	
Etridiazole		461			461	4	4
Mancozeb/metalaxyl			19,102		19,102	85	
<b>All fungicides</b>	<b>19,102</b>	<b>461</b>	<b>19,102</b>		<b>38,665</b>	<b>89</b>	<b>27</b>
<b>Herbicides</b>							
Glyphosate				4,775	4,775	43	
Paraquat				9,551	9,551	85	
<b>All herbicides</b>				<b>14,326</b>	<b>14,326</b>	<b>85</b>	
Area planted (m <sup>2</sup> )					11,210		

**TABLE 8 Other edible crops**

*Insecticides, biological agents, and molluscicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Insecticides</b>	<b>Aphids</b>	<b>Carrot fly</b>	<b>Caterpillars</b>	<b>Red spider mite</b>	<b>Slugs</b>	<b>Vine weevil</b>	<b>Total treated area</b>	<b>% crop treated</b>	<b>% crop treated 1991</b>
Bifenthrin			5,111				5,111	10	
Cypermethrin	2,813						2,813	6	8
Deltamethrin			12,014				12,014	24	
Fenbutatin oxide			9,911				9,911	20	
Pirimicarb	14,351						14,351	19	1
Pirimiphos-methyl		4,775					4,775	10	
<b>All insecticides</b>	<b>17,164</b>	<b>4,775</b>	<b>12,014</b>	<b>15,021</b>			<b>48,974</b>	<b>79</b>	
<b>Biological agents</b>									
<i>Heterorhabditis</i> sp.						4,800	4,800	10	
<i>Phytoseiulus persimilis</i>				9,600			9,600	10	1
<b>All biological agents</b>				<b>9,600</b>		<b>4,800</b>	<b>14,400</b>	<b>19</b>	
<b>Molluscicides</b>									
Metaldehyde					14,402		14,402	29	8
Methiocarb					4,775		4,775	10	16
<b>All molluscicides</b>					<b>19,177</b>		<b>19,177</b>	<b>39</b>	
Area planted (m <sup>2</sup> )							47,719		

**TABLE 9 Other edible crops**

Fungicides and herbicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated

Fungicides	Botrytis	Mildew	Disease precaution	No reason given	General weed control	Total treated area	% crop treated	% crop treated 1991
Bupirimate		19,821				19,821	30	
Chlorothalonil	14,351					14,351	19	
Chlorothalonil/metalaxyl			7,165			7,165	5	
Fenarimol		5,111				5,111	10	
Iprodione	9,600			1,407		11,007	22	+
Sulphur		5,111				5,111	10	
Thiram	4,800					4,800	10	
<b>All fungicides</b>	<b>28,751</b>	<b>30,042</b>	<b>7,165</b>	<b>1,407</b>		<b>67,365</b>	<b>47</b>	<b>14</b>
<b>Herbicides</b>								
Aziprotrryn					12,014	12,014	24	
Glyphosate					14,402	14,402	29	45
Paraquat					2,813	2,813	6	
Prometryn					4,775	4,775	10	
<b>All herbicides</b>					<b>34,004</b>	<b>34,004</b>	<b>44</b>	<b>45</b>
Area planted (m <sup>2</sup> )						47,719		

'+' = < 0.5%



**TABLE 11 Mushrooms**

*Fungicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Fungicides</b>	<b>Bubble</b>	<b>Dactilium</b>	<b>Disease precaution</b>	<b>Total treated area</b>	<b>% crop treated</b>	<b>% crop treated 1991</b>
Carbendazim		57,750	4,464	62,214	16	
Chlorothalonil	11,700			11,700	6	15
Prochloraz	158,258	97,200	89,420	344,878	96	85
<b>All fungicides</b>	<b>169,958</b>	<b>154,950</b>	<b>93,884</b>	<b>418,792</b>	<b>100</b>	<b>100</b>

**TABLE 12 Mushrooms**

*Disinfectants, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Disinfectants</b>	<b>Disease precaution</b>	<b>General hygiene</b>	<b>General hygiene &amp; spore control</b>	<b>Spore control</b>	<b>Mushroom 'whitener'</b>	<b>Total treated area</b>	<b>% crop treated</b>
Formaldehyde		23,930				23,930	12
Paraformaldehyde		27,200				27,200	14
Sodium hypochlorite	14,520	53,516		17,586	80,270	165,892	59
Unspecified disinfectant		47,024	32,400	11,724		91,148	41
<b>All disinfectants</b>	<b>14,520</b>	<b>151,670</b>	<b>32,400</b>	<b>29,310</b>	<b>80,270</b>	<b>308,170</b>	<b>82</b>
Area planted (m <sup>2</sup> )							191,584

**TABLE 13 Bedding & pot plants***Insecticides, biological agents and molluscicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations)*

<b>Insecticides</b>	<b>Aphids</b>	<b>Aphids &amp; leaf miner</b>	<b>Leaf miner</b>	<b>Caterpillars</b>	<b>Red spider mite</b>	<b>Vine weevil</b>	<b>Whitefly</b>	<b>Slugs</b>	<b>Precaution</b>	<b>No reason given</b>	<b>Total treated area</b>
Buprofezin							56,094				56,094
Chlorpyrifos						2,923		11,927		22,811	37,661
Cypermethrin	256,120	22,262		4,813							283,195
Deltamethrin	74,695						49,389			49,389	124,084
Dichlorvos											49,389
Dicofol					24,173						24,173
Dicofol/tetraifon					9,294						9,294
Dimethoate	1,332	14,753			33,895						49,980
Fatty acids									71,610		71,610
Fenitrothion			1,070								1,070
Heptenophos	33,895										33,895
Heptenophos/permethrin							2,082				2,082
Malathion							26,838				26,838
Nicotine	14,316										14,316
Oxydemeton-methyl	129,019										129,019
Permethrin							26,838				26,838
Pirimicarb	204,715										204,715
Resmethrin	7,617										7,617
Teflubenzuron							27,870				27,870
<b>All insecticides</b>	<b>721,708</b>	<b>37,015</b>	<b>1,070</b>	<b>4,813</b>	<b>67,363</b>	<b>2,923</b>	<b>189,111</b>		<b>83,538</b>	<b>72,200</b>	<b>1,179,741</b>

continued

**TABLE 13 Bedding & pot plants (continued)**

*Insecticides, acaricides, biological agents and molluscicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations)*

<b>Biological agents</b>	<b>Aphids</b>	<b>Aphids &amp; leaf miner</b>	<b>Leaf miner</b>	<b>Caterpillars</b>	<b>Red spider mite</b>	<b>Vine weevil</b>	<b>Whitefly</b>	<b>Thrips</b>	<b>Slugs</b>	<b>Total treated area</b>
<i>Amblyseius</i> spp.								271,162		271,162
<i>Orius</i> sp.				9,553						9,553
<i>Phytoseiulus persimilis</i>					9,553					9,553
<i>Verticillium lecanii</i>							49,389			49,389
<b>All biological agents</b>				<b>9,553</b>	<b>9,553</b>		<b>49,389</b>			<b>339,657</b>
<b>Molluscicides</b>										
Metaldelyde									129,019	129,019
Methiocarb									66,391	66,391
<b>All molluscicides</b>									<b>195,410</b>	<b>195,410</b>
Area planted (m <sup>2</sup> )										548,317

**TABLE 14 Bedding & pot plants***Fungicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations)*

<b>Fungicides</b>	<b>Botrytis</b>	<b>Damping off</b>	<b>Mildew</b>	<b>Pestalotiopsis</b>	<b>Disease precaution</b>	<b>No reason given</b>	<b>Total treated area</b>
Benomyl	40,876		1,665				42,541
Bupirimate			54,063				54,063
Bupirimate/triforine			55,244				55,244
Carbendazim					53,100		53,100
Chlorothalonil	54,650		84,765				139,415
Etridiazole		78,548					78,548
Fenarimol			1,332				1,332
Furalaxyl		53,100					53,100
Imazalil			41,371				41,371
Iprodione	246,349		12,627				258,975
Prochloraz			16,350	86,601			102,951
Propamocarb hydrochloride		236,739					236,739
Propiconazole			21,997				21,997
Thiram	33,895						33,895
Tolclofos-methyl		200,868					200,868
Vinclozolin			31,670				31,670
Zineb	10,343					129,019	139,362
<b>All fungicides</b>	<b>386,113</b>	<b>569,255</b>	<b>321,084</b>	<b>86,601</b>	<b>53,100</b>	<b>129,019</b>	<b>1,545,173</b>
Area planted (m <sup>2</sup> )							548,317

**TABLE 15 Bedding & pot plants**

*Herbicides and growth regulators, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations)*

<b>Herbicides</b>	<b>General weed control</b>	<b>Liverwort &amp; moss</b>	<b>Growth regulation</b>	<b>Total treated area</b>
Diphenamid	6,417			6,417
Diquat/paraquat	17,185			17,185
Isoxaben	6,417			6,417
Oxadiazon	58,186			58,186
Paraquat	24,424			24,424
<b>All herbicides</b>	<b>112,630</b>			<b>112,629</b>
<b>Growth regulators</b>				
Chlormequat			13,145	13,145
Daminozide			71,687	71,687
4-indol-3-ylbutyric acid			2,674	2,674
Paclobutrazol			59,816	59,816
<b>All growth regulators</b>			<b>147,323</b>	<b>147,323</b>
<b>Others</b>				
Quinoclammin		64,951		64,951
<b>Area planted (m<sup>2</sup>)</b>				<b>548,317</b>

**TABLE 16 Flowers for cutting**

*Insecticides, molluscicides and fungicides, the reasons for their use (total pesticide treated area, m<sup>2</sup>, of formulations) and percentage of crop treated*

<b>Insecticides</b>	<b>Whitefly</b>	<b>Slugs</b>	<b>Botrytis</b>	<b>White rust</b>	<b>Total treated area</b>	<b>% crop treated</b>	<b>% crop treated 1991</b>
Nicotine	11,522				11,522	22	
<b>Molluscicides</b>							
Methiocarb		3,841			3,841	22	7
<b>Fungicides</b>							
Iprodione			11,522		11,522	22	19
Propiconazole				38,495	38,495	100	25
<b>All fungicides</b>			<b>11,522</b>	<b>38,495</b>	<b>50,017</b>	<b>100</b>	<b>50</b>
Area planted (m <sup>2</sup> )							17,327

**TABLE 17 Edible crops**

*Insecticides, biological agents and molluscicides (total pesticide treated area, m<sup>2</sup>, of active ingredients)*

<b>Insecticides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total treated area</b>	<b>Treated area 1991</b>	<b>Mushrooms</b>	<b>Treated area 1991</b>
<b>Pyrethroids</b>							
Alpha-cypermethrin						35,240	
Bifenthrin			5,111	5,111			
Cypermethrin		9,551	2,813	12,364	4,248	2,232	
Deltamethrin			12,014	12,014			
Permethrin	2,977			2,977	1,250	27,444	114,206
Pyrethrins					1,500	47,398	180,722
Resmethrin					1,500	45,166	115,044
<b>Organophosphates</b>							
Chlorfenvinphos						4,464	38,544
Chlorpyrifos		9,551		9,551			
Diazinon						11,504	232,880
Dichlorvos						32,400	9,460
Heptenophos	2,977			2,977	8,749		
Pirimiphos-methyl			4,775	4,775			
Quinalphos		9,551		9,551			
Thiometon		9,551		9,551			

continued

**TABLE 17 Edible crops (continued)**Insecticides, biological agents and molluscicides (total pesticide treated area, m<sup>2</sup>, of active ingredients)

<b>Insecticides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total treated area</b>	<b>Treated area 1991</b>	<b>Mushrooms</b>	<b>Treated area 1991</b>
<b>Organochlorines</b>							
Dicofol	30,136			30,136	196,827	3,300	39,594
<b>Carbamates</b>							
Pirimicarb		9,551	14,351	23,902	31,827		
<b>Others</b>							
Diflubenzuron						94,594	19,250
Fenbutatin oxide	213,634		9,911	223,544	89,280		
Nicotine	4,005			4,005	74		
Tetradifon	30,136			30,136	188,480		
<b>All insecticides</b>	<b>283,865</b>	<b>47,755</b>	<b>48,975</b>	<b>380,594</b>		<b>316,702</b>	
<b>Biological agents</b>							
Bacillus thuringiensis	80,594			80,594	85,215		
Encarsia sp.	201,485			201,485	1,862,866		
Heterorhabditis sp.			4,800	4,800			
Phytoseiulus persimilis	200,368		9,600	209,968	204,716		
<b>All biological agents</b>	<b>482,447</b>		<b>14,400</b>	<b>496,847</b>			
<b>Molluscicides</b>							
Metaldehyde	8,359	9,551	14,402	32,311	35,679		
Methiocarb			4,775	4,775	4,805		
<b>All molluscicides</b>	<b>8,359</b>	<b>9,551</b>	<b>19,177</b>	<b>37,086</b>			

**TABLE 18 Edible crops**

*Fungicides, soil sterilants and disinfectants, (total pesticide treated area, m<sup>2</sup>, of active ingredients)*

<b>Fungicides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total treated area</b>	<b>Treated area 1991</b>	<b>Mushrooms</b>	<b>Treated area 1991</b>
Benomyl	4,465			4,465	194,022		120,078
Bupirimate			19,821	19,821			
Carbendazim					16,529	62,214	
Chlorothalonil	41,793		21,516	63,309	74,400	11,700	38,544
Copper oxychloride	8,359			8,359			
Dichlofluamid	80,594	19,102		99,696	54,277		
Etridiazole		461		461	3,542		
Fenarimol			5,111	5,111			
Iprodione	153,391		11,007	164,397	212,756		
Mancozeb		19,102		19,102			
Metaxyl		19,102	7,165	26,267			
Prochloraz						344,878	227,066
Propamocarb hydrochloride	51,909			51,909	67,053		
Sulphur			5,111	5,111			
Thiram			4,800	4,800			
<b>All fungicides</b>	<b>340,511</b>	<b>57,767</b>	<b>74,531</b>	<b>472,808</b>		<b>418,792</b>	

continued

**TABLE 18 Edible crops (continued)**Fungicides, soil sterilants and disinfectants, (total pesticide treated area, m<sup>2</sup>, of active ingredients)

	Tomatoes	Vegetable seedlings	Other edible crops	Total treated area	Treated area 1991	Mushrooms	Treated area 1991
<b>Soil sterilants</b>							
Dazomet	3,473			3,473	30,448		
<b>All soil sterilants</b>	<b>3,473</b>			<b>3,473</b>	<b>30,448</b>		
<b>Disinfectants</b>							
Formaldehyde	24,087			24,087	28,470	23,930	*
Paraformaldehyde						27,200	*
Sodium hypochlorite						165,892	*
Unspecified disinfectants						91,148	*
<b>All disinfectants</b>	<b>24,087</b>			<b>24,087</b>		<b>308,170</b>	<b>*</b>

\* = areas treated with disinfectants not reported in 1991.

**TABLE 19 Edible crops**  
 Herbicides, (total pesticide treated area, m<sup>2</sup>, of active ingredients)

<b>Herbicides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total treated area</b>	<b>Treated area 1991</b>
Aziprotryne			12,014	12,014	
Glyphosate		4,775	14,402	19,177	8,003
Paraquat		9,551	2,813	12,364	15,302
Prometryn			4,775	4,775	
<b>All herbicides</b>		<b>14,326</b>	<b>34,004</b>	<b>48,330</b>	

**TABLE 20 Non-edible crops***Insecticides, biological agents and molluscicides (total pesticide treated area, m<sup>2</sup>, of active ingredients)*

<b>Insecticides</b>	<b>Bedding &amp; Flowers pot plants for cutting</b>	<b>Total treated area</b>	<b>Treated area 1991</b>
<b>Pyrethroids</b>			
Cypermethrin	283,195	283,195	181,625
Deltamethrin	124,084	124,084	108,254
Permethrin	28,920	28,920	48,103
Resmethrin	7,617	7,617	46,678
<b>Organophosphates</b>			
Chlorpyrifos	37,661	37,661	1,672
Dichlorvos	49,389	49,389	
Dimethoate	49,980	49,980	2,060
Fenitrothion	1,070	1,070	2,892
Heptenophos	35,977	35,977	26,484
Malathion	26,838	26,838	69,683
Oxydemeton-methyl	129,019	129,019	
<b>Organochlorines</b>			
Dicofol	33,467	33,467	28,966
<b>Carbamates</b>			
Pirimicarb	204,715	204,715	249,359

continued

**TABLE 20 Non-edible crops (continued)**

*Insecticides, biological agents and molluscicides (total pesticide treated area, m<sup>2</sup>, of active ingredients)*

<b>Insecticides</b>	<b>Bedding &amp; pot plants</b>	<b>Flowers for cutting</b>	<b>Total treated area</b>	<b>Treated area 1991</b>
<b>Others</b>				
Buprofezin	56,094		56,094	
Fatty acids	71,610		71,610	
Nicotine	14,316	11,522	25,838	27,820
Teflubenzuron	27,870		27,870	6,440
Tetradifon	9,294		9,294	
<b>All insecticides</b>	<b>1,191,116</b>	<b>11,522</b>	<b>1,202,638</b>	
<b>Biological agents</b>				
<i>Amblyseius spp.</i>	271,162		271,162	
<i>Orius sp.</i>	9,553		9,553	
<i>Phytoseiulus persimilis</i>	9,553		9,553	779
<i>Verticillium lecanii</i>	49,389		49,389	
<b>All biological agents</b>	<b>339,657</b>		<b>339,657</b>	
<b>Molluscicides</b>				
Metaldhyde	129,019		129,019	154,551
Methiocarb	66,391	3,841	70,232	20,228
<b>All molluscicides</b>	<b>195,410</b>	<b>3,841</b>	<b>199,251</b>	

**TABLE 21 Non-edible crops**  
*Fungicides (total pesticide treated area, m<sup>2</sup>, of active ingredients)*

<b>Fungicides</b>	<b>Bedding &amp; Flowers pot plants for cutting</b>	<b>Total treated area</b>	<b>Treated area 1991</b>
Benomyl	42,541	42,541	67,775
Bupirimate	109,307	109,307	62,734
Carbendazim	53,100	53,100	
Chlorothalonil	139,415	139,415	32,252
Etridiazole	78,548	78,548	10,651
Fenarimol	1,332	1,332	
Furalaxyl	53,100	53,100	16,125
Imazalil	41,371	41,371	8,190
Iprodione	258,975	270,497	161,524
Prochloraz	102,951	102,951	7,417
Propamocarb hydrochloride	236,739	236,739	21,142
Propiconazole	21,997	60,493	38,205
Thiram	33,895	33,895	
Tolclofos-methyl	200,868	200,868	16,421
Triforine	55,244	55,244	61,689
Vinclozolin	31,670	31,670	104
Zineb	139,362	139,362	5,628
<b>All fungicides</b>	<b>1,600,415</b>	<b>1,650,433</b>	

**TABLE 22 Non-edible crops**

Herbicides, and growth regulators (total pesticide treated area, m<sup>2</sup>, of active ingredients)

<b>Herbicides</b>	<b>Bedding &amp; Flowers pot plants for cutting</b>	<b>Total treated area</b>	<b>Treated area 1991</b>
Diphenamid	6,417	6,417	23,476
Diquat	17,185	17,185	
Isoxaben	6,417	6,417	4,180
Oxadiazon	58,186	58,186	3,492
Paraquat	41,609	41,609	41,043
<b>All herbicides</b>	<b>129,814</b>	<b>129,814</b>	
<b>Growth regulators</b>			
Chlormequat	13,145	13,145	9,075
Daminozide	71,687	71,687	20,317
4-indol-3-ylbutyric acid	2,674	2,674	13,639
Paclobutrazol	59,816	59,816	36,941
<b>All growth regulators</b>	<b>147,322</b>	<b>147,322</b>	
<b>Others</b>			
Quinoclammin	64,951	64,951	

**TABLE 23 Edible crops**  
Quantities (kg) of insecticides and molluscicides used

<b>Insecticides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total weight</b>	<b>Kg 1991</b>	<b>Mushrooms</b>	<b>Kg 1991</b>
<b>Pyrethroids</b>							
Alpha-cypermethrin						1.9	
Bifenthrin			0.1	0.1			
Cypermethrin		+	+	+		+	
Deltamethrin			+	+			
Permethrin				+	0.1	1.0	2.0
Pyrethrins						0.5	94.9
Resmethrin						2.6	5.9
<b>Organophosphates</b>							
Chlorfenvinphos						2.9	58.0
Chlorpyrifos		27.5		27.5		24.6	224.9
Diazinon						24.3	6.8
Dichlorvos							
Heptenophos					0.6		
Phosphor-methyl				+			
Quinalphos		0.3	0.7	0.7		4.3	2.4
Thiometon		0.3		0.3			
<b>Organochlorines</b>							
Dicofol	2.5			2.5	8.4	1.1	3.3
Carbamates							
Pirimicarb		+	0.1	0.2	0.8		

'+' = < 0.5 kg

continued

**TABLE 23 Edible crops (continued)**  
*Quantities (kg) of insecticides and molluscicides used*

<b>Insecticides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total weight</b>	<b>Kg 1991</b>	<b>Mushrooms</b>	<b>Kg 1991</b>
<b>Others</b>							
Diflubenzuron							
Fenbutatin oxide	5.3		1.9	7.2	2.0	56.2	21.3
Nicotine	1.2			1.2	0.4		
Tetradifon	0.9			0.9	2.9		
<b>All insecticides</b>	<b>7.4</b>		<b>1.9</b>	<b>9.3</b>			
<b>Molluscicides</b>							
Metaldhyde	0.2	0.4	0.6	1.1	3.3		
Methiocarb			0.1	0.1			
<b>All molluscicides</b>				<b>1.2</b>			

**TABLE 24 Edible crops***Quantities (kg) of fungicides, soil sterilants and disinfectants used*

<b>Fungicides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total weight</b>	<b>Kg 1991</b>	<b>Mushrooms</b>	<b>Kg 1991</b>
Benomyl	0.2			0.2	20.3		147.1
Bupirimate			1.3	1.3			
Carbendazim					0.5	28.8	
Chlorothalonil	6.3		1.9	8.2	18.1	7.0	40.0
Copper oxychloride	4.2			4.2			
Dichlofluanid	4.0	4.8		8.8	7.5		
Etridiazole		0.5		0.5	1.9		
Fenarimol			0.1	0.1			
Iprodione	10.1		1.0	11.1	22.6		
Mancozeb		5.5		5.5			
Metalaxyl		1.1	0.1	1.3			
Prochloraz						157.3	148.7
Propamocarb hydrochloride	82.6			82.6	44.8		
Sulphur			1.1	1.1			
Thiram			0.6	0.6			
<b>All fungicides</b>	<b>107.4</b>	<b>11.9</b>	<b>6.1</b>	<b>125.4</b>		<b>227.5</b>	

**continued**

**TABLE 24 Edible crops (continued)**

Quantities (kg) of fungicides, soil sterilants and disinfectants used

	Tomatoes	Vegetable seedlings	Other edible crops	Total weight	Kg 1991	Mushrooms	Kg 1991
<b>Soil sterilants</b>							
Dazomet	136.2			136.2	1,340.3	136.2	
<b>All soil sterilants</b>	<b>136.2</b>			<b>136.2</b>			
<b>Disinfectants</b>							
Formaldehyde	189.0			189.0		34.3	
Paraformaldehyde						293.5	
Sodium hypochlorite	245.2			245.2		602.9	
<b>All disinfectants</b>	<b>434.2</b>			<b>434.2</b>		<b>930.7</b>	

**TABLE 25 Edible crops**  
*Quantities (kg) of herbicides used*

<b>Herbicides</b>	<b>Tomatoes</b>	<b>Vegetable seedlings</b>	<b>Other edible crops</b>	<b>Total weight</b>	<b>Kg 1991</b>
Aziprotryne			2.4	2.4	
Glyphosate		0.7	2.1	2.8	1.5
Paraquat		1.0	0.2	1.1	1.4
Prometryn			0.4	0.4	
<b>All herbicides</b>		<b>1.6</b>	<b>5.0</b>	<b>6.7</b>	

**TABLE 26 Non-edible crops**  
Quantities (kg) of insecticides and molluscicides used

Insecticides	Bedding & Flowers pot plants for cutting	Total weight	Kg 1991
<b>Pyrethroids</b>			
Cypermethrin	0.7	0.7	0.5
Deltamethrin	0.1	0.1	0.9
Permethrin	+	+	1.2
Resmethrin	0.1	0.1	1.4
<b>Organophosphates</b>			
Chlorpyrifos	20.7	20.7	0.1
Dichlorvos	17.7	17.7	
Dimethoate	0.8	0.8	0.1
Fenitrothion	0.2	0.2	0.2
Heptenophos	3.7	3.7	0.3
Malathion	3.2	3.2	11.2
Oxydemeton-methyl	2.9	2.9	
<b>Organochlorines</b>			
Dicofol	1.6	1.6	4.4
<b>Carbamates</b>			
Pirimicarb	5.0	5.0	18.3

continued

'+' = < 0.05 kg

**TABLE 26 Non-edible crops (continued)**  
*Quantities (kg) of insecticides and molluscicides used*

<i>Insecticides</i>	<i>Bedding &amp; Flowers pot plants for cutting</i>	<i>Total weight</i>	<i>Kg 1991</i>
<b>Others</b>			
Buprofezin	0.3	0.3	
Fatty acids	36.2	36.2	
Nicotine	0.3	0.5	13.2
Teflubenzuron	0.8	0.8	
Tetradifon	0.1	0.1	
<b>All insecticides</b>	<b>94.5</b>	<b>94.7</b>	
<b>Molluscicides</b>			
Metaldhyde	2.3	2.3	10.9
Methiocarb	1.8	1.9	0.4
<b>All molluscicides</b>		<b>4.2</b>	

**TABLE 27 Non-edible crops**  
Quantities (kg) of fungicides used

Fungicides	Bedding & Flowers pot plants for cutting	Total weight	Kg 1991
Benomyl	1.1	1.1	7.5
Bupirimate	1.5	1.5	1.0
Carbendazim	1.6	1.6	
Chlorothaloni	9.3	9.3	8.7
Etridiazole	103.6	103.6	36.7
Fenarimol	+	+	
Furalaxyl	66.4	66.4	20.2
Imazalil	1.2	1.2	0.2
Iprodione	16.3	17.4	9.2
Prochloraz	3.5	3.5	0.4
Propamocarb hydrochloride	1,485.7	1,485.7	69.0
Propiconazole	0.3	1.3	0.5
Thiram	2.7	2.7	1.4
Tolclofos-methyl	200.9	200.9	16.4
Triforine	0.8	0.8	1.0
Vinclozolin	1.6	1.6	
Zineb	18.8	18.8	0.9
<b>All fungicides</b>	<b>1,915.3</b>	<b>1,917.5</b>	

\*+ = < 0.05 kg

**TABLE 28 Non-edible crops**  
*Quantities (kg) of herbicides and growth regulators used*

<b>Herbicides</b>	<b>Bedding &amp; Flowers pot plants for cutting</b>	<b>Total weight</b>	<b>Kg 1991</b>
Diphenamid	1.4	1.4	9.1
Diquat	0.4	0.4	
Isoxaben	0.1	0.1	
Oxadiazon	52.1	52.1	0.7
Paraquat	2.8	2.8	4.1
<b>All herbicides</b>	<b>56.7</b>	<b>56.7</b>	
<b>Growth regulators</b>			
Chlormequat	2.7	2.7	1.9
Daminozide	12.2	12.2	32.6
4-indol-3-ylbutyric acid	+	+	
Paclobutrazol	+	+	
<b>All growth regulators</b>		<b>14.9</b>	
<b>Others</b>			
Quinoclammin	0.1	0.1	

'+' = < 0.05 kg

**TABLE 29 Edible crops**

Area (total pesticide treated area, m<sup>2</sup>, x 1000) treated with the 20 most used active ingredients on all crops surveyed (excluding mushrooms)

	1995	1991
1 Fenbutatin oxide	224	89
2 <i>Phytoseuiulus persimilis</i>	210	205
3 <i>Encarsia</i> sp.	201	1,863
4 Iprodione	164	213
5 Dichlofluanid	100	54
6 <i>Bacillus thuringiensis</i>	81	85
7 Chlorothalonil	63	74
8 Propamocarb hydrochloride	52	67
9 Metaldehyde	32	36
10 Dicofof	30	197
11 Tetradifon	30	188
12 Metalaxyl	26	
13 Formaldehyde	24	28
14 Pirimicarb	24	32
15 Bupirimate	20	
16 Glyphosate	19	8
17 Mancozeb	19	
18 Cypermethrin	12	4
19 Paraquat	12	15
20 Aziprotryne	12	

**TABLE 30 Edible crops**

Quantity (kg) of the 20 most used active ingredients on all crops surveyed (excluding mushrooms)

	1995	1991
1 Sodium hypochlorite	245	
2 Formaldehyde	189	134
3 Dazomet	136	1,340
4 Propamocarb hydrochloride	83	45
5 Chlorpyrifos	28	
6 Iprodione	11	23
7 Dichlofluanid	9	8
8 Chlorothalonil	8	18
9 Fenbutatin oxide	7	2
10 Mancozeb	6	
11 Copper oxychloride	4	
12 Glyphosate	3	2
13 Dicofof	3	8
14 Aziprotryne	2	
15 Bupirimate	1	
16 Metalaxyl	1	
17 Nicotine	1	+
18 Paraquat	1	1
19 Metaldehyde	1	3
20 Sulphur	1	

'+' = < 0.5 kg

**TABLE 31 Mushrooms**

Area (total pesticide treated area ( $m^2$ ) x 1000) treated with the 15 most used active ingredients

	1995	1991
1 Prochloraz	345	227
2 Sodium hypochlorite	166	19
3 Diflubenzuron	95	180
4 Carbendazim	62	115
5 Pyrethrins	47	9
6 Resmethrin	45	114
7 Alpha-cypermethrin	35	*
8 Dichlorvos	32	39
9 Permethrin	27	39
10 Paraformaldehyde	27	233
11 Formaldehyde	24	39
12 Pirimiphos-methyl	13	12
13 Chlorothalonil	12	12
14 Diazinon	12	4
15 Chlorfenvinphos	4	

\* = area treated with disinfectants not recorded in 1981 report

**TABLE 32 Mushrooms**

Weight (kg) of the 15 most used active ingredients

	1995	1991
1 Sodium hypochlorite	603	96
2 Paraformaldehyde	293	149
3 Prochloraz	157	21
4 Diflubenzuron	56	
5 Formaldehyde	34	
6 Carbendazim	29	
7 Diazinon	25	225
8 Dichlorvos	24	7
9 Chlorothalonil	7	40
10 Pirimiphos-methyl	4	2
11 Chlorfenvinphos	3	58
12 Resmethrin	3	6
13 Alpha-cypermethrin	2	
14 Dicofof	1	3
15 Permethrin	1	2

**TABLE 33 Non-edible crops**

Area (total pesticide treated area (m<sup>2</sup>) x 1000) treated with the 20 most used active ingredients, on crops surveyed

	1995	1991
1 Cypermethrin	283	182
2 Amblyseius spp	271	
3 Iprodione	270	162
4 Propamocarb hydrochloride	237	21
5 Pirimicarb	205	249
6 Tolclofos-methyl	201	16
7 Chlorothalonil	139	32
8 Zineb	139	6
9 Metalddehyde	129	155
10 Oxydemeton-methyl	129	
11 Deltamethrin	124	108
12 Bupirimate	109	63
13 Prochloraz	103	7
14 Etridiazole	79	11
15 Daminozide	72	20
16 Fatty acids	72	
17 Methiocarb	70	20
18 Propiconazole	60	38
19 Paclobutrazol	60	37
20 Propiconazole	60	38

**TABLE 34 Non-edible crops**

Weight (kg) of the 20 most used active ingredients, on crops surveyed

	1995	1991
1 Propamocarb hydrochloride	1,486	69
2 Tolclofos-methyl	201	16
3 Etridiazole	104	37
4 Furalaxyl	66	20
5 Oxadiazon	52	1
6 Fatty acids	36	
7 Chlorpyrifos	21	+
8 Zineb	19	1
9 Dichlorvos	18	
10 Iprodione	17	9
11 Daminozide	12	33
12 Chlorothalonil	9	9
13 Pirimicarb	5	18
14 Heptenophos	4	+
15 Prochloraz	4	+
16 Malathion	3	11
17 Oxydemeton-methyl	3	
18 Paraquat	3	4
19 Chlormequat	3	2
20 Thiram	3	1

'+' = < 0.5 kg

**TABLE 35 Edible crops (excluding mushrooms)**  
 Comparison of pesticide usage 1981 - 1995, total pesticide treated area (m<sup>2</sup>) of active ingredients and quantities used (kg)

	1987		1991		1995	
	Treated area of a i's (m <sup>2</sup> )	kg	Treated area of a i's (m <sup>2</sup> )	kg	Treated area of a i's (m <sup>2</sup> )	kg
<b>Insecticides</b>						
Pyrethroids	290,385	2.0	11,183	0.1	32,465	0.1
Organophosphates	120,206	7.2	32,129	0.6	36,405	28.8
Organochlorines	8,762	0.5	392,351	8.7	30,136	2.5
Carbamates	130,730	6.2	37,035	2.5	23,902	0.2
Others	133,293	10.5	139,758	30.7	257,685	9.3
<b>All insecticides</b>	<b>683,375</b>	<b>26.4</b>	<b>612,456</b>	<b>42.6</b>	<b>380,593</b>	<b>40.9</b>
<b>Biological agents</b>						
Molluscicides	3,181*		2,156,017		496,847	
Fungicides	21,228	2.1	40,484	3.3	37,087	1.2
Herbicides	1,854,797	675.6	686,498	129.7	472,808	125.4
Growth regulators	75,390	14.0	26,611	3.4	48,331	6.7
Soil sterilants	6,921	0.3	6,612	0.3		
Disinfectants	53,979	2,282.5	30,943	1,340.3	3,473	136.2
Area planted (m <sup>2</sup> )	22,318	45.7	59,721	205.5	24,087	434.2
	362,366		258,234		161,863	

\* = most biological control agents omitted from 1987 survey

**TABLE 36 Mushrooms**

Comparison of pesticide usage 1981 - 1995, total pesticide treated area (m<sup>2</sup>) of active ingredients and quantities used (kg)

	1981		1991		1995	
	Treated area of a i's (m <sup>2</sup> )	kg	Treated area of a i's (m <sup>2</sup> )	kg	Treated area of a i's (m <sup>2</sup> )	kg
<b>Insecticides</b>						
Pyrethroids	7,400	+	419,972	103.4	157,480	6.0
Organophosphates	26,100	72.0	319,428	292.1	61,328	56.1
Organochlorines	1,000	1.0	68,594	9.4	3,300	1.1
Others	5,600	6.0	19,250	21.3	94,594	56.3
<b>All insecticides</b>	<b>40,100</b>	<b>79.0</b>	<b>827,244</b>	<b>426.2</b>	<b>316,702</b>	<b>119.5</b>
<b>Fungicides</b>	21,600	24.0	427,982	364.4	418,792	227.5
<b>Disinfectants</b>	*	*	*	96.1	308,170	434.2
Area planted (m <sup>2</sup> )	42,000		252,696		191,584	

\*+ = <0.5 kg

\* = details not reported

**TABLE 37 Non-edible crops**Comparison of pesticide usage 1981 - 1995, total pesticide treated area ( $m^2$ ) of active ingredients and quantities used (kg)

	1981		1991		1995	
	Treated area of a i's ( $m^2$ )	kg	Treated area of a i's ( $m^2$ )	kg	Treated area of a i's ( $m^2$ )	kg
<b>Insecticides</b>						
Pyrethroids	88,232	0.2	446,314	4.2	443,816	0.9
Organophosphates	81,146	4.3	234,960	51.7	329,935	49.4
Organochlorines	50,863	3.1	47,050	8.5	33,467	1.6
Carbamates	77,473	29.8	263,924	24.2	204,715	5.0
Others	8,655	1.7	86,544	26.9	190,706	38.1
<b>All insecticides</b>	<b>306,369</b>	<b>39.1</b>	<b>1,078,792</b>	<b>115.5</b>	<b>1,202,639</b>	<b>95.0</b>
<b>Biological agents</b>						
Molluscicides	2,588	0.2	174,779	11.3	339,658	4.2
Fungicides	161,439	33.7	618,970	201.3	1,650,434	1,917.5
Herbicides	14,829	5.4	135,029	23.4	129,814	56.7
Growth regulators	10,094	0.4	87,958	34.5	147,323	14.9
Soil sterilants	18,136	1,700.8	44,186	1,429.3		
Area planted ( $m^2$ )	165,546		432,750		565,644	

**TABLE 38 Sampled areas**

Area (m<sup>2</sup>) of protected crop holdings in sample

Northern Scotland	Aberdeen	Angus	East Fife	Central Lowlands	Southern Scotland	Total
32,891	3,484	16,118	2,359	158,357	26,585	239,794

**TABLE 39 Census areas**

Area (m<sup>2</sup>) of protected crop holdings in Scotland

Northern Scotland	Aberdeen	Angus	East Fife	Central Lowlands	Southern Scotland	Total
94,195	50,047	25,074	13,417	282,080	86,944	551,757

**TABLE 40 Raising factors**

Size (m <sup>2</sup> )	Northern Scotland	Aberdeen/ Angus	East Fife	Central Lowlands	Southern Scotland
1 - 3,999	16.38	7.41	5.69	4.42	11.82
4,000 - 9,999	1.79	1.00		1.39	1.00
10,000 +	1.71	3.93		1.18	3.35

**TABLE 41 Adjustment factors for tomatoes**

Northern Scotland	Aberdeen/ Angus	East Fife	Central Lowlands	Southern Scotland	Final Adjustment
		0.382	0.876		1.144







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