



Pesticide Usage in Scotland

Commercial Grain Storage 2008-09

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SUMMARY

This report presents information from a survey of pesticide usage in commercial grain storage premises in Scotland in 2008-09.

Pesticide usage information was collected from all known commercial grain stores.

A total of 46 known commercial grain stores had a throughput of 1.3 million tonnes of grain. Of these stores, 70% used some form of pesticide treatment, although direct treatment of grain with pesticides took place at only 17% of the stores, accounting for 5% of the total grain stored. In all, 344 kg of pesticides were used in commercial grain storage premises during 2008-09.

Since the previous survey in 2002-03, malathion replaced aluminium phosphide as the principal active ingredient when usage is expressed by weight.

INTRODUCTION

As part of a continuing programme of post registration surveillance of pesticides, the Pesticide Survey Unit at SASA conducted a survey of pesticide usage in commercial grain stores over the 2008-09 season.

This was the fourth survey which covered commercial grain storage facilities in Scotland, the previous three being in 1994-95, 1998-99 and 2002-03¹⁻³. Types of premises covered are listed below in 'Definitions and notes' and included not only commercial grain stores, but also flour mills, animal feed mills and maltings. Surveys of commercial grain stores were carried out previously in 1967-68, 1972-73, 1977-78 and 1983-84⁴⁻⁷, flour mills in 1977⁸, animal feed mills in 1970-71, 1975-76 and 1985-86⁹⁻¹¹, and maltings in 1974-75 and 1985-86¹²⁻¹³.

Pesticide usage data were collected from all known commercial grain stores. Figures in the tables represent national pesticide usage.

Coincident with this survey a similar survey of pesticide usage in farm grain stores was also conducted, and the results are presented in this publication.

METHOD

All known commercial grain stores were included in the survey. An introductory letter was sent out to all the stores in the survey, each store was then contacted and interviewed by telephone. When necessary, data was also collected from contractors, who had carried out pesticide applications at the grain stores. Pesticide usage data collected from manufacturing premises was restricted to the grain storage areas.

The survey period was the grain storage year from June 2008 to June 2009, and taken to include pre-harvest fabric treatments to the store in 2008.

DEFINITIONS AND NOTES

The term 'directly to grain' refers to treatments where the products were used in direct contact with the grain in store. Such treatments were applied either as an admixture of liquid to the grain or, as a fumigant by the use of gas or gas releasing pellets.

'Fabric treatments' are those made to the floors, walls, conveyors and ducting of stores and to fumigation or smoke treatments made to empty stores.

Basic tonnage is the quantity of grain treated with a pesticide, irrespective of the number of times it was treated or the number of pesticides used. This figure is used to calculate the percentage of grain treated with a chemical or groups of chemicals.

Tonnes treated is the basic tonnage multiplied by the number of treatments the grain received.

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 term 'occurrences' is used to describe the number of grain stores in which a formulation has been used. If a grain store has used a product with a certain formulation more than once or has used more than one product with the same active ingredients then it is still recorded as a single occurrence.

The term 'any treatment' refers to the number of stores applying one or more active ingredient(s): such stores were recorded once regardless of the number of products applied.

The commercial grain stores in Scotland were categorised by type. The types used were: grain stores, which were holding grain in storage but not processing it; satellite farms, which were holding grain in storage on farm on behalf of a grain merchant; animal feed stores, which were holding grain and processing it into animal feed; flour mills which were holding grain and processing for flour; human consumption mills, which were holding grain and processing it for human consumption and finally maltings, which held barley for processing into malt.

Some grain will have occupied more than one store over the survey period. During data collection, very short term storage was not recorded to avoid any duplication or over-estimation of actual tonnage stored (throughput).

Data from the previous surveys in 1998-99 and 2002-03 are provided for comparison purposes in table 7, although it should be borne in mind that there may be differences in types and tonnages of grain stored.

RESULTS AND DISCUSSION

Stores in sample (Table 8)

There were 46 known commercial grain storage premises in Scotland, of which 27 were stores holding grain but not processing it. The remaining 19 premises both stored and processed grain, either for human or animal consumption. Pesticide usage data was collected from all of the 46 commercial grain storage premises.

Throughput of grain in commercial grain storage premises (Tables 1 & 8)

There was approximately 1.3 million tonnes of grain in Scottish grain storage premises during 2008-09, a 37% decline compared with the previous survey. As in 2002-03, the majority of this was barley (78%), followed by wheat (18%). The remaining 5% was made up of oats, oilseed rape and beans.

Commercial grain stores accounted for the largest throughput (60%); this was greater than the previous survey (44%). Maltings, storing barley only, accounted for 25% of the total throughput, compared with 34% in the previous survey. 'Mills' was the only store type to hold significantly more wheat than any other crop and accounted for 13% of the throughput. The other stores (animal feed, satellite farms & seed merchants) accounted for only around 2% of the total throughput of grain.

Extent of pesticide usage (Tables 1 & 2)

Of the 46 stores holding grain, 32 (70%) used some form of pesticide during the survey period, compared with 83% in the previous survey. Most of the treatments were to the fabric and equipment (70%) whilst applications made directly to grain occurred at 17% of the premises. Just over 58,000 tonnes of grain (5%) were treated by direct application of pesticides, roughly a quarter of that recorded in 2002-03. As in the previous survey, the majority of the grain treated directly was barley.

Insecticides and acaricides (Table 3)

When measured by number of occurrences, pirimiphos-methyl was the most popular active ingredient, and was used at 25 of the 32 premises where pesticides were recorded. There was only one occurrence of the active ingredient malathion, but it replaced aluminium phosphide as the principal pesticide by weight applied (156 kg and 31 kg respectively).

As in the two previous surveys, reasons for use have not been tabulated in this report, as in most cases treatments were either precautionary or preventative measures. Specific reasons were cited at only a few stores, and these were saw-toothed grain beetle or grain pests.

Application methods (Table 5)

The most popular application method by weight, whether to the fabric or directly to grain was as a liquid (90%), compared with only 38% in the previous survey. In 2002-03, fumigants had been the principal method of treatment (61%), but in the present survey, this method accounted for only 9% of treatments. This change was due to a significant reduction in the use of aluminium phosphide, and no incidence of methyl bromide use (banned under the EC Ozone Depleting Substances Regulation, except for critical uses), together they accounted for 61% of pesticides by weight in 2002-03.

Status of user (Table 6)

When measured by weight of active ingredients, just over three quarters of the pesticides were applied by contractors, with the remainder by store staff. The number of treatments carried out by contractors was only around a third of those carried out by store staff. However all malathion treatments were carried out by contractor and as this active ingredient accounted for 45% of all treatments by weight, it made a substantial contribution to the proportion applied by this user group.

Comparison with previous surveys (Table 7)

The total grain stored in 2008-09 was almost 1.3 million tonnes, a 37% fall compared with that reported for the 2002-03 storage period, and only half the throughput of 1998-99. In 2008-09 there was a 20% increase in tonnage of grain stored in farm stores compared with the 2002-03 storage period; this was mainly due to difficult market conditions.

The quantity of grain treated directly in the 2008-09 storage period was just over 58,000 tonnes, a decrease of 74% compared with 2002-03. This fall continued from the 1998-99 storage period, where 437,000 tonnes of grain was treated directly.

The total weight of pesticides applied in the present survey was 344 kg, a 75% reduction compared with 2002-03. Fabric and admixture treatments contributed evenly to the decline in pesticide use, both decreasing by a very similar percentage.

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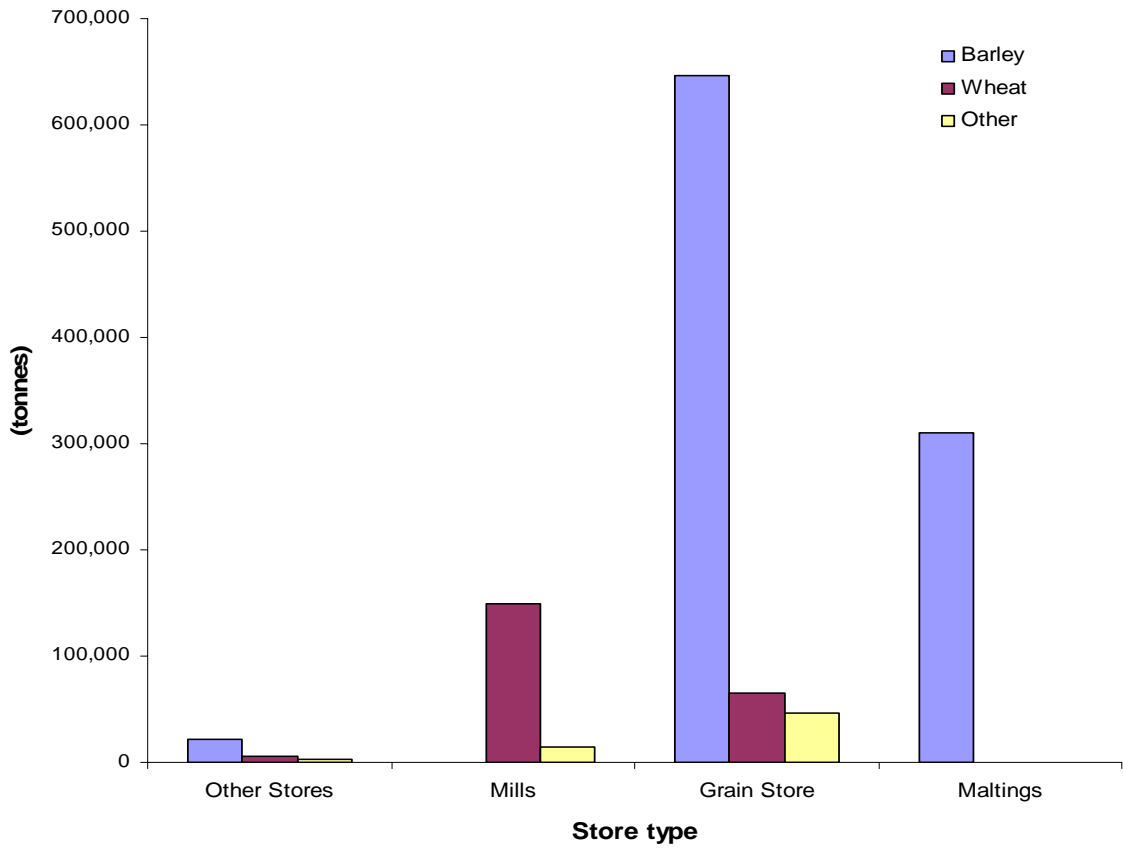
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FIGURE 1 Grain Stored

Total tonnes of grain in each store type



(Other stores: animal feed, satellite farms & seed merchants)

FIGURE 2 Pesticide use by application method

Percentage by weight of active ingredients

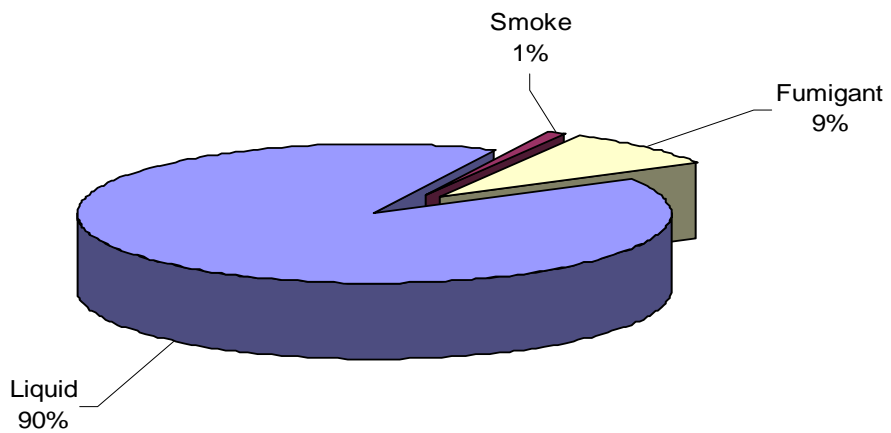


TABLE 1 Grain storage

Tonnes of grain held in store, and treated directly with pesticide

Crop	Stored (tonnes)	Treated directly (tonnes)	Treated directly (%)
Barley	979,422	47,233	5
Wheat	221,072	7,490	3
Oats	34,674	3,640	10
Oilseed rape	27,606	0	0
Field Beans	400	0	0
All crops	1,263,174	58,363	5
Total number of known stores	46	8	17

TABLE 2 Numbers of stores and those using pesticides

Treatment	No. of stores	%
Fabric	32	70
Directly to grain	8	17
Any treatment	32	70
Total number of known stores	46	

TABLE 3 Insecticides and acaricides

Number of occurrences, quantities (kg) applied, quantities (tonnes) of grain treated

Active ingredient	Number of occurrences	Fabric and equipment (kg)	Applied directly to grain (kg)	All treatments (kg)	Grain treated directly (t)
Aluminium phosphide	1	0	30.80	30.80	11,000
Bifenthrin*	1	0	7.80	7.80	26,000
Chlorpyrifos-methyl	4	7.11	0	7.11	0
Deltamethrin	10	3.54	4.33	7.88	17,829
Malathion*	1	0	156.00	156.00	26,000
Pirimiphos-methyl	25	120.59	14.14	134.73	3,534
Pyrethrins	2	0.11	0	0.11	0
All active ingredients	44	131.35	213.07	344.42	58,363

* Bifenthrin / Malathion applied as a formulation

TABLE 4 Pesticide usage by application method
(%) by weight of active ingredients

Active ingredient	Liquid (%)	Smoke (%)	Fumigant (%)	All treatments (kg)
Aluminium phosphide	0	0	100	30.80
Bifenthrin	100	0	0	7.80
Chlorpyrifos-methyl	100	0	0	7.11
Deltamethrin	100	0	0	7.88
Malathion	100	0	0	156.00
Pirimiphos-methyl	97	3	0	134.73
Pyrethrins	100	0	0	0.11
All active ingredients	90	1	9	344.42

TABLE 5 Pesticide usage by application method
(%) by total weight of active ingredients to fabric and grain

Active ingredient	Liquid (%)	Smoke (%)	Fumigant (%)	All treatments (kg)
Fabric & equipment	97	3	0	131.35
Directly to grain	86	0	14	213.07
All treatments	90	1	9	344.42

TABLE 6 Pesticide usage by user
(%) by total weight of active ingredients

Active ingredient	Store staff (%)	Contractor (%)	All Treatments (kg)
Aluminium phosphide	0	100	30.80
Bifenthrin	0	100	7.80
Chlorpyrifos-methyl	81	19	7.11
Deltamethrin	88	12	7.88
Malathion	0	100	156.00
Pirimiphos-methyl	50	50	134.73
Pyrethrins	100	0	0.11
All Active ingredients	23	77	344.42

TABLE 7 Comparison of pesticide usage with previous surveys

Pesticide usage in 1998-99, 2002-03 and 2008-09, tonnes of grain treated and quantities of active ingredients applied

Active ingredient	1998-99				2002-03				2008-09			
	Fabric & equip. (kg)	Directly to grain (kg)	Total (kg)	Tonnes treated	Fabric & equip. (kg)	Directly to grain (kg)	Total (kg)	Tonnes treated	Fabric & equip. (kg)	Directly to grain (kg)	Total (kg)	Tonnes treated
Aluminium phosphide	0	45.22	45.22	9,031	0	521.99	521.99	89,486	0	30.80	30.80	11,000
Bifenthrin	0	0	0	0	0	0	0	0	0	7.80	7.80	26,000
Chlorpyrifos-methyl	54.39	4.1	58.49	1,216	16.91	0	16.91	0	7.11	0	7.11	0
Deltamethrin	0	0	0	0	0	0	0	0	3.54	4.33	7.88	17,829
Etrimfos	2.81	129.45	132.27	34,210	0	0	0	0	0	0	0	0
Malathion	0	0	0	0	0	0	0	0	0	156.00	156.00	26,000
Methyl bromide	440.49	0	440.49	0	304.09	0	304.09	0	0	0	0	0
Permethrin	0.94	0	0.94	0	*	0	*	0	0	0	0	0
Phenothrin	0.24	0	0.24	0	0	0	0	0	0	0	0	0
Pirimiphos-methyl	228.56	1,521.92	1,750.48	392,658	187.37	327.76	515.13	131,403	120.59	14.14	134.73	3,534
Pyrethrins	0.14	0	0.14	0	0.64	0.00	0.64	0	0.11	0	0.11	0
Tetramethrin	0.12	0	0.12	0	*	0.00	*	0	0	0	0	0
All active ingredients	728	1,701	2,428	437,115	509	850	1,359	220,889	131	213	344	58,363
Grain stored (tonnes)				2,563,144				2,011,302				1,263,174

** Quantity not known but expected to be relatively low

TABLE 8 Number of stores by type and tonnage stored

Store Type	Number of stores	Total tonnage stored
Animal feed	5	6,670
Flour mill	1	150,000
Grain store	23	758,844
Human consumption mill	4	14,000
Maltings	9	310,500
Satellite farm	1	8,780
Seed merchant	3	14,380
All stores	46	1,263,174



Pesticide Usage in Scotland

Farm Grain Stores 2008-09

SUMMARY

This report presents information from a survey of pesticide usage in farm grain stores on farms in Scotland from June 2008 to June 2009. The data have been raised to give estimates of national pesticide usage.

It was estimated that 5,681 farms in Scotland stored a total of 1.88 million tonnes of grain during the survey period. Pesticides were used at 18% of these stores, and the vast majority of treatments were applied to the fabric and equipment. Only 17,070 tonnes of grain was treated directly with pesticide.

A total 612 kg of pesticides were used. Pirimiphos-methyl remained the principal pesticide, both by number of occurrences and by weight applied.

INTRODUCTION

As part of a continuing program of post registration surveillance of pesticides, the Pesticide Survey Unit at SASA conducted a survey of pesticide usage in farm grain stores over the 2008-09 storage season.

This was the ninth survey of pesticide usage in farm grain stores. The previous eight surveys of this type were conducted for the storage seasons 1966-67, 1971-72, 1976-77, 1982-83, 1990-91, 1994-95, 1998-99 and 2002-03¹⁻⁷.

Coincident with this survey a similar survey of pesticide usage in commercial grain storage premises was also conducted, the results of which are presented in this publication.

DEFINITIONS AND NOTES

The term 'directly to grain' refers to treatments where the products were used in direct contact with the grain in store. Such treatments were applied either as an admixture of liquid to the grain or, as a fumigant by the use of gas or gas releasing pellets.

'Fabric treatments' are those made to the floors, walls, conveyors and ducting of stores and to fumigation or smoke treatments made to empty stores.

The term 'occurrences' is used to describe the number of grain stores in which a formulation has been used. If a grain store has used a product with a certain formulation more than once or has used more than one product with the same active ingredients then it is still recorded as a single occurrence.

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

The term 'any treatment' refers to the number of holdings applying one or more active ingredient(s): such holdings were recorded once regardless of the number of products applied.

METHOD

The sample was drawn from holdings in the June 2008 Agricultural Census⁸ growing any combinable crops in Scotland (cereals, oilseed rape, peas, beans and linseed). Before sampling, the country was divided into 11 land use regions⁹ (Figure 3) and 5 size groups. Sampling fractions within both region and size groups were based on areas of crops grown rather than numbers of holdings, so that smaller holdings would not dominate the sample.

The sample was made up of 291 farm visits and a postal questionnaire, sent to 632 holdings, asking whether:

- 1) grain had been stored on the farm during the survey period, June 2008 to June 2009, and if so how many tonnes of each crop,
- 2) pesticides to control insects or mites were used on stored grain or on the fabric of the grain stores prior to storing grain.

If pesticides were used, farmers were asked to provide details of the treatments: whether the pesticides were applied solely to the fabric or admixed with grain (and to specify the cereal and tonnage treated), the physical formulation of the pesticide, the name of the product, the reason, and the total quantity of product used.

A small number of farmers were telephoned in those cases where questionnaires were unclear or incomplete. There were 384 (61%) usable questionnaires returned, combined with the 291 farm visits giving a total of 675 holdings. Details of the numbers of holdings and their distributions are given in Table 15.

Sample data were raised to national levels to give an estimate of pesticide usage in Scotland. Raising factors (Table 17) were based on the numbers of farms growing combinable crops in Scotland (Table 16). An adjustment factor (Table 18) was required for those regions where there was no sample data in one or more size groups.

RESULTS AND DISCUSSION

Stores in sample (Table 15)

There was a total of 675 holdings in the sample. Information from 291 holdings was obtained by farm visit, and the remainder by postal questionnaire. Of the 632 questionnaires sent, 384 (61%) replied. Thirty-one per cent of the holdings surveyed did not store grain (207 holdings). Of the remaining 468 holdings which did store grain, 157 holdings used pesticides. There were 5 holdings that did not store grain, but used pesticides on the fabric of the store.

Extent of pesticide usage (Tables 9 & 11)

An estimated 5,681 holdings in Scotland stored a total of 1.9 million tonnes of grain. Approximately 18% of these holdings used pesticides, but only 0.27% treated grain directly with pesticides, representing a total of 1,002 and 15 holdings respectively. An estimated 61 holdings that did not store grain used pesticides on the fabric, which represents only 1% of all holdings not storing grain. Of all the grain stored on farms in Scotland, only 0.91%, 17,070 tonnes, was treated directly with pesticides, whilst all other treatments were to the fabric of the stores or to equipment used for handling grain prior to storage. An estimated 612 kg of active ingredients were used in farm grain stores over the survey period.

Insecticides and acaricides (Table 11)

All active ingredients encountered in this survey were insecticides and/or acaricides. As with previous surveys, pirimiphos-methyl was by far the most commonly used active ingredient when measured by number of occurrences and weight applied, it was used on an estimated 939 farms in Scotland, and an estimated total of 489 kg of active ingredient was used (80% of all actives by weight). Chlorpyrifos-methyl was also popular with an estimated 82 occurrences on farms in Scotland, and an estimated total of 33 kg used. Aluminium phosphide was the most popular active ingredient applied directly to the grain when measured by weight applied; an estimated total of 49 kg was used.

Application methods (Figure 5 & Table 12)

When measured by weight, the majority of active ingredients in the 2008-09 storage season were applied as liquids (85%), followed by gas releasing products (8%) and smoke generators (7%).

Comparison with previous surveys (Table 14)

The estimated tonnage of grain stored in 2008-09 was 1.9 million tonnes, an increase of around 20% compared with the 1.6 million tonnes reported in the previous survey.

The proportion of farms that stored grain where pesticides were used, increased from 14% in the previous survey to 18% in the current survey. Direct treatment of grain remained low and in the present survey represented only 0.91% of the total tonnage stored (0.36% in 2002/03).

The total weight of pesticides applied in the present survey was 612 kg, a 16% reduction compared with 2002-03, but an 11% increase compared with 1998-99.

Pirimiphos-methyl remained the principal active ingredient, compared with recent surveys, the quantity applied increased from 392 kg in 2002-03 to 489 kg in 2008-09. The quantity of chlorpyrifos-methyl used significantly decreased, from 294 kg in 2002-03 to only 33 kg in 2008-09.

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FIGURE 3 Land-Use Regions of Scotland



FIGURE 4 Percentage of crops stored by weight
Other refers to peas, beans, lupins, mixed corn, rye and triticale

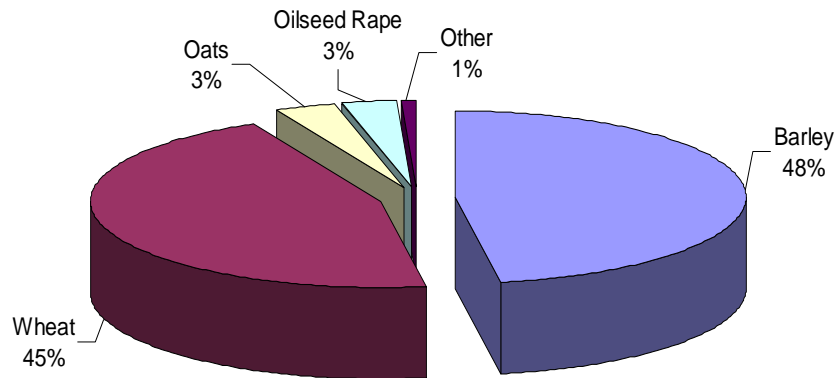


FIGURE 5 Application methods for all active ingredients
Percentage by weight

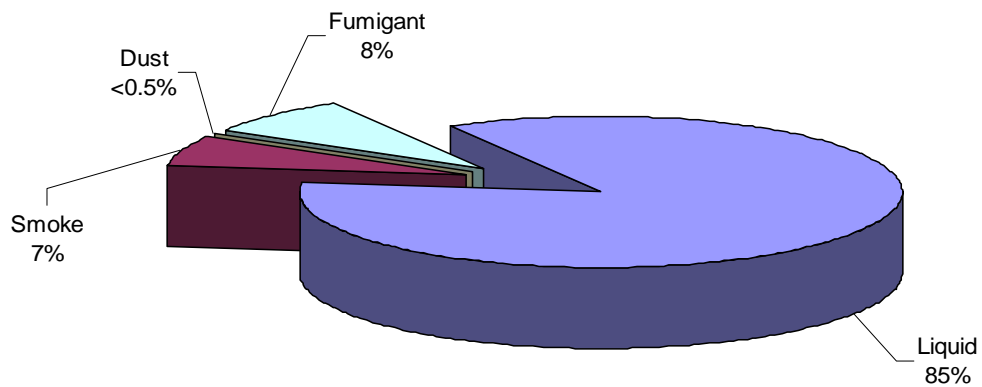


TABLE 9 Number of holdings storing grain and those using pesticides

Store/Treatment	Holdings	%
Admix	15	0.27
Any treatment holdings storing	1,002	17.63
Holdings not storing but using fabric treatment*	61	1.16
Grain stored	5,681	

*' holdings using fabric treatments but not storing, either intended to store or the grain was processed

TABLE 10 Quantities (tonnes) harvested, stored and treated with pesticides

Crop	Census (ha)	Harvest (t)	Stored (t)	Admixed (t)	Admixed (%)
Wheat	113,797	947,500	852,016	11,667	1.37
Barley	319,934	1,871,700	888,867	5,403	0.61
Oats	21,720	119,000	64,215	0	0
Triticale	1,096	6,400	1,948	0	0
Rye	*	*	1,196	0	0
Mixed corn	239	*	171	0	0
Oilseed rape	33,623	115,200	56,635	0	0
Peas(dry harvest)	1,480	5,300	1,133	0	0
Field beans	3,172	11,600	9,164	0	0
Lupins	398	*	372	0	0
All crops	495,458	3,076,700	1,875,718	17,070	0.91
Number of holdings	10,921	10,921	5,681	15	0.27

*' data not available

TABLE 11 Weight (kg) and number of occurrences of active ingredients

Active ingredient	Number of occurrences	Fabric & equipment (kg)	Admixed (kg)	All applications (kg)
Aluminium phosphide	7	0	48.5	48.5
Bifenthrin**	70	1.9	0	1.9
Chlorpyrifos-methyl	82	32.8	0	32.8
Deltamethrin	26	1.5	0	1.5
Malathion**	70	38.4	0	38.4
Pirimiphos-methyl	939	464.6	24.1	488.7
All actives	1,195	539.2	72.6	611.8

***' Bifenthrin / Malathion applied together as a formulation

TABLE 12 Pesticide usage by application method
(%) by weight of active ingredient

Active ingredient	Liquid (%)	Smoke (%)	Dust (%)	Fumigant (%)	All methods (kg)
Aluminium phosphide	0	0	0	100	48.5
Bifenthrin	100	0	0	0	1.9
Chlorpyrifos-methyl	100	0	0	0	32.8
Deltamethrin	100	0	0	0	1.5
Malathion	100	0	0	0	38.4
Pirimiphos-methyl	92	8	+	0	488.7
All actives	85	7	+	8	611.8

'+' = < 0.5 kg / %

TABLE 13 Pesticide usage by user
(%) by weight of active ingredient

Active ingredient	Farmer (%)	Contractor (%)	All users (kg)
Aluminium phosphide	0	100	48.5
Bifenthrin	65	35	1.9
Chlorpyrifos-methyl	100	0	32.8
Deltamethrin	8	92	1.5
Malathion	65	35	38.4
Pirimiphos-methyl	91	9	488.7
All actives	82	18	611.8

TABLE 14 Comparison with previous surveys

Comparison by weight (kg) with 1998-99, 2002-03 and 2008-09

Active ingredient	1998-99 (kg)	2002-03 (kg)	2008-09 (kg)
Aluminium phosphide	0	43.7	48.5
Bifenthrin	0	0	1.9
Chlorpyrifos-methyl	62.7	294.1	32.8
Deltamethrin	0	0	1.5
Gamma-HCH	3.1	0.2	0
Malathion	0	0	38.4
Phenothrin	0.8	0	0
Pirimiphos-methyl	482.6	391.7	488.7
Pyrethrins	0	1.3	0
Tetramethrin	0.4	0	0
All actives	549.6	731.0	611.8
Tonnage stored	1,308,845	1,560,124	1,875,718

TABLE 15 Sampled holdings

Number of holdings (visit & postal) by region and size group

Size (ha)	Highlands & Islands	Caithness & Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Southern Uplands	Solway	Scotland
0.1 - 19.9	17	7	7	11	2	0	0	9	3	2	4	62
20.0 - 49.9	2	3	12	26	13	6	3	19	7	3	10	104
50.0 - 99.9	2	3	20	37	40	14	11	23	15	1	4	170
100.0 - 149.9	1	0	17	23	23	11	13	13	18	1	1	121
150.0 +	0	0	22	32	45	20	36	18	40	2	3	218
All sizes	22	13	78	129	123	51	63	82	83	9	22	675

TABLE 16 Census holdings

Number of holdings in Scotland by region and size group

Size (ha)	Highlands & Islands	Caithness & Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Southern Uplands	Solway	Scotland
0.1 - 19.9	1,264	670	474	980	302	94	117	695	131	132	388	5,247
20.0 - 49.9	67	109	261	698	339	105	79	401	109	40	199	2,407
50.0 - 99.9	22	31	186	461	328	144	100	219	113	28	61	1,693
100.0 - 149.9	6	6	74	173	178	73	79	72	105	9	8	783
150.0 +	0	2	78	134	177	79	105	59	137	9	11	791
All sizes	1,359	818	1,073	2,446	1,324	495	480	1,446	595	218	667	10,921

TABLE 17 Raising factors

Size (ha)	Highlands & Islands	Caithness & Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Southern Uplands	Solway
0.1 - 19.9	74.35	95.71	67.71	89.09	151.00	NA	NA	77.22	43.67	66.00	97.00
20.0 - 49.9	33.50	36.33	21.75	26.85	26.08	17.50	26.33	21.11	15.57	13.33	19.90
50.0 - 99.9	11.00	10.33	9.30	12.46	8.20	10.29	9.09	9.52	7.53	28.00	15.25
100.0 - 149.9	6.00	NA	4.35	7.52	7.74	6.64	6.08	5.54	5.83	9.00	8.00
150.0 +	NA	NA	3.55	4.19	3.93	3.95	2.92	3.28	3.43	4.50	3.67

'NA' not applicable

TABLE 18 Adjustment factors

Region	Highlands & Islands	Caithness & Orkney	Moray Firth	Aberdeen	Angus	East Fife	Lothian	Central Lowlands	Tweed Valley	Southern Uplands	Solway
Adjustment factor	1.0000	1.0099	1.0000	1.0000	1.0000	1.2344	1.3223	1.0000	1.0000	1.0000	1.0000