PESTICIDE USAGE IN SCOTLAND

VEGETABLES FOR HUMAN CONSUMPTION 2003

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SUMMARY

This report presents information from a survey of pesticide usage on outdoor vegetable crops grown for human consumption in Scotland during 2003. The data have been raised to give estimates of national pesticide usage.

The total area of vegetable crops grown had increased by 4%, from 10,158 hectares in 1999, when the previous survey was carried out, to 10,594 hectares in 2003. There were some specific decreases in cropping which were almost entirely restricted to brassicas, and a small reduction in the carrot crop. Increases occurred in the remainder, including Brussels sprouts, and particularly broad beans, which rose by 270%.

When the increase in area grown is taken into account there was an overall reduction in the total area treated with insecticides and herbicides, but increases in areas receiving fungicide and molluscicide treatments.

When measured by area of active ingredients, overall insecticide usage declined by 21% compared with 1999. This was mainly due to substantial decreases in the use of organophosphates, with pyrethroids replacing them as the most dominant insecticide type. Lambda-cyhalothrin remained the principal insecticide, being applied to over 8,500 hectares.

Molluscicide usage has risen by almost a fifth, with metaldehyde remaining the most extensively used, particularly on turnips and swedes and Brussels sprouts.

The total area treated with fungicide active ingredients increased by 39% compared with 1999. The most popular fungicide continued to be tebuconazole, being applied to 4,275 hectares, predominantly on carrots. The major change to fungicide use was the introduction of azoxystrobin, which was applied to 3,923 hectares, also mainly on carrots.

Herbicide usage has declined by 6% since the previous survey, when measured by area of active ingredients. Terbutryn was the most widely used herbicide, being applied to over 4,000 hectares, mainly on vining peas.

INTRODUCTION

This is the seventh survey of pesticide usage on outdoor vegetable crops in Scotland, the previous surveys being in 1977, 1982, 1989, 1991, 1995 and 1999[1-6].

There are a number of changes in this report compared with the previous ones. Firstly, tables containing reasons for the pesticides are no longer published, as only a small proportion of reasons are specified by users, with the majority given as precautionary or unknown. Where appropriate, reasons for use are provided in the text. Also, summary tables have been split into three divisions: peas and beans, leaf brassicas, and vegetables excluding legumes and leaf brassicas. In addition, data containing seed treatments are presented separately for each of these crop divisions, in the same way as for the different pesticide types.

DEFINITIONS AND NOTES

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

Area treated (or hectares treated) is the basic area of a crop treated with a given pesticide multiplied by the number of treatments that area received. These terms are synonymous with 'spray area' and 'spray hectare' which have appeared in previous reports. The new terms are believed to be more appropriate where pelleted or granular treatments are applied.

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

The reasons given for the uses of pesticides were those given by growers and may sometimes not reflect label recommendations.

When viewing the pesticide tables for the individual crops it should be borne in mind that some of the herbicides may not have been applied directly to the crop itself but as pre-planting/sowing clean-up treatments.

Information about pesticides applied as seed treatments was collected for field-sown crops only, not for transplanted crops. Where the seed was known to be treated but the product unknown this was recorded as an 'unspecified seed treatment'. If the grower did not know if the seed was treated this was recorded as 'no information about seed treatment'.

Pesticides applied to transplants in nurseries before going to the grower are not recorded in this survey but included in the Protected Crops survey.

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

Data from the 1999 survey[6] 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.

When leaf brassicas are referred to in the text, this includes, Brussels sprouts, cabbage (summer/autumn), cabbage (all other), calabrese and cauliflower. When brassicas are referred to in the text, this includes the above and turnips and swedes.

METHOD

Using the June 2003 Agricultural Census[8] two samples were drawn representing the whole of Scotland. The first sample was selected from holdings growing any of the vegetable crops, excluding vining peas, and the second from holdings known to have grown vining peas. Two samples were taken to achieve a better representation of all vegetable crops, since most vining pea crops are grown on farms growing arable crops rather than other vegetable crops.

The country was divided into 11 land-use regions as shown in Figure 1[7]. For each sample, holdings were stratified by land-use region and by size group (based on the total area of relevant crops grown). The number of holdings sampled in each region was based on the number of growers within the individual regions.

The period of the survey covered pesticide applications to vegetable crops where all, or the bulk, of the growing season was in 2003. As well as recording treatments to the actual crop itself, data were also collected on pre-drilling/planting treatments as well as post harvest treatments to the previous crops in order to clear ground ready for sowing/planting the vegetable crop.

With few exceptions, each grower was visited by a surveyor, following an introductory letter and telephone call. A small number of growers in remote areas had to be interviewed by telephone, again by prior arrangement. When necessary, data were also collected from consultant agronomists and contractors. In all, information was obtained from 59 holdings growing any of the vegetable crops, excluding peas, and from 30 holdings growing peas. Details of the numbers of holdings visited and their distribution are shown in Tables 2 and 3.

The total area of vegetable crops, excluding peas, surveyed within each size group is shown in Table 32, and for peas in Table 35. For all crops, sample data were raised to give estimates of national pesticide usage using raising factors (Tables 34 and 37). These were based on the areas reported to have grown vegetable crops in 2003 Agricultural Census[8] within regions and size groups (Tables 33 & 36). Adjustments (Table 38) were made for each crop within each region by applying raising factors to the sample area of each crop grown and comparing this with the area from the 2003 Agricultural Census. A second adjustment was made for crops where no holdings were sampled in one or more regions (Table 38).

VINING PEAS

The area of vining peas grown in 2003 was 3,310 hectares compared with 2,763 hectares in 1999, a 20% increase.

Seed treatments (Tables 5 & 17)

All the seed for this crop was treated with a cymoxanil/fludioxonil/metalaxyl-M formulation. By comparison, in 1999 77% of the crop was treated with metalaxyl/thiabendazole/thiram and the remaining 23% with carbendazim/cymoxanil/oxadixyl/thiram.

Insecticides (Tables 4,6 & 18)

The proportion of crop treated with an insecticide has substantially increased from 36% in 1999, to 60% in the present survey, with aphid control being the only specified reason for usage.

Only two insecticides were recorded, pirimicarb and lambda-cyhalothrin, replacing deltamethrin and heptenophos, which were the main actives in 1999. Just under 2,000 hectares were treated with pirimicarb (60%), compared with only 6% in 1999, and a little over 1,000 hectares was treated with lambda-cyhalothrin (31%), which was not recorded at all in 1999.

Fungicides (Tables 4,7 & 19)

In contrast to the previous surveys where no fungicides were used, 29% of the 2003 crop was treated with fungicides.

The two actives encountered were azoxystrobin, used on 15% of the crop against sclerotinia, and sulphur, used on 18% of the crop predominantly for disease precaution, but also for mildew.

Herbicides (Tables 4,8 & 20)

The entire crop was treated with herbicides, which was also the case in previous surveys. The main reason given for their use was for general weed control.

Similarly to the previous two surveys, terbuthylazine/terbutryn, was the most commonly used formulation, applied to 74% of the crop area in the present survey. Another commonly encountered active was fomesafen, used to treat 26% of the crop.

BROAD BEANS

The area of broad beans grown in Scotland had substantially increased by 270%, from 218 hectares in 1999 to 807 hectares in 2003.

Seed treatments (Tables 5 & 17)

As in the previous survey, the entire crop was treated with a seed treatment. The proportion of seed treated with thiram has increased from 64% in 1999 to 90% in 2003. The remaining ten percent was treated with an unspecified seed treatment.

Insecticides (Tables 4,6 & 18)

Ninety percent of the broad bean crop grown in 2003 was treated with an insecticide, compared with only 64% in the last survey. Only two actives were encountered, both for aphid control. These were predominantly deltamethrin, used on 80% of the crop, and also pirimicarb, used to treat 37% of the crop. This is in contrast to 1999, when lambda-cyhalothrin was the only insecticide recorded.

Fungicides (Tables 4,7 & 19)

Fungicide use has substantially increased from 64% of the crop being treated in 1999 to the entire crop in 2003.

Several actives were encountered, most commonly chlorothalonil, which was used on all broad beans, and also metalaxyl to treat 64% of the crop. Unlike the present survey, chlorothalonil and metalaxyl were the only actives encountered in the previous survey.

The most common reasons specified were chocolate spot and downy mildew.

Herbicides (Tables 4,8 & 20)

In keeping with previous surveys, the entire 2003 crop was treated with a herbicide.

The main actives were terbutryn applied to the whole 807 hectares, and fomesafen used on 597 hectares or 74% of the crop. Whereas simazine was one of the most popular herbicide formulations used in 1999, it was only applied to 10% of the present crop.

The main reasons for herbicide use were general weed control and the control of annual broad-leaved weeds. Unlike 1999, diquat was also used on 8% of the crop in the present survey for the purpose of desiccation, where the crop was downgraded to animal feed.

BRUSSELS SPROUTS

The area of Brussels sprouts rose by 37% from 356 hectares in 1999 to 486 hectares in 2003. This increase follows a similar 37% rise recorded between 1995 and 1999.

Seed treatments (Tables 9 & 21)

All the crops sampled were grown from transplants.

Insecticides and molluscicides (Tables 4,10 & 22)

Use of insecticides fell since the last survey, with 86% of the current crops being treated with an insecticide, compared with the entire crop in 1999.

The main actives encountered were the same as in 1999. Lambda-cyhalothrin was used on 1,131 hectares and pirimicarb was used on 708 hectares.

For the majority of insecticide use, no reason was given. However the main specified reason was aphids followed by caterpillars.

Sixty-two percent of the crop was treated for slugs with metaldehyde. Where 25% of the crop in 1999 was treated with methiocarb, none was reported in 2003.

Fungicides (Tables 4,11 & 23)

Fungicide use fell considerably, from the entire crop being treated in the previous survey to only 70% being treated in the current survey.

Chlorothalonil used on 808 hectares and tebuconazole on 700 hectares were the predominant actives. Where metalaxyl had been common in 1999, it was not encountered at all in 2003. However metalaxyl-M was used on 563 hectares or 47% of the crop.

By far the most common reason given was disease precaution. Alternaria, ring-spot, and white blister were also frequently cited.

Herbicides (Tables 4,12 & 24)

A small decline in herbicide use occurred, with only 86% of the current crop being treated compared with the whole crop in 1999.

The main actives remained the same as those recorded in the last survey, with metazachlor used on 312 hectares or 64% of the crop, and trifluralin on 214 hectares. However this year glyphosate was also common (used on 44% of the crop) whereas it was used on only 14% in 1999.

The main reason specified was for general weed control.

CABBAGES & SAVOYS (SUMMER/AUTUMN)

The Census area declined by a fifth, from 144 hectares in 1999 to 115 hectares in the present survey. The total estimated area of this crop for 2003 was 116 hectares, which includes 2 hectares entered in the 'mixed crop' category within the Census.

Seed treatments (Tables 9 & 21)

All the crops sampled were grown from transplants, compared with 93% of the crop area in 1999.

Insecticides and molluscicides (Tables 4,10 & 22)

Insecticide use increased, with 84% of the current crop treated, compared with 67% in 1999.

Deltamethrin used on 128 hectares (53%), and cypermethrin used on 70 hectares (31%), were the principal insecticides. Lambda-cyhalothrin was the most popular active in the previous survey, however it was used on only 22 hectares in 2003.

Caterpillars were the most common specified reason, followed by aphids.

Thirty-two percent of the crop was treated for slugs, with metaldehyde used on almost the entire area of crop treated with molluscicides, and with only a very small proportion being treated with methiocarb (2%). This is contrary to the previous survey where methiocarb was the most commonly used and metaldehyde was used on only very small areas.

Fungicides (Tables 4,11 & 23)

The proportion of crop treated with fungicides has declined slightly, from 57% in 1999 to 48% in 2003.

Azoxystrobin was the most commonly encountered active, used on 78 hectares or 48% of the crop. This active has only recently been approved for use on cabbages and was not reported at all in the last survey. Tebuconazole was used on 44 hectares or 19% of the crop. Although this active was not encountered in 1999, it was previously widely used in 1995.

Disease precaution was the most specified reason, closely followed by sclerotinia.

Herbicides (Tables 4,12 & 24)

Eighty-three percent of the crop was treated with a herbicide, having increased from sixty-four percent in the previous survey.

The main herbicides remain the same, with metazachlor used on 62 hectares, and trifluralin on 56 hectares.

General weed control was the main specified reason for herbicide use.

CABBAGES & SAVOYS (ALL OTHER)

The area of crop grown declined by 16%, from 70 hectares in 1999 to 59 hectares in 2003.

Seed treatments (Tables 9 & 21)

It was estimated that only 38% of the crop was grown from transplants, compared with the entire crop in the previous survey. The remainder was field sown and was treated with carbendazim/chlorpyrifos/iprodione/thiram (62%) and metalaxyl (62%) formulations.

Insecticides (Tables 4,10 & 22)

The proportion of crop treated with insecticides has significantly decreased from 100% in the last survey to 62% in 2003.

Only two active ingredients were recorded, which were the same as the most popular insecticides encountered in 1999. Lambda-cyhalothrin was applied to 72 hectares, or 62% of the crop for caterpillars. Pirimicarb was used on 36 hectares, also 62% of the crop.

No molluscicides were used in the current survey, although 87% of the crop was treated in 1999.

Fungicides (Tables 4,11 &23)

Fungicide use has dropped, from the whole crop being treated in 1999 to only 62% of the crop in 2003.

Only two formulations were encountered, for disease control as a precautionary measure. Chlorothalonil/metalaxyl-M and difenoconazole were both applied to 36 hectares or 62% of the crop. In the last survey the entire crop received sulphur as a foliar feed, but none was recorded in 2003.

Herbicides (Tables 4,12 & 24)

The estimated area of crop treated with a herbicide in 2003 was 62%, compared with the whole crop in the previous survey.

Three actives were used: chlorthal-dimethyl, glyphosate, and propachlor, each used to treat 36 hectares for general weed control. Metazachlor had been used on 100% of the crop in 1999, but was not recorded at all in 2003.

CALABRESE

The area of calabrese grown in Scotland had declined by almost a quarter since the last survey, having fallen from 1,351 hectares in 1999 to 1,027 hectares in 2003.

Seed treatments (Tables 9 & 21)

The area of crop grown from transplants decreased from almost all (99%) of the crop grown in 1999 to only 77% of the crop grown in 2003. The remaining area was field sown and treated with carbendazim/chlorpyrifos/iprodione/thiram (23%) and metalaxyl (23%) formulations.

Insecticides and molluscicides (Tables 4,10 & 22)

The proportion of crop treated with an insecticide (76%) was very similar to that recorded in 1999, with the most common specified reason as aphid control.

The principal insecticides remained the same as in the previous survey, with lambda-cyhalothrin used on 1,181 hectares, and pirimicarb applied to 971 hectares.

A very small area of the crop (1%) was treated with methiocarb against slugs, compared with 12% in 1999.

Fungicides (Tables 4,11 & 23)

The area of calabrese treated with fungicides has risen considerably from 20% in the last survey to 76% in the present survey.

Only two actives were encountered: copper oxychloride applied to 845 hectares, or 70% of the crop, mainly for spear rot control, and sulphur, applied to 565 hectares, or 41% of the crop (only 2% in 1999), used mainly as a foliar feed. Quintozene, the principal fungicide in the last report, has been withdrawn from use and was not recorded at all in 2003.

Herbicides (Tables 4,12 & 24)

Almost all the crop (98%) was treated with a herbicide, similar to that recorded in 1999.

The most common actives were glyphosate, used on 832 hectares or 81% of the crop, and metazachlor used on 580 hectares or 56% of the crop. Trifluralin had been the main herbicide in 1999 (86%), however in 2003 it was used on only a quarter of the crop area.

The only reported reason for herbicide use was general weed control.

CAULIFLOWER

The Census area has substantially increased by 64%, from 363 hectares in 1999 to 594 hectares in 2003. The total estimated area for cauliflower comprised 594 hectares of Census area and also 2 hectares of cauliflower which was included in the 'mixed vegetable' category of the Census.

Seed treatments (Tables 9 & 21)

It was estimated that the entire crop was grown from transplants, just slightly more than in 1999.

Insecticides and molluscicides (Tables 4,10 & 22)

Insecticide use has dropped slightly, from the entire crop being treated in the previous survey to 87% in the current survey.

The most popular actives encountered remained the same, with lambda-cyhalothrin being used on 844 hectares, and pirimicarb being applied to 115 hectares.

The most common specified reason for insecticide use was aphid control.

Fungicides (Tables (4,11 & 23)

The use of fungicides has more than doubled, with 69% of the 2003 crop being treated, compared with 32% in 1999.

Only two actives were encountered. Difenoconazole was applied to 280 hectares, or 47% of the crop for disease precaution. Sulphur was applied to 128 hectares or 22% of the crop as a foliar feed, compared with only 14% in the previous survey. As with calabrese, quintozene was the principal fungicide in the last report but was not recorded at all in 2003, as it had been withdrawn from the market.

Herbicides (Tables 4,12 & 24)

The proportion of crop treated with a herbicide has decreased from 100% in 1999, to 95% in 2003, for general weed control.

Trifluralin was the most extensively used active, having been applied to 408 hectares, or a quarter of the cauliflower crop. This was followed by glyphosate, which was applied to 363 hectares, or 70% of the area of the crop. The most popular active in the previous survey was metazachlor, used on 70% of the crop, however this fell to 59% in 2003.

TURNIPS AND SWEDES

The area of turnips and swedes grown had decreased by 32% from 2,127 hectares in 1999 to 1,446 hectares in 2003. As in previous surveys, these crops are predominantly swedes. The total estimated area comprised 1,445 hectares of Census area plus 2 hectares of swedes included in the 'mixed vegetable' category within the Census.

Seed treatments (Tables 13 & 25)

The entire crop was grown from seed, of which 42% was treated with a seed treatment. This has fallen from almost the entire seed (99%) being treated in the previous survey. Of the seed treated, 42% was treated with iprodione and 42% was treated with thiram.

Insecticides and molluscicides (Tables 4,14 & 26)

The proportion of crop treated with an insecticide had declined considerably from almost the whole crop (97%) being treated in 1999, to only 63% in 2003.

The main actives encountered were deltamethrin applied to 973 hectares or 60% of the crop, and pirimicarb used on 496 hectares or 34% of the crop. The most popular insecticide in the previous survey was chlorfenvinphos (96% treated), however it was used to treat only 9% of the crop in 2003, and was subject to a phased revocation following the UK review of anticholinesterase active ingredients. Lack of suitable insecticides for control of cabbage root fly has led to the increased use of fly proof netting.

Eighty-one percent of the crop was treated with a molluscicide for slug control. Usage of metaldehyde predominated, with less than 0.5 hectares being treated with methiocarb.

Fungicides (Tables 4,15 & 27)

Fungicide use has only slightly increased with 58% being treated, compared with 49% in 1999.

Only two actives were recorded. Azoxystrobin was applied to 952 hectares for disease precaution, and sulphur was used on 204 hectares or 14% of the crop as a foliar feed, having fallen from 47% in the last survey. Triadimenol was the most widely used fungicide in 1999, but it was not recorded in the current survey.

Herbicides (Tables 4,16 & 28)

Herbicides were used on the entire crop, similar to usage recorded in the previous survey.

The main actives have remained the same, with metazachlor used on 1,091 hectares, and trifluralin on 1,050 hectares.

General weed control was the most commonly specified reason for herbicide use.

CARROTS

The Census area for carrots grown in Scotland had remained very similar, having only declined by 2% from 1,861 hectares in 1999, to 1,822 hectares in 2001. The estimated area for carrots was 1,921 hectares, comprised of 1,822 hectares from the Census in addition to 4 hectares which were previously included in the Census 'mixed vegetables' category and also 95 hectares of 'bunch carrots' included in the 'other vegetable' category within the Census.

Seed treatments (Tables 13 & 25)

Eighty-three percent of the carrot seed was treated with a pesticide. The main formulations used were cymoxanil/fludioxonil/metalaxyl-M applied to 80% of the seed, and tefluthrin to 59%.

Insecticides (Tables 4,14 & 26)

Insecticide use on carrots fell slightly, from 96% of the crop area in the last survey to 81% in the current survey.

Lambda-cyhalothrin applied to 4,318 hectares mainly for carrot fly, and aldicarb used on 439 hectares for nematodes, remain the most popular actives. Deltamethrin was the only other insecticide used, applied to 165 hectares for aphids.

No molluscicides were recorded in 2003.

Fungicides (Tables 4,15 & 27)

There was a slight decrease in the area of carrots treated with a fungicide since the last survey, having dropped from 93% in 1999 to 81% in 2003.

The main fungicides recorded were tebuconazole applied to 3,284 hectares or 79% of the crop, and azoxystrobin used on 1,687 hectares, 67% of the crop. Iprodione, metalaxyl-M, and thiophanate-methyl were also widely used. Fenpropimorph was one of the most common fungicides in 1999 having been applied to 73% of the crop, this dropped to 42% in 2003.

Alternaria and crown rot were the main specified reasons, followed by disease precaution.

Herbicides (Tables 4,16 & 28)

The proportion of carrots treated with a herbicide declined from 99% in the last survey to 83% in the present survey.

The principal actives remained the same, with linuron applied to 2,144 hectares (83%), metoxuron to 1,549 hectares (69%), and pendimethalin to 1,271 hectares (66%).

LEEKS

The area of leeks grown had increased by almost a quarter, from 159 hectares in 1999 to 196 hectares in 2003.

Seed treatments (Tables 13 & 25)

The entire crop was field sown with all the seed treated with thiram. This is in complete contrast with 1999, when the whole crop was grown from transplants.

Insecticides (Table 4)

As with previous surveys, there was no insecticide usage recorded in 2003.

Fungicides (Tables 4,15 & 27)

There has been a dramatic decline in the use of fungicides on leeks, with the area treated falling from 100% in 1999 to only 30% in 2003.

The main actives encountered were chlorothalonil and metalaxyl-M, applied together as a formulation against white tip, on 75 hectares or 10% of the crop. Azoxystrobin and cyproconazole were also widely used.

Herbicides (Tables 4,16 & 28)

In keeping with earlier surveys the entire crop received a herbicide.

The principal actives were applied to the whole crop at least once. They were ioxynil used on 254 hectares, and prometryn to 215 hectares.

The most common reason specified for herbicide use was general weed control.

LETTUCE

There was a small 5% increase in the area of lettuce grown in Scotland, from 157 hectares in 1999 to 161 hectares in 2003.

Seed treatments (Tables 13 & 25)

All the crops sampled were grown from transplants.

Insecticides (Tables 4,14 & 26)

Eighty-nine percent of the crop was treated with an insecticide, a slight increase from the 75% treated in the previous survey.

As in 1999, the most commonly used insecticide was cypermethrin which was applied to 146 hectares, 89% of the crop area, in the present survey. Deltamethrin was also widely used, applied to 116 hectares or 70% of the crop, whereas this active was not recorded in 1999.

The main specified reason was caterpillars followed by aphids.

Fungicides (Tables 4,15 & 27)

The proportion of crop treated with a fungicide was 89%, a slight reduction from the 99% treated in the last survey.

Azoxystrobin was the most popular fungicide, applied to 232 hectares for sclerotinia, followed by iprodione used on 146 hectares, which had previously been the most common in 1999. Seventy-eight percent of the crop also received sulphur as a foliar feed.

Herbicides (Tables 4,16 & 28)

The whole crop received herbicide, similar to that recorded in the earlier surveys, mainly for general weed control.

The principal actives remained the same, with propyzamide being applied to the entire crop and propachlor to 146 hectares or 89% of the crop.

RHUBARB

The area of rhubarb grown in Scotland decreased by 32%, from 142 hectares in 1999, to 96 hectares in 2003.

Data on pesticide usage has been amalgamated with that of 'other vegetable crops' in the summary tables.

As in previous surveys, no insecticides or fungicides were recorded on rhubarb in 2003.

Metaldehyde was used on 63 hectares or 66% of the crop for slugs.

Sixty-six percent of the crop received a herbicide. The two herbicides encountered were glyphosate and simazine, each applied to 63 hectares.

OTHER VEGETABLE CROPS

The only crops encountered in this category in the 2003 survey were beetroot, onions, spinach, peas and podded peas, totalling 368 hectares. The data have been raised to national level and are included in the summary tables under the heading 'other vegetable crops'. Pesticides used were as follows:

Herbicides (39% area treated): ethofumesate, lenacil, phenmedipham, triflusulfuron-methyl.

Molluscicides (42% area treated): methiocarb.

No fungicides or insecticides were recorded on any of the crops within this category in 2003.

COMPARISONS WITH PREVIOUS SURVEYS

There was a slight increase (4%) in the total area of vegetables grown for human consumption in Scotland, having increased from 10,158 hectares in 1999 to 10,594 hectares in 2003. The areas of the majority of crops remained very similar or increased, principally broad beans and cauliflower. Reductions occurred in other crops, in particular turnips and swedes and calabrese.

Comparisons in the usage of pesticides in terms of areas treated with formulations, active ingredients, and weight applied between the current and previous surveys are presented in Table 31.

The total area treated with all pesticide active ingredients remained fairly similar, being 73,736 and 73,839 hectares, in 1999 and 2003 respectively. However the total weight applied decreased by 8%, from 45,920 kg in 1999 to 42,159 kg in the current survey.

The total area treated with insecticide active ingredients decreased by just over a fifth (21%), however the weight fell more, by a substantial 79%. This was mainly due to the decreased use of organophosphates, and the corresponding increase in the usage of pyrethroids (42%) which are applied at lower dose rates. In particular the removal of chlorfenvinphos from the market and the lack of alternatives, contributed largely to the decrease in the application of organophosphates. In addition, the 68% decrease in weights of carbamates compared with only an 18% decline in area treated was due mainly to the withdrawal of carbofuran from the market, and the reduction in usage of aldicarb, both of which were applied at relatively high dosage rates. Lambda-cyhalothrin, applied to 8,589 hectares, was the most common insecticide used both in this survey and the last. Its repeated use (particularly on carrots) contributed to the increased usage of total pyrethroids.

There was an increase in the area treated with molluscicides (19%), accompanied by a much greater increase in weight applied (95%). This was mainly due to increases in metaldehyde use on brassica crops.

Fungicide usage, as measured by treated areas of active ingredients increased by 39% mainly due to the greater area of broad beans and increased usage on leaf brassicas, in particular, calabrese. By comparison, the weight of fungicide applied increased by only 21%, and this is due mainly to the significant usage of azoxystrobin which is applied at relatively low dosage rates. Overall, tebuconazole remained the most popular fungicide.

Usage of herbicides, as measured by treated hectares of active ingredients and their weights applied, decreased by 6% and 7% respectively compared with 1999. Terbutryn, used exclusively on vining peas and broad beans, replaced trifluralin as the principal herbicide on vegetable crops.

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Figure 1 Land-Use Regions of Scotland

Figure 2 Vegetable crop areas (%) 2003

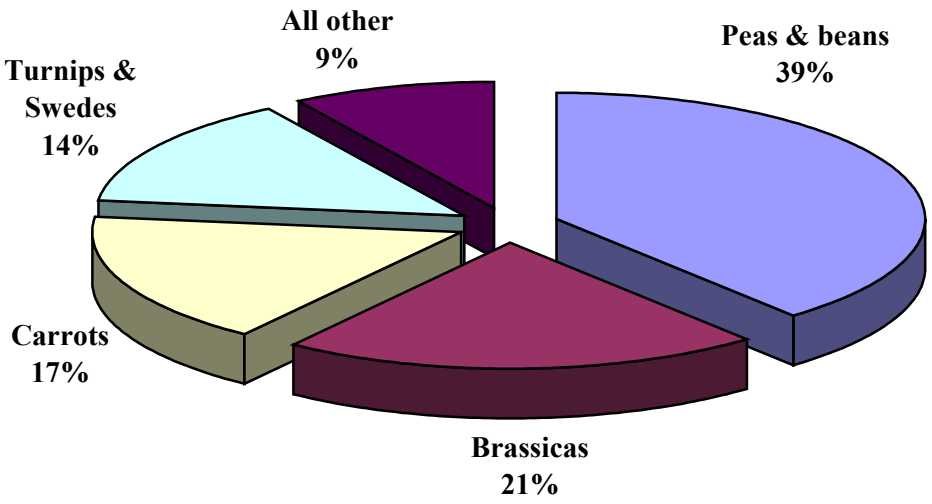

Figure 3 Trends in crop areas (ha) in successive surveys

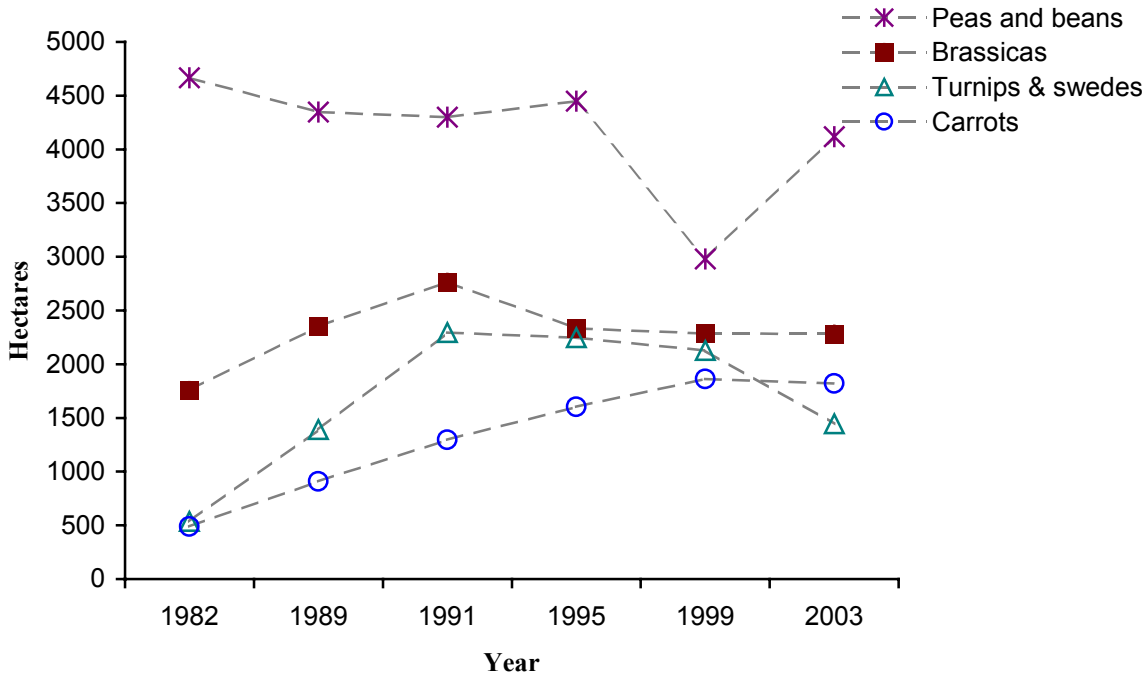

Figure 4 Percentages of leaf brassica crops treated with pesticides

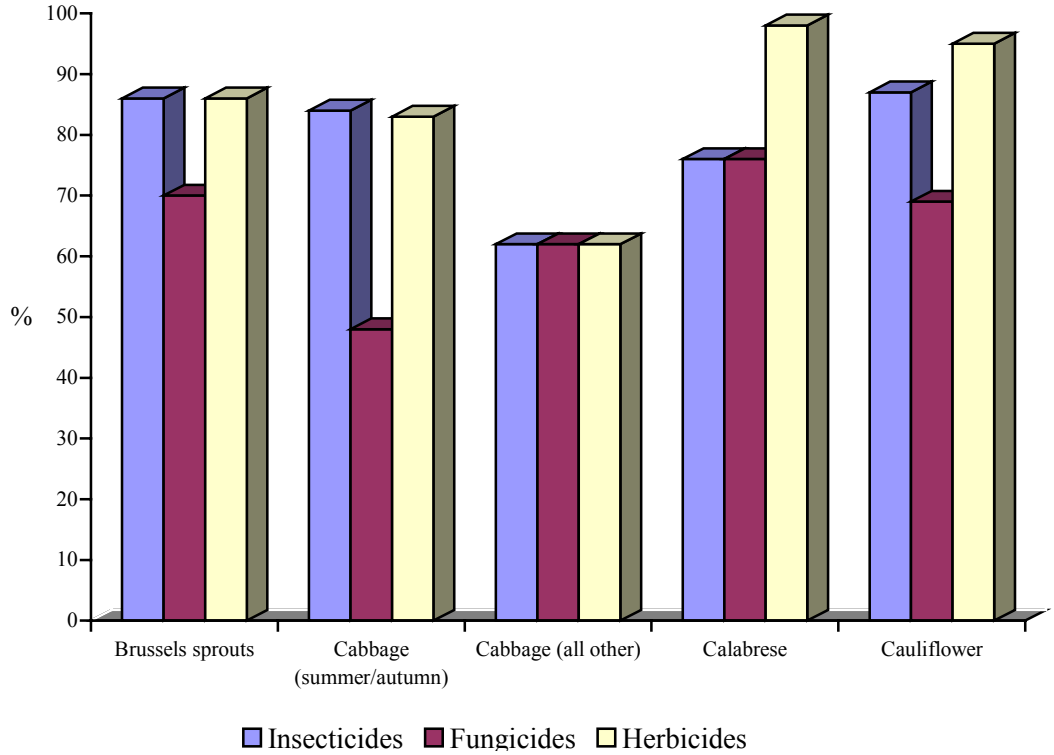

Figure 5 Percentages of crops treated with pesticides

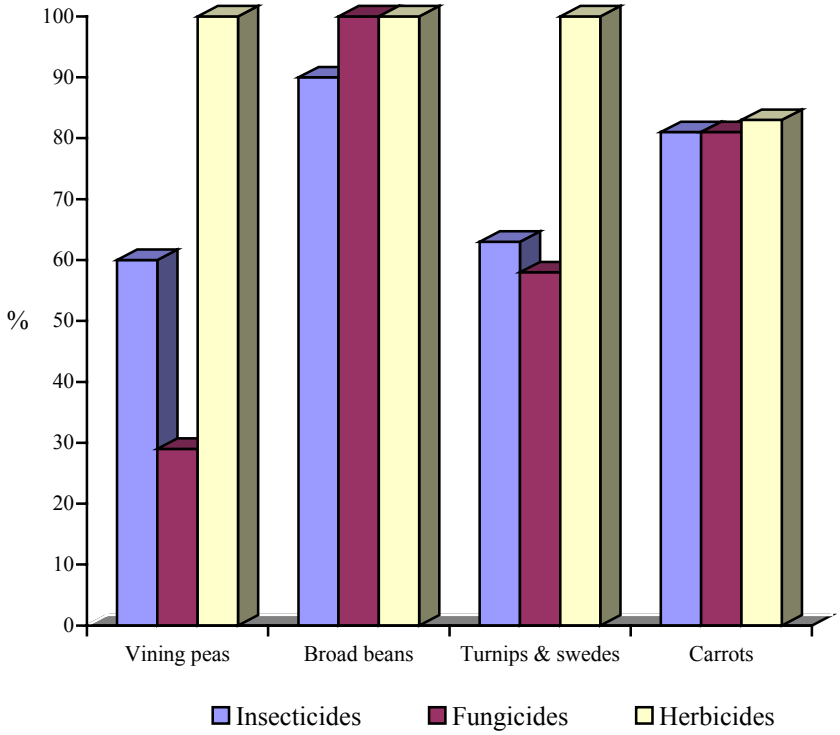

TABLE 1 *Crop areas 2003 (hectares)*

	Scotland 2003	*Scotland 1999*	*% change*
Vining peas	**3,310**	2,763	20
Broad beans	**807**	218	270
Brussels sprouts	**486**	356	37
Cabbage (summer/autumn)	**115**	144	-20
Cabbage (all other)	**59**	70	-16
Calabrese	**1,027**	1,351	-24
Carrots	**1,822**	1,861	-2
Cauliflower	**594**	363	64
Leeks	**196**	159	23
Lettuce	**161**	157	5
Turnips & swedes	**1,445**	2,127	-32
All vegetable crops *	**10,589**	10,158	4

'*' Includes rhubarb, other vegetable crops and an area of 197 hectares of mixed vegetables. The 'mixed' Census category comprises areas of individual crops which are too small to be shown separately on the Census form.

TABLE 2 *Distribution of vegetable sample (excluding holdings growing only peas)*

Size (ha)*	*Moray Firth*	*Aberdeen*	*Angus*	*East Fife*	*Lothian*	*Central Lowlands*	*Tweed Valley*	*Scotland*
0.1 - 9.9	1	2	3	2		1	1	**10**
10 - 19.9	1	1	9	3	2	1	4	**21**
20 - 29.9	1		3	2	1	1	1	**9**
30 - 39.9	1		2	1	1	1	1	**7**
40 +			4	5	1	1	1	**12**
All sizes	**4**	**3**	**21**	**13**	**5**	**5**	**8**	**59**

'*' size refers to area of vegetable crops (excluding vining peas) grown on holding

TABLE 3 *Distribution of pea sample (including holdings growing other vegetable crops)*

*Size * (ha)*	*Angus*	*Lothian*	*Central Lowlands*	*Tweed Valley*	*Scotland*
0.1 - 9.9	4				**4**
10 - 19.9	9	1	1	1	**12**
20 - 29.9	5		2	1	**8**
30 - 39.9	2				**2**
40 +	4				**4**
All sizes	**24**	**1**	**3**	**2**	**30**

'*' refers to the area of vining peas grown on holding

TABLE 4 *Proportion (%) of each crop treated with pesticides*

	Vining peas	*Broad beans*	*Brussels sprouts*	*Cabbage (summer/ autumn)*	*Cabbage (all other)*	*Calabrese*	*Carrots*	*Cauliflower*	*Leeks*	*Lettuce*	*Turnips & swedes*	*Rhubarb*	*Other vegetable crops*
Insecticides	60	90	86	84	62	76	81	87		89	63		
Molluscicides			62	32		+		37			81	66	42
Fungicides	29	100	70	48	62	76	81	69	30	89	58		
Herbicides	100	100	86	83	62	98	83	95	100	100	100	66	39
Any pesticide	100	100	86	86	62	99	83	96	100	100	100	66	81

'+' = < 0.5%

TABLE 5 *Peas and beans seed treatment formulations*

Area treated (ha) and percentage of crop treated

Seed treatments	***Broad beans***		***Vining peas***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Cymoxanil/fludioxonil/metalaxyl-M			3,310	100	**3,310**	
Thiram	729	90			**729**	140
Unspecified seed treatment	78	10			**78**	
Area grown	807	100	3,310	100	**4,117**	2,981

TABLE 6 *Peas and beans insecticide formulations*

Area treated (ha) and percentage of crop treated

Insecticides	***Broad beans***		***Vining peas***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Deltamethrin	1,076	80			**1,076**	
Lambda-cyhalothrin			1,022	31	**1,022**	140
Pirimicarb	381	37	1,993	60	**2,374**	160
All insecticides	**1,457**	**90**	**3,015**	**60**	**4,472**	**1,124**
Area grown	807		3,310		**4,117**	2,981

TABLE 7 *Peas and beans fungicide formulations*

Area treated (ha) and percentage of crop treated

Fungicides	***Broad beans***		***Vining peas***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Azoxystrobin			485	15	**485**	
Carbendazim	86	11			**86**	
Chlorothalonil	86	11			**86**	
Chlorothalonil/metalaxyl	952	64			**952**	140
Chlorothalonil/metalaxyl-M	288	36			**288**	
Sulphur	210	26	601	18	**811**	
Tebuconazole	210	26			**210**	
Vinclozolin	172	11			**172**	
All fungicides	**2,003**	**100**	**1,086**	**29**	**3,089**	**140**
Area grown	807		3,310		**4,117**	2,981

TABLE 8 *Peas and beans herbicide formulations*

Area treated (ha) and percentage of crop treated

Herbicides	***Broad beans***		***Vining peas***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Bentazone/MCPB			236	7	**236**	283
Cyanazine			236	7	**236**	511
Diquat	38	5			**38**	
Diquat/paraquat	26	3			**26**	
Fomesafen/terbutryn	597	74	858	26	**1,455**	140
Glyphosate	32	4	149	4	**181**	98
Simazine	78	10			**78**	140
Terbuthylazine/terbutryn	210	26	2,451	74	**2,661**	2,255
Trifluralin	78	10			**78**	
All herbicides	**1,059**	**100**	**3,930**	**100**	**4,989**	**3,721**
Area grown	807		3,310		**4,117**	2,981

TABLE 9 *Leaf brassicas seed treatment formulations*

Area treated (ha) and percentage of crop treated

Seed treatments	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Carbendazim/chlorpyrifos/iprodione/ thiram					36	62	240	23			**276**	
Metalaxyl					36	62	240	23			**276**	
Crop grown from transplant	486	100	116	100	22	38	787	77	596	100	**2,008**	2,298
Area grown	486		116		59	62	1,027	23	596		**2,284**	2,284

TABLE 10 *Leaf brassica insecticide and molluscicide formulations*

Area treated (ha) and percentage of crop treated

Insecticides	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Carbosulfan	145	30									**145**	
Chlorpyrifos	12	2									**12**	81
Cypermethrin			70	31			28	3	2	+	**100**	60
Deltamethrin	140	29	128	53					73	12	**341**	131
Deltamethrin/pirimicarb	145	30					240	23			**384**	
Diflubenzuron	259	31									**259**	
Lambda-cyhalothrin	897	69	22	19	72	62	1,181	73	844	74	**3,016**	2,684
Lambda-cyhalothrin/pirimicarb	234	30									**234**	178
Pirimicarb	329	68	22	19	36	62	731	63	115	19	**1,234**	2,386
Pymetrozine	454	81	40	34			146	14			**640**	
Triazamate	687	80	40	34							**727**	
All insecticides	**3,302**	**86**	**322**	**84**	**108**	**62**	**2,325**	**76**	**1,033**	**87**	**7,091**	**6,534**
Molluscicides												
Metaldehyde	1,436	7	36	31					259	35	**1,730**	1,439
Methiocarb			2	2			4	+	7	1	**13**	604
All molluscicides	**1,436**	**62**	**38**	**32**			**4**	+	**266**	**37**	**1,744**	**2,042**
Area grown	486		116		59		1,027		596		**2,284**	2,284

'+' = < 0.5%

TABLE 11 *Leaf brassica fungicide formulations*

Area treated (ha) and percentage of crop treated

Fungicides	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Azoxystrobin	432	57	78	48							**510**	
Boscalid/pyraclostrobin	327	67	22	19							**349**	
Chlorothalonil	245	30									**245**	49
Chlorothalonil/metalaxyl-M	563	47			36	62					**599**	
Copper oxychloride							845	70			**845**	
Difenoconazole	295	58			36	62			280	120	**611**	477
Fosetyl-aluminium	12	2									**12**	
Iprodione	246	25									**246**	89
Propamocarb hydrochloride	12	2									**12**	
Sulphur	27	5					565	41	128	70	**720**	438
Tebuconazole	700	64	44	19							**744**	771
Tolclofos-methyl	12	2									**12**	
All fungicides	**2,871**	**70**	**144**	**48**	**72**	**62**	**1,410**	**76**	**408**	**69**	**4,906**	**2,930**
Area grown	486		116		59		1027		596		**2,284**	2,284

TABLE 12 Leaf brassica herbicide formulations

Area treated (ha) and percentage of crop treated

Herbicides	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Chlorthal-dimethyl					36	62					**36**	
Clopyralid	199	20									**199**	97
Diquat/paraquat							16	2			**16**	122
Glyphosate	215	44			36	62	832	81	363	61	**1,446**	472
Metazachlor	312	64	62	53			580	56	353	59	**1,306**	1,635
Paraquat							31	3			**31**	
Pendimethalin	125	26					98	10			**222**	57
Propachlor	27	5	34	29	36	62	282	27	169	28	**548**	398
Trifluralin	214	44	56	48			258	25	408	69	**937**	2,028
All herbicides	**1,091**	**86**	**152**	**83**	**108**	**62**	**2,096**	**98**	**1,294**	**95**	**4,741**	**5,025**
Area grown	486		116		59		1,027		596		**2,284**	2,284

TABLE 13 *Vegetables (excluding legumes and leaf brassicas) seed treatment formulations*

Area treated (ha) and percentage of crop treated

Seed treatments	*Carrots*		*Leeks*		*Lettuce*		*Turnips & swedes*		*Other vegetable crops*		*Total*	*1999*
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Cymoxanil/fludioxonil/metalaxyl-M	1,536	80									**1,536**	
Iprodione	15	1					612	42			**627**	1,061
Metalaxyl/thiabendazole	15	1									**15**	646
Tefluthrin	1,127	59									**1,127**	1,194
Thiram	47	2	196	100			612	42	145	31	**1,000**	316
No information about seed treatment									179	39	**179**	1
Crop grown from transplant					165	100					**165**	349
No seed treatment	323	17					835	58	43	9	**1,201**	
Area grown	1,921	83	196	100	165		1,446	42	464	88	**4,193**	4,893

TABLE 14 *Vegetables (excluding legumes and leaf brassicas) insecticide and molluscicide formulations*

Area treated (ha) and percentage of crop treated

Insecticides	***Carrots***		***Leeks***		***Lettuce***		***Turnips and swedes***		***Other vegetable crops***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Aldicarb	439	23									**439**	1,000
Chlorfenvinphos							291	9			**291**	5,008
Cypermethrin					146	89					**146**	136
Deltamethrin	165	9			116	70	973	60			**1,254**	23
Lambda-cyhalothrin	4,318	79									**4,318**	4,192
Pirimicarb							496	34			**496**	491
Pymetrozine					13	8					**13**	
All insecticides	**4,922**	**81**			**275**	**89**	**1,760**	**63**			**6,957**	**15,458**
Molluscicides												
Metaldehyde							2,544	80	63	14	**2,607**	1,112
Methiocarb							5	+	154	33	**160**	622
All molluscicides							**2,549**	**81**	**217**	**25**	**2,765**	**1,734**
Area grown	1,921		196		165		1,446		464		4,192	4,893

'+' = 0.5%

TABLE 15 *Vegetables (excluding legumes and leaf brassicas) fungicide formulations*

Area treated (ha) and percentage of crop treated

Fungicides	*Carrots*		*Leeks*		*Lettuce*		*Turnips & swedes*		*Other vegetable crops*		*Total*	*1999*
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Azoxystrobin	1,645	64	58	30	232	70	952	53			**2,886**	
Azoxystrobin/fenpropimorph	42	2									**42**	
Chlorothalonil/metalaxyl-M			75	10							**75**	
Copper oxychloride	500	26									**500**	
Cyproconazole			58	30							**58**	159
Fenpropimorph	907	43	19	10							**925**	2,292
Iprodione					146	89					**146**	344
Iprodione/thiophanate-methyl	1,124	58									**1,124**	212
Mancozeb			19	10							**19**	23
Metalaxyl-M	1,182	61									**1,182**	1,419
Sulphur					129	78	204	14			**333**	1,560
Tebuconazole	3,284	79	38	10							**3,322**	4,007
Unspecified fungicide	165	9									**165**	
All fungicides	**8,846**	**81**	**266**	**30**	**507**	**89**	**1,156**	**58**			**10,775**	11,164
Area grown	1,921		196		165		1,446		464		4,192	4,893

TABLE 16 *Vegetables (excluding legumes and leaf brassicas) herbicide formulations*

Area treated (ha) and percentage of crop treated

Herbicides	*Carrots*		*Leeks*		*Lettuce*		*Turnips & swedes*		*Other vegetable crops*		*Total*	*1999*
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Chloridazon			176	80							**176**	318
Chloridazon/propachlor			19	10							**19**	
Chlorpropham/pentanochlor	15	1									**15**	
Clopyralid							79	5			**79**	341
Diquat/paraquat	251	13	19	10			40	3			**310**	357
Ethofumesate									145	31	**145**	127
Fluroxypyr			39	20							**39**	
Glyphosate	313	16			19	11	687	47	64	14	**1,083**	399
Ioxynil			254	100							**254**	318
Lenacil									289	31	**289**	
Linuron	2,144	83									**2,144**	2,848
Metazachlor							1,091	75			**1,091**	1,570
Metoxuron	1,549	69									**1,549**	2,140
Metribuzin	519	27									**519**	438
Pendimethalin	1,271	66	138	70							**1,409**	1,890
Pentanochlor	866	30									**866**	1,065
Phenmedipham									289	31	**289**	490

cont…….

TABLE 16 *Vegetables (excluding legumes and leaf brassicas) herbicide formulations continued*

Area treated (ha) and percentage of crop treated

Herbicides	***Carrots***		***Leeks***		***Lettuce***		***Turnips & swedes***		***Other vegetable crops***		***Total***	***1999***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(ha)
Prometryn	121	6	215	100							**336**	181
Propachlor			157	80	146	89	193	13			**496**	573
Propaquizafop	427	21	19	10							**446**	1,178
Propyzamide					165	100					**165**	175
Simazine									64	14	**64**	11
Sodium monochloroacetate			19	10							**19**	
Tepraloxydim	310	16	73	37							**383**	
Trifluralin							1,050	73			**1,050**	1,870
Triflusulfuron-methyl									289	31	**289**	388
All herbicides	**7,788**	**83**	**1,128**	**100**	**330**	**100**	**3,140**	**100**	**1,140**	**56**	**13,525**	**17,690**
Area grown	1,921		196		165		1,446		464		**4,192**	4,893

TABLE 17 *Peas and beans seed treatment active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Seed treatments	***Broad beans***		***Vining peas***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Cymoxanil			3,310	100	**3,310**	144
Fludioxonil			3,310	100	**3,310**	72
Metalaxyl-M			3,310	100	**3,310**	253
Thiram	729	90			**729**	101
Unspecified seed treatment	78	10			**78**	
Area grown	807	100	3,310	100	**4,117**	

TABLE 18 *Peas and beans insecticide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Insecticides	***Broad beans***		***Vining peas***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Pyrethroids						
Deltamethrin	1,076	80			**1,076**	8
Lambda-cyhalothrin			1,022	31	**1,022**	5
All pyrethroids	**1,076**		**1,022**		**2098**	**13**
Carbamates						
Pirimicarb	381	37	1,993	60	**2,374**	249
All carbamates	**381**		**1,993**		**2,374**	**249**
All insecticides	**1,457**	**90**	**3,015**	**60**	**4,472**	**262**
Area grown	807		3,310		**4,117**	

TABLE 19 *Peas and beans fungicide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Fungicides	***Broad beans***		***Vining peas***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Azoxystrobin			485	15	**485**	121
Carbendazim	86	11			**86**	21
Chlorothalonil	1,326	100			**1,326**	756
Metalaxyl	952	64			**952**	78
Metalaxyl-M	288	36			**288**	11
Sulphur	210	26	601	18	**811**	2,528
Tebuconazole	210	26			**210**	39
Vinclozolin	172	11			**172**	64
All fungicides	**3,243**	**100**	**1,086**	**29**	**4,329**	**3,618**
Area grown	807		3,310		**4,117**	

TABLE 20 *Peas and beans herbicide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Herbicides	***Broad beans***		***Vining peas***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Bentazone			236	7	**236**	94
Cyanazine			236	7	**236**	236
Diquat	64	8			**64**	17
Fomesafen	597	74	858	26	**1,455**	294
Glyphosate	32	4	149	4	**181**	140
MCPB			236	7	**236**	94
Paraquat	26	3			**26**	3
Simazine	78	10			**78**	39
Terbuthylazine	210	26	2,451	74	**2,661**	962
Terbutryn	807	100	3,310	100	**4,117**	3,714
Trifluralin	78	10			**78**	38
All herbicides	**1,892**	**100**	**7,476**	**100**	**9,368**	**5,631**
Area grown	807		3,310		**4,117**	

TABLE 21 *Leaf brassica seed treatment active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Seed treatments	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Carbendazim					36	62	240	23			**276**	+
Chlorpyrifos					36	62	240	23			**276**	+
Iprodione					36	62	240	23			**276**	+
Metalaxyl					36	62	240	23			**276**	+
Thiram					36	62	240	23			**276**	+
Crop grown from transplant	486	100	116	100	22	38	787	77	596	100	**2,008**	
Area grown	486		116		59	62	1,027	23	596		**2,284**	

'+' = < 0.5kg

TABLE 22 *Leaf brassicas insecticide and molluscicide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Insecticides	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Pyrethroids												
Cypermethrin			70	31			28	3	2	+	**100**	2
Deltamethrin	285	35	128	53			240	23	73	23	**725**	5
Lambda-cyhalothrin	1,131	69	22	19	72	62	1,181	73	844	74	**3,249**	18
All pyrethroids	**1,416**		**220**		**72**		**1,448**		**918**		**4,075**	**25**
Carbamates												
Carbosulfan	145	30									**145**	174
Pirimicarb	708	68	22	19	36	62	971	63	115	63	**1,852**	280
All carbamates	**853**		**22**		**36**		**971**		**115**		**1,996**	**454**
Organophosphates												
Chlorpyrifos	12	2									**12**	13
All organophosphates	**12**										**12**	**13**
Others												
Diflubenzuron	259	31									**259**	22
Pymetrozine	454	81	40	34			146	14		14	**640**	76
Triazamate	687	80	40	34							**727**	40
All others	**1,400**		**80**				**146**				**1,626**	**138**
All insecticides	**3,680**	**86**	**322**	**84**	**108**	**62**	**2,565**	**76**	**1,033**	**87**	**7,709**	**630**

Cont….

TABLE 22 *Leaf brassicas insecticide and molluscicide active ingredients continued*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Molluscicides	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Metaldehyde	1,436	62	36	31					259	36	**1,731**	792
Methiocarb			2	2			4	1	7	1	**13**	2
All molluscicides	**1,436**	**62**	**38**	**32**			**4**	+	**266**	**37**	**1,744**	**794**
Area grown	486		116		59		1,027		596		**2,284**	

'+' = < 0.5%

TABLE 23 *Leaf brassicas fungicide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Fungicides	***Brussels sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Azoxystrobin	432	57	78	48							**510**	106
Boscalid	327	67	22	19							**349**	93
Chlorothalonil	808	47			36	62					**844**	774
Copper oxychloride							845	70			**845**	448
Difenoconazole	295	58			36	62			280	47	**611**	33
Fosetyl-aluminium	12	2									**12**	191
Iprodione	246	25									**246**	126
Metalaxyl-M	563	47			36	62					**599**	40
Propamocarb hydrochloride	12	2									**12**	43
Pyraclostrobin	327	67	22	19							**349**	23
Sulphur	27	5					565	41	128	22	**720**	3,183
Tebuconazole	700	64	44	19							**744**	101
Tolclofos-methyl	12	2									**12**	90
All fungicides	**3,760**	**70**	**166**	**48**	**108**	**62**	**1,410**	**76**	**408**	**69**	**5,853**	**5,251**
Area grown	486		116		59		1,027		596		**2,284**	

TABLE 24 *Leaf Brassicas herbicide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Herbicides	***Brussels Sprouts***		***Cabbage (summer/autumn)***		***Cabbage (all other)***		***Calabrese***		***Cauliflower***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Chlorthal-dimethyl					36	62					**36**	35
Clopyralid	199	20									**199**	23
Diquat							16	2			**16**	4
Glyphosate	215	44			36	62	832	81	363	61	**1,446**	1,548
Metazachlor	312	64	62	53			580	56	353	59	**1,306**	848
Paraquat							47	5			**47**	24
Pendimethalin	124	26					98	10			**222**	246
Propachlor	27	5	34	29	36	62	282	27	169	28	**548**	1,835
Trifluralin	214	44	56	48			258	25	408	25	**937**	792
All herbicides	**1,091**	**86**	**152**	**83**	**108**	**62**	**2,112**	**98**	**1,294**	**95**	**4,757**	**5,355**
Area grown	486		116		59		1,027		596		**2,284**	

TABLE 25 *Vegetables (excluding legumes and leaf brassicas) seed treatment active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Seed treatments	*Carrots*		*Leeks*		*Lettuce*		*Turnips & swedes*		*Other vegetable crops*		*Total*	*Total*
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Cymoxanil	1,536	80									**1,536**	2
Fludioxonil	1,536	80									**1,536**	1
Iprodione	15	1					612	42			**627**	1
Metalaxyl	15	1									**15**	+
Metalaxyl-M	1,536	80									**1,536**	3
Tefluthrin	1,127	59									**1,127**	88
Thiabendazole	15	1									**15**	+
Thiram	47	2	196	100			612	42	145	31	**1,000**	4
No information about seed treatment									179	39	**179**	
Crop grown from transplants					165	100					**165**	
No seed treatment	323	17					835	58	43	9	**1,201**	
Area grown	1,921	83	196	100	165		1,446	42	464	88	**4,193**	

'+' = < 0.5kg

TABLE 26 Vegetables (excluding legumes and leaf brassicas) insecticide and molluscicide active ingredients

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Insecticides	***Carrots***		***Leeks***		***Lettuce***		***Turnips & swedes***		***Other vegetable crops***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Pyrethroids												
Cypermethrin					146	89					**146**	4
Deltamethrin	165	9			116	70	973	60			**1,254**	9
Lambda-cyhalothrin	4,318	79									**4,318**	63
All pyrethroids	**4,483**				**262**		**973**				**5718**	**76**
Carbamates												
Aldicarb	439	23									**439**	307
Pirimicarb							496	34			**496**	65
All carbamates	**439**						**496**				**935**	**372**
Organophosphates												
Chlorfenvinphos							291	9			**291**	209
All organophosphates							291				**291**	**209**
Others												
Pymetrozine					13	8					**13**	2
All others					**13**						**13**	**2**
All insecticides	**4,922**	**81**			**275**	**89**	**1,760**	**81**			**6,957**	**659**
Molluscicides												
Metaldehyde							2,544	80	63	14	**2,607**	1,590
Methiocarb							5	+	154	33	**159**	19
All molluscicides							**2,548**		**217**		**2,765**	**1,609**
Area grown	1,921		196		165		1,446		464		**4,193**	

'+' = < 0.5%

TABLE 27 Vegetables (excluding legumes and leaf brassicas) fungicide active ingredients

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Fungicides	***Carrots***		***Leeks***		***Lettuce***		***Turnips & swedes***		***Other vegetable crops***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Azoxystrobin	1,687	67	58	30	232	70	952	53			**2,928**	625
Chlorothalonil			75	10							**75**	75
Copper oxychloride	500	26									**500**	458
Cyproconazole			58	30							**58**	3
Fenpropimorph	949	43	19	10							**967**	662
Iprodione	1,124	58			146	89					**1,270**	451
Mancozeb			19	10							**19**	19
Metalaxyl-M	1,182	61	75	10							**1,257**	576
Sulphur					129	78	204	14			**333**	2,060
Tebuconazole	3,284	79	38	10							**3,322**	497
Thiophanate-methyl	1,124	58									**1,124**	366
Unspecified fungicides	165	9									**165**	3
All fungicides	**10,012**	**81**	**341**	**30**	**507**	**89**	**1,156**	**58**			**12,044**	**5,798**
Area grown	1,921		196		165		1,446		464		**4,192**	

TABLE 28 *Vegetables (excluding legumes and leaf brassicas) herbicide active ingredients*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Herbicides	*Carrots*		*Leeks*		*Lettuce*		*Turnips & swedes*		*Other vegetable crops*		*Total*	*Total*
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Chloridazon			195	80							**195**	66
Chlorpropham	15	1									**15**	7
Clopyralid							79	5			**79**	7
Diquat	251	13	19	10			40	3			**310**	35
Ethofumesate									145	31	**145**	29
Fluroxypyr			39	20							**39**	2
Glyphosate	313	16			19	11	687	47	64	14	**1,083**	1,393
Ioxynil			254	100							**254**	23
Lenacil									289	31	**289**	93
Linuron	2,144	83									**2,144**	1,005
Metazachlor							1,091	75			**1,091**	622
Metoxuron	1,549	69									**1,549**	2,399
Metribuzin	519	27									**519**	190
Paraquat	251	13	19	10			40	3			**310**	52
Pendimethalin	1,271	66	138	70							**1,409**	1,972
Pentanochlor	882	30									**882**	908
Phenmedipham									289	31	**289**	81

cont….

TABLE 28 *Vegetables (excluding legumes and leaf brassicas) herbicide active ingredients continued*

Area treated (ha), percentage of crop treated, and weights (kg) of active ingredients for all crops

Herbicides	***Carrots***		***Leeks***		***Lettuce***		***Turnips & swedes***		***Other vegetable crops***		***Total***	***Total***
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	**(ha)**	(kg)
Prometryn	121	6	215	100							**336**	122
Propachlor			176	80	146	89	193	13			**515**	1,757
Propaquizafop	427	21	19	10							**446**	40
Propyzamide					165	100					**165**	214
Simazine									64	14	**64**	217
Sodium monochloroacetate			19	10							**19**	357
Tepraloxydim	310	16	73	37							**383**	29
Trifluralin							1,050	73			**1,050**	911
Triflusulfuron-methyl									289	31	**289**	1
All herbicides	**8,054**	**83**	**1,165**	**100**	**330**	**100**	**3,180**	**100**	**1,140**	**56**	**13,869**	**12,532**
Area grown	1,921		196		165		1,446		464		**4,192**	

TABLE 29 *Principal active ingredients*

Area treated with the 20 most used active ingredients, excluding seed treatments, on all vegetable crops surveyed.

	Active	*Type**	*2003*	*1999*
1	Lambda-cyhalothrin	I	**8,589**	7,194
2	Pirimicarb	I	**4,721**	3,216
3	Metaldehyde	M	**4,337**	2,551
4	Tebuconazole	F	**4,275**	4,778
5	Terbutryn	H	**4,117**	2,460
6	Azoxystrobin	F	**3,923**	
7	Deltamethrin	I	**3,055**	979
8	Glyphosate	H	**2,710**	969
9	Terbuthylazine	H	**2,661**	2,255
10	Metazachlor	H	**2,397**	3,205
11	Chlorothalonil	F	**2,258**	764
12	Linuron	H	**2,144**	2,848
13	Metalaxyl-M	F	**2,144**	1,419
14	Trifluralin	H	**2,065**	3,898
15	Sulphur	F	**1,864**	1,998
16	Pendimethalin	H	**1,632**	1,947
17	Metoxuron	H	**1,549**	2,140
18	Iprodione	F	**1,516**	645
19	Fomesafen	H	**1,455**	140
20	Copper oxychloride	F	**1,345**	

*Pesticide type. (Where:- H: Herbicide, F: Fungicide, I: Insecticide & M: Molluscicide)

TABLE 30 Principal active ingredients

Quantity (kg) of the most used active ingredients, excluding seed treatments, on all vegetable crops surveyed.

	Active	*Type**	*2003*	*1999*
1	Sulphur	F	**7,772**	6,490
2	Terbutryn	H	**3,714**	1,444
3	Propachlor	H	**3,592**	3,767
4	Glyphosate	H	**3,081**	612
5	Metoxuron	H	**2,399**	3,993
6	Metaldehyde	M	**2,382**	1,038
7	Pendimethalin	H	**2,218**	2,835
8	Trifluralin	H	**1,740**	3,902
9	Chlorothalonil	F	**1,605**	563
10	Metazachlor	H	**1,470**	1,937
11	Linuron	H	**1,005**	1,392
12	Terbuthylazine	H	**962**	580
13	Pentanochlor	H	**908**	1,223
14	Copper oxychloride	F	**907**	
15	Azoxystrobin	F	**854**	
16	Fenpropimorph	F	**662**	1,720
17	Tebuconazole	F	**637**	691
18	Metalaxyl-M	F	**627**	799
19	Pirimicarb	I	**594**	480
20	Iprodione	F	**577**	243

TABLE 31 All vegetable crops, comparison with previous surveys

Pesticide usage in 1995, 1999, and 2003, area treated with formulations, active ingredients (a.i.), and quantities (kg) applied

	1995			1999			2003		
	Formulations (ha)	*a.i. (ha)*	*kg*	*Formulations (ha)*	*a.i. (ha)*	*kg*	*Formulations (ha)*	*a.i. (ha)*	*kg*
Insecticides									
Pyrethroids	5,611	6,709	69	7,365	8,386	87	11,273	11,891	114
Organophosphates	12,480	13,477	7,974	8,479	9,313	3,766	303	303	222
Carbamates	8,032	8,430	5,334	6,260	6,439	3,409	4,688	5,305	1,075
Unspecified or mixed formulations	1,126	28		1,012			618		
Other insecticides							1,639	1,639	140
All insecticides	27,251	28,645	13,378	23,117	24,138	7,262	18,521	19,138	1,551
Molluscicides	2,493	2,493	803	3,777	3,777	1,235	4,509	4,509	2,403
Fungicides	9,951	13,381	17,520	14,234	15,936	12,100	18,771	22,198	14,667
Herbicides	25,190	30,403	42,845	26,435	29,885	25,323	23,255	27,994	23,518
Soil sterilants	9	9	2,608						
All pesticides	64,894	74,931	77,154	67,563	73,736	45,920	65,056	73,839	42,139
Area of all vegetable crops (ha)	11,474			10,158			10,594		

TABLE 32 Sampled areas

Areas (ha) of vegetable crops (excluding peas) grown in sample

Size(ha)*	*Scotland***
0.1 - 9.9	**51.1**
10 - 19.9	**309.9**
20 - 29.9	**225.7**
30 - 39.9	**234.0**
40+	**814.6**
All sizes	**1,635.2**

TABLE 33 Census areas

Areas (ha) of vegetable crops (excluding peas) grown in Scotland

Size (ha)*	*Scotland***
0.1 - 9.9	**1,547.9**
10 - 19.9	**2,187.6**
20 - 29.9	**1,336.0**
30 - 39.9	**861.0**
40+	**1,347.0**
All sizes	**7,279.5**

TABLE 34 Raising factors (vegetable crops excluding peas)

Size (ha)*	*Moray Firth*	*Aberdeen*	*Angus*	*East Fife*	*Lothian*	*Central Lowlands*	*Tweed Valley*
0.1 - 9.9	25.17	46.85	21.19	20.92		21.28	102.41
10 - 19.9	10.34	10.40	6.76	8.87	3.48	11.59	4.74
20 - 29.9	7.78		7.50	3.70	6.47	2.85	7.00
30 - 39.9	1.00		3.53	9.41	1.93	3.23	3.31
40+			1.95	1.41	2.92	1.00	1.43

'*' size refers to area of vegetable crops (excluding peas) grown on holding.
'**' regional data have not been provided in order to prevent disclosure of information relating to fewer than 5 holdings.

TABLE 35 Sampled areas (peas)

Area (ha) of peas grown in sample

Size (ha)*	*Scotland***
0 .1 - 9.9	**35.0**
10 - 19.9	**171.7**
20 - 29.9	**185.0**
30 - 39.9	**70.4**
40+	**175.4**
All sizes	**637.5**

TABLE 36 Census areas (peas)

Area (ha) of peas grown in Scotland

*Size * (ha)*	*Scotland***
0.1 - 9.9	**393.1**
10 - 19.9	**1,232.8**
20 - 29.9	**964.7**
30 - 39.9	**301.0**
40+	**418.1**
All sizes	**3,309.7**

TABLE 37 Raising factors (peas)

Size (ha)*	*Angus*	*Lothian*	*Central Lowlands*	*Tweed Valley*
0.1 - 9.9	9.10			
10 - 19.9	6.58	2.44	11.28	13.02
20 - 29.9	5.43		3.94	5.55
30 - 39.9	2.34			
40+	2.13			

'*' size refers to area of peas on holding.

'**' regional data have not been provided in order to prevent disclosure of information relating to fewer than 5 holdings.

TABLE 38 First and second adjustment factors

	Moray Firth	*Aberdeen*	*Angus*	*East Fife*	*Lothian*	*Central Lowlands*	*Tweed Valley*	*Adj 2*
Vining peas			1.00		1.69	1.23	1.61	**1.02**
Broad beans			0.78				0.93	**1.01**
Brussels sprouts	0.19		1.39	12.05	0.88	0.20	3.97	**1.00**
Cabbage (all other)		1.28		0.16				**2.73**
Cabbage (summer/autumn)				0.76	0.90			**1.14**
Calabrese		0.28	0.87	1.01		2.16	0.84	**1.01**
Carrots	0.80		0.92	0.74		0.67		**1.05**
Cauliflower		5.40		2.76	2.44		1.18	**1.26**
Leeks					0.83	1.34		**1.23**
Lettuce				1.49		0.39		**1.04**
Total mixed veg	6.74	0.43		0.89			0.03	**3.23**
Total other veg	41.79	0.12	0.45	1.31				**1.14**
Rhubarb			1.55			0.60		**1.02**
Turnips & swedes		1.13	1.80	1.09	3.95	3.93	1.31	**1.04**