

PESTICIDE USAGE IN SCOTLAND

***HARDY NURSERY
STOCK 1993***



Scottish Agricultural Science Agency

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	● <i>Page</i>
Summary	1
Introduction.....	2
Definitions and notes	2
Method	3
Pesticide usage on fruit stocks	4
Pesticide usage on roses and rose stocks	5
Pesticide usage on ornamental trees and shrubs	6
Pesticide usage on other nursery stock	7
Comparisons with previous surveys	8
References	9
Acknowledgements	9
Figure 1 showing agricultural land-use regions	10
Figure 2 showing percentages of crop areas grown	11
Figure 3 showing percentages of crop areas treated with pesticides.....	11

	● <i>Table</i>
Regional distribution of crops grown	1
Number of holdings in sample	2
Proportions of crops treated with pesticides.....	3
Pesticide usage on fruit stocks	4-5
Pesticide usage on roses and rose stocks	6-7
Pesticide usage on ornamental trees and shrubs	8-10
Pesticide usage on other nursery stock.....	11-12
Summary of pesticide usage by area of active ingredients	13-15
Summary of pesticide usage by weight of active ingredients	16-18
Principal 20 active ingredients by area and weight	19-20
Comparisons with previous surveys	21
Areas of hardy nursery stock crops grown in sample	22
Areas of hardy nursery stock crops grown in Scotland	23
Raising and adjustment factors	24-26

This report presents information from a survey of pesticide usage on hardy nursery stocks grown in Scotland in 1993. The previous survey on these crops was carried out in 1981, at a time when pesticide usage surveys were carried out on an ad hoc basis. There was little change in the overall area of crops grown compared with the previous survey, at around 450 hectares.

Pesticide usage, as measured by the proportion of the area of all hardy nursery stock treated, increased compared with the previous survey; insecticides from 14 to 56%, fungicides from 17 to 41%, and herbicides from 28 to 83%.

Oxydemeton-methyl was the principal insecticide recorded, applied to 238 spray hectares, followed by dimethoate (218 spray hectares), pirimicarb (187 spray hectares) and cypermethrin (173 spray hectares).

The three main fungicides were bupirimate (224 spray hectares), benomyl (189 spray hectares) and triforine (167 spray hectares), used mostly on other nursery stock (herbaceous plants and heathers).

As in the previous survey, simazine was the most widely used herbicide, applied to 375 spray hectares in 1993. Paraquat (205 spray hectares) and glyphosate (132 spray hectares) were also popular.

INTRODUCTION

This was the third survey of pesticide usage on hardy nursery stock crops. The previous two were in 1976 and 1981 (References 1 & 2). Crops surveyed included fruit stocks, roses and rose stocks, ornamental trees and shrubs, and other nursery stocks comprising herbaceous plants and heathers.

DEFINITIONS AND NOTES

Basic area (or basic ha) is the planted area of crop which was treated with a given pesticide, irrespective of the number of times it was applied to that area.

Spray area (or spray ha) is the basic area of a crop treated with a given pesticide multiplied by the number of treatments that area received.

The reasons reported for the uses of pesticides are those given by growers and may sometimes be inappropriate.

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

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

Data from the 1981 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 1992 Agricultural Census (Reference 3), a sample was drawn representing the whole of Scotland and was selected from holdings growing any of the hardy nursery stock crops.

The country was divided into 11 land-use regions (Fig 1, Reference 4). Holdings were stratified by land-use region and by size group. Sampling fractions within size groups were based on the areas of the relevant crops grown rather than number of holdings, so that smaller size groups would not dominate the sample.

Information on pesticide usage was collected by personal interview. The survey period was the 12 months from September 1992 to September 1993. Details of the numbers of holdings visited and their distribution are given in Table 2 and the areas of crops within size-groups are shown in Table 22.

For all crops, sample data were raised to give estimates of national pesticide usage using raising factors (Table 24). These were based on the areas growing hardy nursery crops in the 1993 Agricultural Census (Reference 5) within regions and size groups (Table 23). Land-use regions 1, 2, 3 and 4 were amalgamated (Northern Scotland), as were regions 5 & 6 (Angus & East Fife), and regions 7, 9, 10 and 11 (South & South-East Scotland). Adjustments (Table 25) were made for each crop within each region by applying the raising factors to the sample area of each crop grown and comparing this with the area from the 1993 Agricultural Census. A second adjustment was made for crops where no holdings were sampled in one or more regions (Table 26).

The area of fruit stocks grown had more than halved since 1981 to below 30 hectares in the present survey. Crops encountered were fruit trees and bushes, raspberry spawn beds and strawberry runner beds.

● ***Insecticides and molluscicides (Table 4)***

The proportion of the area of crops treated with insecticides rose from 25% in the previous survey to 66% in 1993. The main reason for the use of insecticides was for aphid control, whilst only small areas were treated against caterpillars.

Pirimicarb was the main insecticide, applied to 25 spray hectares (54% of the crop), followed by oxydemeton-methyl to 7 spray hectares (25%). In 1981, demeton S-methyl and fenitrothion had been the principal insecticides.

As in the previous survey, no molluscicides were recorded on fruit stocks.

● ***Fungicides (Table 4)***

Fifty-four percent of the crop received fungicide, compared with 29% in 1981. The only specified reason for use was for mildew control.

By far the most commonly used fungicide was triadimefon, applied to 16 spray hectares, 54% of the crop. In 1981, triforine and drazoxolon had been the most popular.

● ***Herbicides (Table 5)***

Nearly all (98%) of the crop was treated with herbicide, compared with only 38% in the previous survey.

The principal herbicide used was propachlor, applied to 32 spray hectares (54% of the crop), followed by isoxaben to 24 spray hectares (81%), and simazine to 21 spray hectares (69%), all for annual weed control. In 1981, lenacil and trifluralin, used on strawberry runner beds only, had been the main herbicides recorded.

The area of these crops fell from 70 hectares in 1981 to only 19 hectares in the present survey.

● ***Insecticides (Table 6)***

Forty-three percent of the crop was treated with insecticide, compared with 20% in 1981. The only reason given for their use was for aphid control.

By far the most widely used insecticide was pirimicarb, applied to 8 hectares, 40% of the crop, compared with only 8% in 1981. In the previous survey, malathion had been the main insecticide, as measured by the area treated, applied to over 17 hectares.

● ***Fungicides (Table 6)***

The proportion of the crop treated with fungicide rose from 30% in the previous survey to 85% in 1993. The main reason for use was for the control of mildew, a change from 1981 when rust had been the principal reason given.

Benomyl, applied to 21 hectares, 74% of the crop, and myclobutanil to 9 hectares (45%) were the most popular fungicides used. In 1981, benodanil and oxycarboxin had been the main fungicides due to the large number of repeat treatments for the control of rust.

● ***Herbicides (Table 7)***

There was a large increase in the proportion of the crop area treated with herbicide since the previous survey, from 36% to 94% in 1993.

As in 1981, the principal herbicide used was simazine; in the present survey, it was applied to 8 spray hectares, 42% of the crop. Also popular in 1993 were propyzamide and diphenamid, each applied to 4 spray hectares.

The area of this category of hardy nursery stock has remained fairly constant and increased by less than 10% to 336 hectares grown in 1993.

● ***Insecticides and molluscicides (Table 8)***

Fifty-seven percent of the crop received insecticide, compared with only 11% in the previous survey. The control of aphids and caterpillars were the predominant reasons given for their use.

Oxydemeton-methyl, applied to 231 spray hectares (14% of the crop), followed by dimethoate to 216 spray hectares (29%) and cypermethrin to 173 spray hectares (6%) were the most popular insecticides recorded. In 1981, malathion had been the main formulation used.

Metaldehyde, applied to only 2 spray hectares was the only molluscicide used, for slug control. None had been recorded in the previous survey.

● ***Fungicides and soil sterilants (Table 9)***

Thirty-three percent of the crop was treated with fungicide, double the figure in 1981. In the present survey, mildew was the main specified reason recorded for their use.

Sulphur, although used on only 2% of the crop was applied to 58 spray hectares due to a large number of repeated treatments. Also popular were bupirimate, applied to 52 spray hectares (52%) and imazilil to 43 spray hectares (3%). In 1981, triadimefon and benomyl had been the most widely used fungicides.

Dazomet was used on 4 hectares as a soil sterilant, roughly similar to the area treated in 1981.

● ***Herbicides (Table 10)***

The proportion of the crop treated with herbicide increased from only 33% in 1981 to 94% in the present survey.

As in 1981, simazine was the principal herbicide used, and in the present survey was applied to 346 spray hectares (57% of the crop). Also popular were paraquat, on 182 spray hectares (42%), glyphosate on 119 spray hectares (23%) and oxadiazon on 103 spray hectares (15%).

The area of crops in this category (herbaceous plants and heathers) increased from less than 2 hectares in 1981 to 71 hectares in 1993.

● ***Insecticides (Table 11)***

Forty-five percent of the crop was treated with insecticide. The principal active ingredient was pirimicarb, applied mainly in a mixed formulation to 138 spray hectares and alone to small areas.

● ***Fungicides (Table 11)***

Fifty-nine percent of the crop received fungicide, a similar proportion to that in 1981. Benomyl was the most popular fungicide recorded, applied to 150 spray hectares, 56% of the crop. Bupirimate and triforine were also widely used.

● ***Herbicides (Table 12)***

Only 18% of the crop area was treated with herbicide. None had been recorded in 1981.

Glyphosate was by far the most commonly used formulation, being applied to 12 spray hectares.

COMPARISONS WITH PREVIOUS SURVEYS

The total area of hardy nursery stock grown in 1993 was similar to that recorded 12 years previously in the last survey, at around 450 hectares.

Comparisons in the usage of pesticides in terms of weight and spray hectares of active ingredients applied between the current and previous surveys are presented in Table 21.

In line with the reported substantial increases of pesticide usage on other crops since the early 1980's, this survey showed similar increased usage on hardy nursery crops since the previous survey conducted in 1981. The proportion of all crops treated with the three main pesticide groups increased: insecticides from 14 to 56%, fungicides from 17 to 41%, and herbicides from 28 to 83%.

Although insecticide usage, when measured by the spray area of active ingredients, increased more than 3-fold, the total weight applied fell from 875 kg to only 314 kg. This is due mainly to the large use of malathion in 1981, which was applied at relatively high dose rates, and a small area treated with tar oils, applied at a very high rate.

When compared with 1981, the total spray area of fungicide active ingredients increased by only 75%, whilst the weight applied rose dramatically from only 320 kg in the previous survey to over 5,700 kg in 1993. This is due mainly to the use of propamocarb hydrochloride which is applied at very high dose rates, and to a lesser extent, the applications of sulphur and fosetyl-aluminium.

Herbicide usage, as measured by the spray area of active ingredients increased roughly 3-fold, whilst the total weight applied doubled. As in the previous survey, simazine was the most popular herbicide employed.

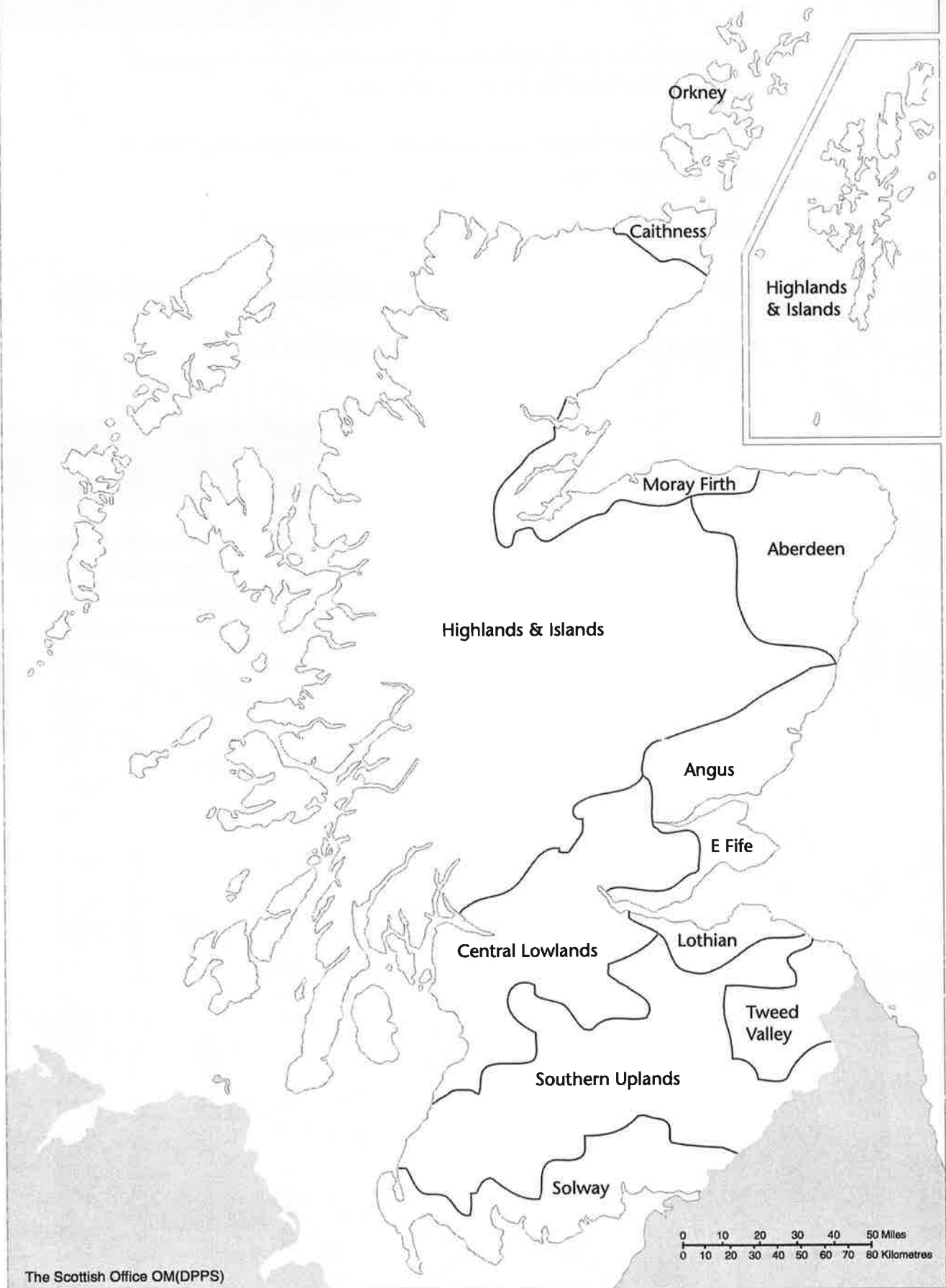
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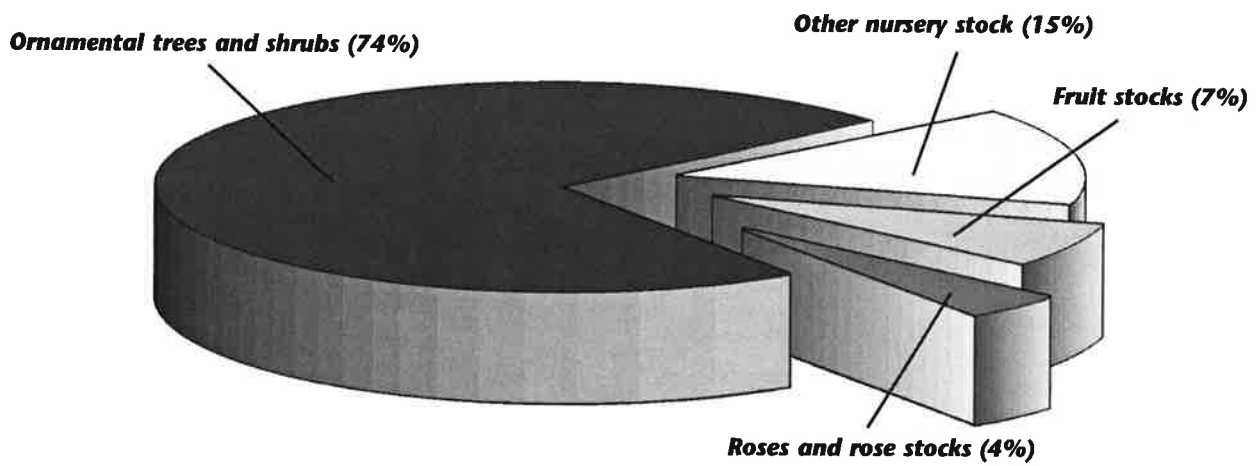
ACKNOWLEDGEMENTS

The author wishes to thank the growers who provided the information for this report. Thanks are also given to Mr H M Bowen, Mr P R Shave and Mr L A Thomas who collected some of the data, and to Dr C J Griffiths for providing editorial assistance. In addition, the author is most grateful for support from Mr D Marr of Information Technology Section, SASA, and to Mr I Nevison of Biomathematics & Statistics Scotland.

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



● **Figure 2 Hardy nursery stock crop areas (%) in 1993**



● **Figure 3 Percentages of crop areas treated with pesticide**

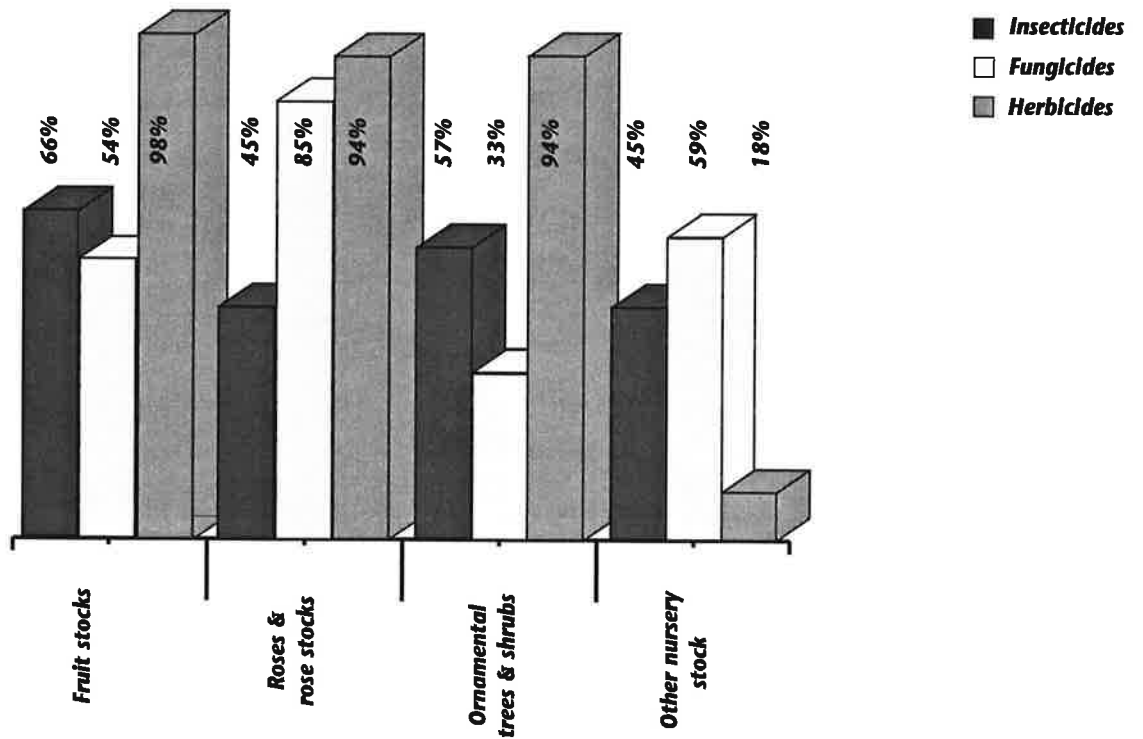


TABLE 1 Crop Areas 1993 (hectares)

	Northern Scotland	Angus & East Fife	South & South-East Scotland	Central Scotland	Scotland 1981
Fruit stocks	8.2	19.9	1.6	0.1	62.8
Roses and rose stocks	3.4	7.1	0.5	8.1	72.9
Ornamental trees and shrubs	95.8	138	58.7	43.7	306.3
Other nursery stock	13.4	6.1	38.6	12.5	1.8
All hardy nursery stock	120.8	171.1	99.4	64.4	443.9

TABLE 2 Distribution of sample

Size (ha)	Northern Scotland	Angus & East Fife	South & South-East Scotland	Central Scotland	Scotland
0.1 - 1.9	9	4	4	4	21
2 - 5.9	3	3	2	1	9
6 - 19.9		3		1	4
20 - 29.9			1		1
30+	1	1	1		3
All sizes	13	11	8	6	38

TABLE 3 Proportions (%) of crops treated with pesticides

	Fruit stocks	Roses & rose stocks	Ornamental trees & shrubs	Other nursery stock	All crops
Insecticide	66	45	57	45	56
Molluscicide			+		+
Fungicide	54	85	33	59	41
Soil sterilant	+		1		1
Herbicide	98	94	94	18	83
Any pesticide	98	98	96	81	94

'+' = <0.5%

TABLE 4 Fruit stocks

Insecticides, molluscicides, fungicides and soil sterilants, the reasons for their use (spray hectares of formulations) and percentage of crop treated

<i>Insecticides</i>	Aphids	Caterpillars	Mildew	Disease precaution	Clean up	No reason given	Total spray area	% crop treated
Demeton-S-methyl	4						4	12
Heptenophos/permethrin	+					1	1	+
Oxydemeton-methyl	7						7	25
Permethrin		+					+	+
Pirimicarb	25						25	54
All insecticides	36	+				1	36	66
<i>Molluscicides</i>								
None recorded								
<i>Fungicides</i>								
Mancozeb				1			1	+
Myclobutanil				1			1	+
Propiconazole			+				+	+
Triadimefon			16				16	54
All fungicides			16	1			17	54
<i>Soil sterilants</i>								
Cresylic acid					+		+	+
All soil sterilants					+		+	+
Area planted (ha)								30

'+' = <0.5 ha or <0.5%

TABLE 5 Fruit stocks

Herbicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Herbicides	Annual bl weeds	Annual bl & annual grass weeds	Annual bl & grass weeds	General weed control	Total spray area	% crop treated
Bromacil			5		5	17
Dichlobenil				+	+	+
Diquat/paraquat				5	5	15
Isoxaben	24				24	81
Paraquat		11		5	16	29
Pendimethalin		4			4	12
Propachlor		32			32	54
Simazine	5	16			21	69
All herbicides	29	62	5	10	106	98
Area planted (ha)						30

†+ = <0.5 ha or <0.5%

TABLE 6 Roses and rose stocks*Insecticides and fungicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated*

Insecticides	Aphids	Mildew	Mildew & black spot	Rust	Stem rot	Disease precaution	Aphids & black spot	Total spray area	% crop treated
Cypermethrin	1							1	+
Dimethoate	1							1	2
Heptenophos/permethrin	+							+	+
Pirimicarb	8							8	40
Pirimiphos-methyl	+							+	+
All insecticides	9							9	*45
Fungicides									
Benodanil		1						1	2
Benomyl		20				1		21	74
Bupirimate/triforine		+	3			+		3	6
Fenarimol		1						1	2
Fosetyl-aluminium		1						1	2
Mancozeb					+			+	1
Myclobutanil		5		4		+		9	45
Propamocarb hydrochloride					+			+	+
Triforine						+		+	+
All fungicides		27	3	4	+	2		37	85
Mixed formulations									
Bupirimate/pirimicarb/triforine						+	1	1	3
Dinocap/permethrin/sulphur/triforine						+	+	+	1
All mixed formulations						+	1	1	3
Area planted (ha)									19

*+ = <0.5 ha or <0.5%

*# = includes insecticide from mixed formulations

TABLE 7 *Roses and rose stocks*

Herbicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Herbicides	Annual bl weeds	Annual bl & annual grass weeds	Annual & perennial bl weeds	Perennial bl & grass weeds	Couch	General weed control	Total spray area	% crop treated
Dichlobenil						+	+	+
Diphenamid		4					4	11
Diquat/paraquat						+	+	+
Glyphosate				+		+	+	3
Isoxaben						+	+	2
Metazachlor						1	1	4
Oxadiazon	+	+	+			+	+	5
Paraquat						3	3	14
Propyzamide					4		4	20
Simazine	8					1	8	42
Unspecified herbicide			6				6	31
All herbicides	8	4	6	+	4	4	26	94
Area planted (ha)								19

'+' = <0.5 ha or <0.5%

TABLE 8 Ornamental trees and shrubs

Insecticides and molluscicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Insecticides	Aphids	Aphids & caterpillars	Caterpillars	Leaf hopper & vine weevil	Red spider mite	No reason given	Slugs	Total spray area	% crop treated
Bioallethrin/permethrin	+							+	+
Chlorpyrifos	17							17	1
Cypermethrin	173							173	6
Demeton-S-methyl	83							83	18
Diflubenzuron	+		1					1	+
Dimethoate	216							216	29
Dimethoate/permethrin	1							1	+
Fatty acids	4							4	1
Fenvalerate	2							2	+
Fonofos								+	+
Heptenophos/permethrin	+					1		1	+
Malathion				9	1			10	3
Oxydemeton-methyl			231		+			231	14
Permethrin	23							23	7
Pirimicarb	14							14	3
Pirimiphos-methyl	1	4						5	1
Trichlorfon	1		136					137	8
All insecticides	535	4	368	9	1	1		917	57
Molluscicides									
Metalddehyde							2	2	+
All molluscicides							2	2	+
Area planted (ha)									336

'+' = <0.5 ha or <0.5%

TABLE 9 Ornamental trees and shrubs

Fungicides and soil sterilants, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Fungicides	Mildew	Rust	Botrytis	Liverwort	Red spot	Black spot	Disease precaution	Soil sterilisation	Total spray area	% crop treated
Benodanil		10							10	2
Benomyl	6						12		17	3
Bupirimate	52								52	15
Bupirimate/triforine	24								24	1
Captan					1				1	+
Chlorothalonil			11	7	3				20	2
Cyproconazole		4							4	1
Fenarimol	8								8	1
Fenpropimorph	4								4	1
Fosetyl-aluminium	11								11	2
Imazalil	43								43	3
Mancozeb	1						1		2	+
Maneb							6		6	2
Myclobutanil							1		1	+
Prochloraz	3								3	+
Propamocarb hydrochloride							38		38	3
Propiconazole	+								+	+
Sulphur	58								58	2
All fungicides	209	14	11	7	3	2	56		304	33
Soil sterilants										
Dazomet								4	4	1
All soil sterilants								4	4	1
Area planted (ha)										336

'+' = <0.5 ha or <0.5%

TABLE 10 Ornamental trees and shrubs

Herbicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Herbicides	Annual bl weeds	Annual bl & annual grass weeds	Annual & perennial bl weeds	Perennial bl weeds	Perennial weeds	General weed control	Total spray area	% crop treated
Chlorthal-dimethyl	1						1	+
Clopyralid	3						3	1
Dichlobenil						1	1	+
Diphenamid	22					21	44	8
Diquat/paraquat						+	+	+
Diuron						16	16	5
Glyphosate	+	1	31	9	1	76	119	23
Hexazinone					9		9	3
Isoxaben	42						42	8
Metazachlor		69				4	72	22
Napropamide		6					6	2
Oxadiazon		21	5			77	103	15
Paraquat	6	10	61			105	182	42
Propyzamide	9	9					17	3
Simazine	6	230	1			109	346	57
All herbicides	88	346	99	9	10	409	960	94
Area planted (ha)								336

'+' = <0.5 ha or <0.5%

TABLE 11 Other nursery stock
Insecticides and fungicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Insecticides	Aphids	Mildew	Disease precaution	No reason given	Soil sterilisation	Total spray area	% crop treated
Demeton-S-methyl	1					1	1
Malathion	1					1	+
Pirimicarb				2		2	+
Unspecified insecticide				5		5	4
All insecticides	1			7		8	*45
Fungicides							
Benomyl			13	138		150	56
Bupirimate		6				6	2
Chlorothalonil		2				2	2
Formaldehyde					+	+	+
Mancozeb			1	2		3	1
All fungicides		9	14	140	+	162	59
Mixed formulations							
Bupirimate/pirimicarb/triforine				138		138	39
All mixed formulations				138		138	39
Area planted (ha)							71

*+ = <0.5 ha or <0.5%

* = includes insecticide from mixed formulations

TABLE 12 Other nursery stock

Herbicides, the reasons for their use (spray hectares of formulations) and percentage of crop treated

Herbicides	General weed control	No reason given	Total spray area	% crop treated
Dichlobenil	+	+	+	1
Diquat/paraquat	+		+	+
Glyphosate	+	12	12	18
Paraquat		+	+	+
Simazine	+	+	+	+
All herbicides	+	12	12	18
Area planted (ha)				71

'+' = <0.5 ha or <0.5%

TABLE 13 All hardy nursery stock

Usage of insecticides and molluscicides (spray hectares of active ingredients)

<i>Insecticides</i>	Fruit stocks	Roses and rose stocks	Ornamental trees & shrubs	Other nursery stock	Total spray area	Spray area 1981
<i>Pyrethroids</i>						
Bioallethrin			+		+	
Cypermethrin		1	173		173	
Fenvalerate			2		2	
Permethrin	1	+	26		27	
<i>Carbamates</i>						
Pirimicarb	25	9	14	140	187	12
<i>Organophosphates</i>						
Chlorpyrifos			17		17	
Demeton-S-methyl	4		83	1	87	61
Dimethoate		1	218		218	
Fonofos			+		+	
Heptenophos	1		1		2	
Malathion			10	1	10	213
Oxydemeton-methyl	7		231		238	
Pirimiphos-methyl		+	5		5	1
Trichlorfon			137		137	
<i>Other insecticides</i>						
Diflubenzuron			1		1	
Fatty acids			4		4	
Unspecified insecticide				5	5	
All insecticides	37	10	920	146	1,113	327
<i>Molluscicides</i>						
Metaldelhyde			2		2	
All molluscicides			2		2	

'+' = <0.5 ha

TABLE 14 All hardy nursery stock*Usage of fungicides (spray hectares of active ingredients)*

Fungicides	Fruit stocks	Roses and rose stocks	Ornamental trees & shrubs	Other nursery stock	Total spray area	Spray area 1981
Benodanil		1	10		11	127
Benomyl		21	17	150	189	95
Bupirimate		4	76	144	224	9
Captan			1		1	+
Chlorothalonil			20	2	23	
Cyproconazole			4		4	
Dinocap		+			+	
Fenarimol		1	8		9	
Fenpropimorph			4		4	
Formaldehyde				+	+	
Fosetyl-aluminium		1	11		11	
Imazalil			43		43	
Mancozeb	1	+	2	3	5	
Maneb			6		6	
Myclobutanil	1	9	1		10	
Prochloraz			3		3	
Propamocarb hydrochloride		+	38		38	
Propiconazole	+		+		+	
Sulphur		+	58		58	
Triadimefon	16				16	49
Triforine		5	24	138	167	34
All fungicides	17	42	328	438	825	474
Soil sterilants						
Dazomet			4		4	6
Cresylic acid	+				+	
All soil sterilants	+		4		4	6

‘+’ = <0.5 ha

TABLE 15 All hardy nursery stock
Usage of herbicides (spray hectares of active ingredients)

Herbicides	Fruit stocks	Roses and rose stocks	Ornamental trees & shrubs	Other nursery stock	Total spray area	Spray area 1981
Bromacil	5				5	12
Chlorthal-dimethyl			1		1	
Clopyralid			3		3	
Dichlobenil	+	+	1	+	1	
Diphenamid		4	44		48	13
Diquat	5	+	+	+	5	
Diuron			16		16	
Glyphosate		1	119	13	132	62
Hexazinone			9		9	
Isoxaben	24	+	42		66	
Metazachlor		1	72		73	
Napropamide			6		6	
Oxadiazon		1	103		104	10
Paraquat	20	3	182	1	205	57
Pendimethalin	4				4	
Propachlor	32				32	
Propyzamide		4	17		21	9
Simazine	21	8	346	+	375	179
Unspecified herbicide		6			6	
All herbicides	110	28	960	13	1,111	434

'+' = <0.5 ha

TABLE 16 All hardy nursery stock

Quantities (kg) of insecticides and molluscicides used

Insecticides	Fruit stocks	Roses and rose stocks	Ornamental trees & shrubs	Other nursery stock	Total weight (kg)	kg 1981
Pyrethroids						
Bioallethrin			+		+	
Cypermethrin		+	4		4	
Fenvalerate			+		+	
Permethrin	+	+	1		1	4
Carbamates						
Pirimicarb	3	1	3	3	10	4
Organophosphates						
Chlorpyrifos			11		11	
Demeton-S-methyl	1		19	+	19	30
Dimethoate		+	70		70	+
Fonofos			+		+	
Heptenophos			+		+	
Malathion	+		24		25	448
Oxydemeton-methyl	8		28	1	36	
Pirimiphos-methyl		+	4		4	
Trichlorfon			110		110	
Other insecticides						
Diflubenzuron			+		+	
Fatty acids			21		21	
Unspecified insecticide				+	+	21
All insecticides	13	1	295	4	313	875
Molluscicides						
Metaldelyde			2		2	
All molluscicides			2		2	

'+' = <0.5 kg

TABLE 17 All hardy nursery stock

Quantities (kg) of fungicides and soil sterilants used

Fungicides	Fruit stocks	Roses and rose stocks	Ornamental trees & shrubs	Other nursery stock	Total weight (kg)	Kg 1981
Benodanil		1	6		7	130
Benomyl		9	9	83	101	48
Bupirimate		+	9	5	14	5
Captan			4		4	+
Chlorothalonil			69	6	76	
Cyproconazole			+		+	
Dinocap		+			+	
Fenarimol		+	+		+	
Fenpropimorph			3		3	
Formaldehyde				257	257	
Fosetyl-aluminium		37	421		458	
Imazalil			9		9	
Mancozeb	1	+	2	4	7	
Maneb			6		6	
Myclobutanil	+	1	+		1	
Prochloraz			1		1	
Propamocarb hydrochloride		24	4,152		4,176	
Propiconazole			+		+	
Sulphur		+	583		583	
Triadimefon	+		+		+	6
Triforine		1	3	4	8	9
All fungicides	1	72	5,279	359	5,710	320
Soil sterilants						
Cresylic acid	+				+	
Dazomet			1,529		1,529	2,823*
All soil sterilants	+		1,529		1,529	2,823*

*+ = <0.5 kg

** = weight estimated

TABLE 18 All hardy nursery stock
Quantities (kg) of herbicides used

Herbicides	Fruit stocks	Roses and rose stocks	Ornamental trees & shrubs	Other nursery stock	Total weight (kg)	Kg 1981
Bromacil	6				6	27
Chlorthal-dimethyl			4		4	
Clopyralid			+		+	
Dichlobenil	+	+	3	2	5	
Diphenamid		29	181		210	99
Diquat	1		+	+	1	
Diuron			8		8	
Glyphosate		1	139	3	143	120
Hexazinone			16		16	
Isoxaben	4	+	5		10	
Metazachlor		1	62		63	
Napropamide			16		16	
Oxadiazon		4	356		360	8
Paraquat	9	2	108	+	118	34
Pendimethalin	6				6	
Propachlor	108				108	
Propyzamide		6	2		9	14
Simazine	16	9	540	1	566	313
All herbicides	149	52	1,438	6	1,646	

'+' = <0.5 kg

TABLE 19 Principal active ingredients
Area (spray hectares) treated with the 20 most used active ingredients on all hardy nursery crops

	1993	1981
1 Simazine	375	179
2 Oxydemeton-methyl	238	
3 Bupirimate	224	9
4 Dimethoate	218	
5 Paraquat	205	57
6 Benomyl	189	95
7 Pirimicarb	187	12
8 Cypermethrin	173	
9 Triforine	167	34
10 Trichlorfon	137	
11 Glyphosate	132	62
12 Oxadiazon	104	10
13 Demeton-S-methyl	87	61
14 Metazachlor	73	
15 Isoxaben	66	
16 Sulphur	59	
17 Diphenamid	48	13
18 Imazalil	43	
19 Propamocarb hydrochloride	39	
20 Propachlor	32	

TABLE 20 Principal active ingredients
Quantity (kg) of the 20 most used active ingredients on all hardy nursery crops

	1993	1981
1 Propamocarb hydrochloride	4,176	
2 Dazomet	1,529	2,823
3 Sulphur	583	
4 Simazine	566	313
5 Fosetyl-aluminium	458	
6 Oxadiazon	360	6
7 Formaldehyde	257	
8 Diphenamid	210	99
9 Glyphosate	143	120
10 Paraquat	118	34
11 Trichlorfon	110	
12 Propachlor	108	
13 Benomyl	101	48
14 Chlorothalonil	76	
15 Dimethoate	70	+
16 Metazachlor	63	
17 Oxydemeton-methyl	36	
18 Malathion	25	448
19 Fatty acids	21	
20 Demeton-S-methyl	20	30

'+' = <0.5 kg

TABLE 21 All hardy nursery stock

Comparison of pesticide usage 1976 - 1993, spray hectares of formulations, active ingredients and quantities (kg) used

	1976		1981		1993	
	sp ha of a.i.'s	kg	sp ha of a.i.'s	kg	sp ha of formulations	kg
Insecticides						
Pyrethroids	+		6		198	
Organophosphates	217	203	288	488	712	6
Organochlorines	114	129	13	4		276
Carbamates	1	1	12	4	49	10
Mixed & other insecticides	51	325	8	379	13	21
Total Insecticides	383	658	327	875	971	314
Molluscicides						
	+	+			2	2
Fungicides						
	275	282	474	320	521	5,712
Mixed insecticide/fungicide					139	
Herbicides						
	992	1,603	434	849	1,107	1,646
Soil sterilants						
	12	6,302	6	2,823*	4	1,529
Total pesticides	1,662	8,845	1,240	2,044	2,744	9,204
Area planted (ha)	566		444			456

‘+’ = <0.5 ha or <0.5 kg

‘**’ = weight estimated

TABLE 22 Sampled areas

Area (ha) of hardy nursery crops grown in sample

Size (ha)	Northern Scotland	Angus & East Fife	South-East Scotland	Central Scotland	Scotland
0.1 - 1.9	2.95	2.43	1.32	1.13	7.83
2 - 5.9	9.8	12.08	9.85	2.06	33.79
6 - 19.9		43.62		7.38	51
20 - 29.9			25.09		25.09
30+	72.9	80.3	32.38		185.58
All sizes	85.65	138.43	68.64	10.57	303.29

TABLE 23 Census areas

Area (ha) of hardy nursery crops grown in Scotland

Size (ha)	Northern Scotland	Angus & East Fife	South-East Scotland	Central Scotland	Scotland
0.1 - 1.9	22.4	12.8	14.1	17	66.3
2 - 5.9	17.4	20.3	17.8	12.2	67.7
6 - 19.9	8.1	57.7	7.1	35.2	108.1
20 - 29.9			28		28
30+	72.9	80.3	32.4		185.6
All sizes	120.8	171.1	99.4	64.4	455.7

TABLE 24 Raising factors

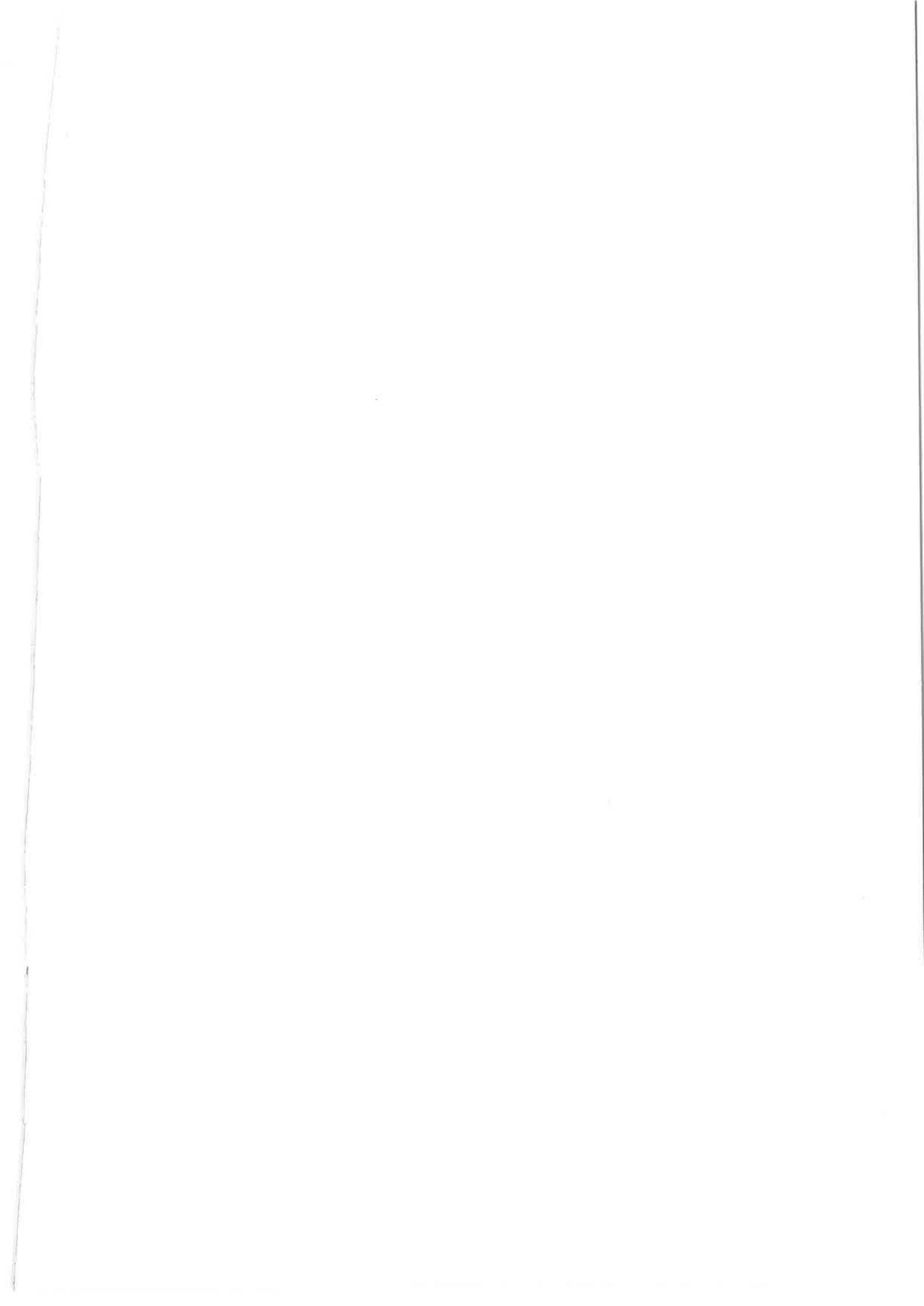
Size (ha)	Northern Scotland	Angus & East Fife	South & South-East Scotland	Central Scotland
0.1 - 1.9	7.59	5.27	10.68	15.04
2 - 5.9	1.78	1.68	1.81	5.92
6 - 19.9		1.32		4.77
20 - 29.9			1.12	
30+	1.00	1.00	1.00	

TABLE 26 Second adjustment factors

Fruit stocks	1.06
Roses and rose stocks	1.00
Ornamental trees and shrubs	1.00
Other nursery stock	2.21

TABLE 25 First adjustment factors

	Northern Scotland	Angus & East Fife	South & South-East Scotland	Central Scotland
Fruit stocks	0.90	2.03		
Roses and rose stocks	1.99	0.37	0.17	0.22
Ornamental trees and shrubs	1.03	0.97	0.66	1.60
Other nursery stock	1.53	7.85		83.09





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