

PESTICIDE USAGE SURVEY REPORT 179

FARM GRAIN STORES

IN GREAT BRITAIN

1998/1999



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ROUNDING

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

DEFINITIONS

- a) 'Flat Stores' include those storing grain on the floors of buildings.
- b) 'Upright Stores' include grain silos and bins.
- c) 'Fabric Treatments' are those made to the floors, walls, conveyors, ducting and augers of stores and to fumigation or smoke treatments made to empty stores.
- d) 'Grain Treatments' are those made directly to the grain on entry into the store, surface and layer applications and fumigation or smoke treatments made to stores containing grain.
- e) 'Space Treatments' include both fumigation and smoke treatments.
- f) 'Reasons for Use' are the farmers' own reason for use.
- g) Throughout this report, pulses and oilseeds are classed as "grain" for the purpose of storage treatments.

QUALITY CONTROL OF DATA

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

SUMMARY

This report contains data from 1,858 replies to a preliminary questionnaire sent to 2,997 holdings growing combinable crops and the results from visits to 444 holdings using pesticides on stored grain from the 1998 harvest in Great Britain. Data have been raised to give national estimates of usage in Great Britain.

A total of 17.9 million tonnes of grain was stored of which 74% was kept in flat stores. Results of the questionnaire showed that 72% of all holdings responding stored grain and 51% used pesticides either as fabric treatments or admixture treatments. Those holdings in Scotland, South Western, Northern and Midlands & Western regions were more likely to be applying fabric treatments alone. A combination of both fabric and admixture treatments, whilst not as common as fabric applications alone, was more prevalent in both South Eastern and South Western regions.

Approximately 15.9 tonnes of pesticides were applied in farm grain stores in Great Britain with Eastern region accounting for 29%, South Eastern 25%, Midlands & Western 20% and South Western 14% of this total. By weight, 54% of pesticides were applied as fabric treatments, with pirimiphos-methyl accounting for 88% of all fabric treatments. The remaining 46% of pesticides were applied to the grain either at, or during, storage. Pirimiphos-methyl accounted for 78% of the weight of pesticide applied, either as complete admixture treatments or incorporated into the surface of the grain in store. Of all grain treated, 57% was treated by admixture, the rest receiving surface treatment.

Contractors applied 14% of fabric treatments but only 7% of the admixture treatments. Contractors made all applications of aluminium phosphide recorded in this survey.

Rodenticides were used on 69% of all farm grain stores in England and Wales in 1998/99. Difenacoum, the most commonly occurring rodenticide, was used on 27% of all farm grain stores, followed by bromadiolone at 10%. Almost 74 kilogrammes of rodenticide active substance and approximately 500 kilogrammes of bait were recorded in the current survey.

Since the survey conducted in 1994/95, there has been a 2% increase in the tonnage of grain stored.

The weight of active substances applied has increased by less than one percent, which is broadly in line with the increase in the tonnage of grain stored since 1994/95. There has been a decrease in the number of active substances applied to grain from 13 individual active substances in 1990/91 to 9 in 1998/99. Organophosphates continue to account for the majority of pesticides used in grain stores and, in the current survey, these accounted for 97% of the total weight of pesticides applied.

INTRODUCTION

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

As part of the ongoing process for obtaining data, The Pesticide Usage Survey Team of the Central Science Laboratory, an executive agency of the Department for Environment, Food and Rural Affairs, and the Scottish Agricultural Science Agency, an agency of the Scottish Executive Environment and Rural Affairs Department, conducted a survey of pesticide usage in farm grain stores in 1998.

This was the second fully co-ordinated survey of pesticide usage in farm grain stores throughout Great Britain, but was the seventh survey of pesticide usage in farm grain stores in England and Wales and the seventh in Scotland. The most recent reports on pesticide use in grain stores in England and Wales were by Olney & Garthwaite (1991) and Norris & Garthwaite (1997). In Scotland the most recent surveys were reported by Snowden & Dixon, (1992) and Shave & Snowden (2001).

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

A list of the most recently published survey reports is given in the Appendix. Copies of reports on pesticide usage in England & Wales and Great Britain may be purchased from DEFRA Publications, London SE99 7TP, Tel. 01645 556000, quoting the relevant PB number (see Appendix). Copies of reports on pesticide usage in Northern Ireland may be obtained from Her Majesty's Stationery Office, PO Box 29, Norwich, NR3 1GN, tel. 0870 600 5522.

Summaries of published reports can also be viewed on the Internet at: www.csl.gov.uk

METHODS

The sample of holdings to be surveyed was selected using data from the Agricultural Census returns, June 1998 for England & Wales (Anon, 1999a) and for Scotland (Anon, 1999b). Frequency distributions for each individual combinable crop and for all crops combined were examined prior to sample selection to ensure that a representative sample could be selected.

The samples were drawn from the census returns so as to represent the total area of combinable crops (cereals, field beans, dry harvest peas and oilseed rape) grown throughout Great Britain. For England & Wales the sample was selected within each of the six old MAFF regions (Fig. 1) while in Scotland the country was divided into land use regions (Wood, 1931). The samples were stratified according to the total area of all combinable crops grown in each region and by size group based on the total area of combinable crops grown on each holding. The area of combinable crops sampled in each size group and each region was proportional to the total area of combinable crops grown on holdings of each size group in each region.

Postal questionnaires were sent to 2,997 holdings to identify those holdings storing grain from the 1998 harvest and those that had made pesticide applications either to the grain or to the fabric of the store. Information on the total amount of grain stored on all holdings was collected even if pesticides were not used. A letter was sent with the questionnaire to inform farmers of the purpose of the survey and that a follow up visit from a member of the survey team was likely.

Replies were received from 1,858 holdings, and of these 72% stored grain. Pesticides were used on 687 holdings (51% of all holdings storing grain) of which 444 were visited during the summer of 1999. Holdings were stratified according to the same size group as the initial sample.

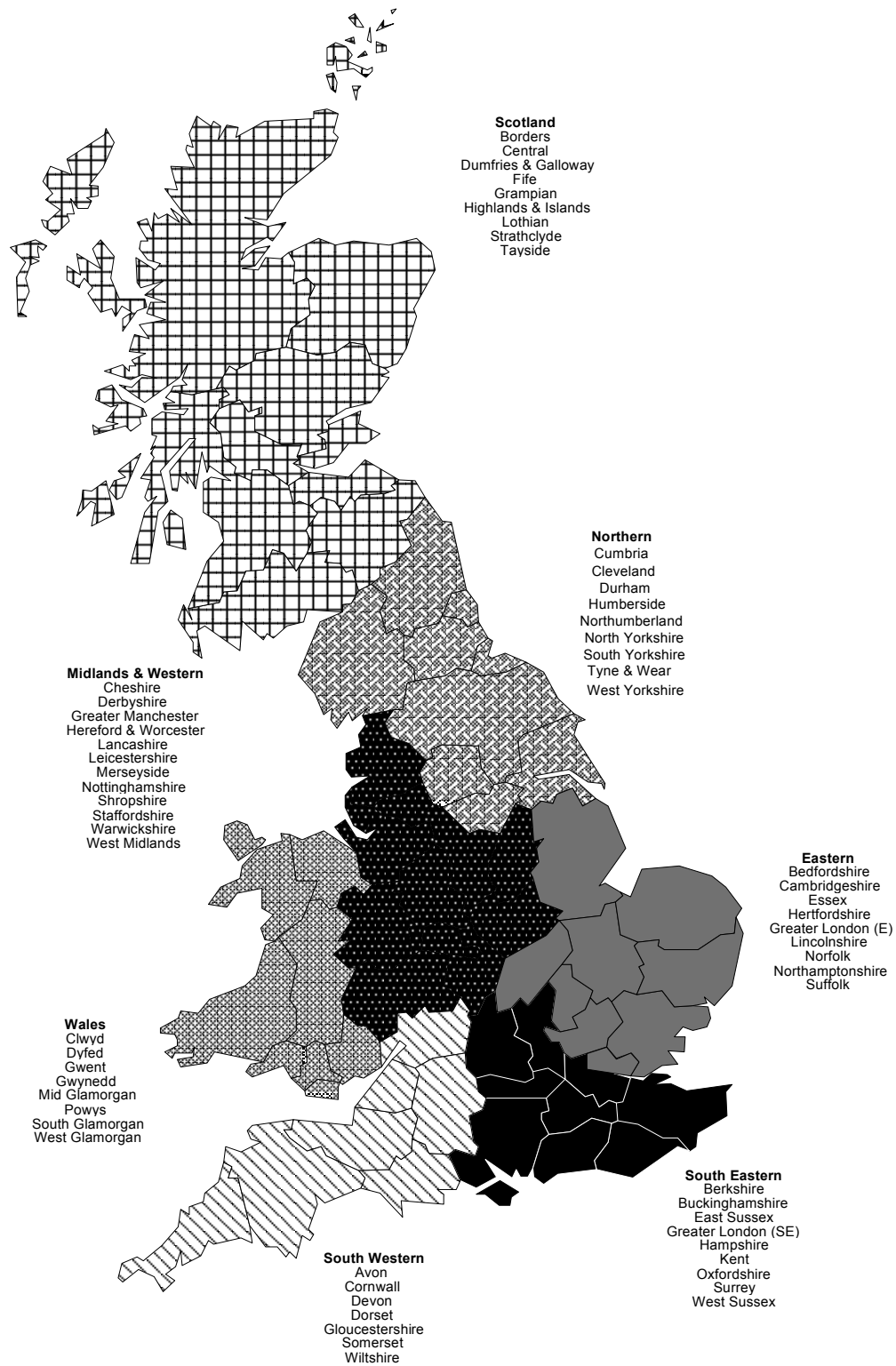
During visits to participating holdings data were collected by a trained pesticide usage surveyor using a second questionnaire comprising two forms. The first summarised the method of storage and the tonnage of each type of grain stored. The second dealt with all aspects of pesticide usage in each store, including grain admixture and treatments to the floors, walls and machinery. Treatments to air spaces and grain within the stores, including smoke generators and phosphine generating tablets, were also recorded. A separate form was used for each grain/store-type/treatment combination.

As with other surveys, pre-set categories of reasons for use were not established and any reasons recorded were those given by the farmer.

Raising factors

Data were raised to give estimates of total pesticide usage in Great Britain. Raising factors were based on the results of the June 1998 Agricultural Census Returns (Anon., 1999a, Anon., 1999b), results of the Cereal Stocks Survey (Anon., 1999c) and on the relative proportion of holdings in each size group and region both storing and treating grain.

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



RESULTS OF THE QUESTIONNAIRE

Of the 2,997 questionnaires sent, 1,858 (62%) were returned and 1,335 (72% of the returns) stated that they were storing grain (Table 1). Pesticides were used on 687 holdings, of which 444 were visited.

Table 2 illustrates the crops encountered in the survey. Approximately 17.9 million tonnes of grain were stored after the 1998 harvest, of which 74 % was in flat stores. Wheat was the most important commodity stored, accounting for 67% of the total with barley comprising a further 21%. In total, cereals comprised 91% of all grain stored.

In line with the geographical distribution of combinable crops grown, (Garthwaite & Thomas, 1999), the greatest proportion of grain, 37%, was stored in Eastern Region (Table 3), with a further 16% being stored in Northern Region, 15% in Midlands & Western, 14% in South Eastern, 11% in South Western, 5% in Scotland and one percent in Wales.

Overall, 51% of holdings storing grain used pesticides. Fabric treatments were used on 46% of all holdings storing grain and grain treatments on 10% (Table 1). Fabric applications made to holdings both storing grain and using pesticides were found to be made most often in Scotland (75%) with South Western region, Northern region, Midlands and Western region, Wales and Eastern region (50%, 39%, 38%, 33% and 32% respectively) showing comparable usage (Table 4). Grain treatments in the absence of fabric treatments were not encountered in Eastern and Northern regions, Scotland and Wales. In the Midlands and Western, South Eastern and South Western regions the usage of grain treatments only was limited. Pesticides applied to the fabric and grain were most widely used in the South Eastern (16%) and South Western regions (10%) with Eastern region accounting for 5%, Midlands & Western 4%, Northern (2%) and Scotland (2%). There were no reported grain treatments in Wales.

Table 1 *Analysis of returned forms – Great Britain 1998*

Size Group	Total received	Total storing grain	Total not treated	Total using fabric treatments	Total using admixture treatments
0 - 50 ha	436	230	174	43	2
50 – 100 ha	405	264	171	80	19
100 – 150 ha	323	240	110	121	27
150 – 250 ha	528	442	183	239	48
> 250 ha	166	159	10	130	43
Total	1,858	1,335	648	613	139

Table 2 *Estimated amount of stored grain in Great Britain 1998 harvest (tonnes)*

Crop	Storage Type		Total
	Flat	Upright	
<i>Cereals</i>			
Barley	2,403,234	1,384,447	3,787,681
Mixed Corn	11,821	383	12,204
Oats	221,125	115,299	336,424
Rye	59,748	12,724	72,472
Triticale	8,240	25,762	34,002
Wheat	9,258,418	2,712,644	11,971,063
<i>Oilseeds</i>			
Linseed	62,700	42,448	105,148
Oilseed rape	648,460	259,174	907,633
<i>Pulses</i>			
Field beans	219,274	45,075	264,349
Peas	238,155	84,890	323,044
Other crops	77,601	69	77,669
<i>All crops</i>	13,208,774	4,682,915	17,891,689

Table 3 *Estimated regional amount of stored grain in Great Britain 1998 harvest (tonnes)*

Crop	Eastern	Midlands & Western	Northern	Scotland	South Eastern	South Western	Wales	Total
<i>Cereals</i>								
Barley	1,083,653	618,305	663,595	479,879	371,249	384,364	186,636	3,787,681
Mixed Corn	383	.	.	.	.	11,821	.	12,204
Oats	27,466	69,136	40,010	42,183	97,352	60,278	.	336,424
Rye	46,433	12,040	.	.	.	13,999	.	72,472
Triticale	4,567	20,735	1,397	1,067	3,436	2,800	.	34,002
Wheat	4,932,492	1,710,935	1,972,603	399,217	1,769,411	1,170,502	15,903	11,971,063
<i>Oilseeds</i>								
Linseed	35,975	18,446	6,153	235	26,746	17,592	.	105,148
Oilseed rape	312,980	119,907	117,270	39,944	147,168	170,365	.	907,633
<i>Pulses</i>								
Field Beans	140,403	25,155	25,857	408	37,980	34,546	.	264,349
Peas	114,046	74,161	46,522	2,320	51,354	34,641	.	323,044
Other crops	9,858	41,763	.	7,975	5,925	12,149	.	77,669
All crops	6,708,258	2,710,582	2,873,407	973,227	2,510,620	1,913,056	202,539	17,891,689

Table 4 *Percentages of fabric and admixture treatments on sampled holdings both storing grain and using pesticides*

Region	Fabric treatments only	Admixture Treatments only	Fabric and admixture treatments
Eastern	32	.	5
Midlands & Western	38	5	4
Northern	39	.	2
Scotland	75	.	2
South Eastern	18	4	16
South Western	50	4	10
Wales	33	.	.
Mean	52	1	4

RESULTS OF THE VISIT SURVEY

Regional usage

Approximately 15.9 tonnes of pesticides were applied in farm grain stores in Great Britain with Eastern region accounting for 29%, South Eastern, 25%, Midlands & Western, 20%, South Western, 14%, Northern, 9%, Scotland 3% and Wales less than one percent.

Fabric treatments to stores and machinery

Fifty four percent of the total weight of pesticides was applied as fabric treatment. Eighty seven percent of this was applied by spraying. Most applications, 72%, were applied to the fabric of the store, 28% to both fabric and equipment and less than one percent to the equipment alone.

Pirimiphos-methyl was the most commonly used active substance, accounting for 88%, by weight, of all fabric treatments. It was also the only active substance applied using all four methods of application with 87% being applied as a spray, 10% as a smoke, 3% as a dust and less than one percent as a mist. Etrimfos and chlorpyrifos-methyl were the second and third most frequently used active substances accounting for 6% and 5% respectively of the total weight of active substances applied to the fabric of the store.

Treatments to grain at or during storage

Almost two million tonnes of grain, 10% of the total quantity of grain stored, was treated either on entry into the store or at some time during storage.

Forty six percent, by weight, of pesticides were applied to the grain, either as admixtures or to its surface (Table 7). Admixtures accounted for 57% of this. By weight, approximately 58% of all active substances were applied as dusts to the grain at or during storage, with a further 35% applied as sprays. The remainder was aluminium phosphide applied as a fumigant. Surface applications, which comprised 43% of the total weight of grain treatments, were applied to control specific pests encountered during the storage life of the crop.

Pirimiphos-methyl accounted for 78% of the total weight of all pesticides applied as grain treatments, of which 60% was applied to wheat. Of the total weight of pirimiphos-methyl applied to the grain 29% was applied as a surface treatment. Etrimfos was the second most important pesticide applied either as an admixture or surface treatment and comprised 16% of the total weight of all grain treatments. Aluminium phosphide was the only other grain treatment recorded.

Admixture and surface applications made to wheat accounted for 64% of the weight of all grain treated and for 62% of the weight of active substances applied. Barley accounted for a further 23% of the weight of grain treated and 21% of active substances applied.

Usage on oilseeds accounted for 11% of the total weight of pesticide applied and 6% of the total tonnage treated. Of this, oilseed rape accounted for 90% of the weight of active substances applied and 91% of the treated tonnage.

Usage on peas accounted for 4% of both active substance applied and treated tonnes stored.

Usage on oats comprised 3% of the total quantity of active substances applied and 3% of the total tonnage treated.

Use of contractors

Eighty six percent of the weight of active substances applied to the fabric and 93% of all grain treatments were made by the farmer.

Contractors made the majority, 72%, of chlorpyrifos-methyl applications to the fabric and all applications of aluminium phosphide.

Table 5 *Regional usage of grain store pesticides - kg's of active substances used*

Active substance	Eastern Midlands & Western	Northern	Scotland	South Eastern	South Western	Wales	Total
<i>Dust</i>							
Etrimfos	10	.	87	1	981	72	1,150
Pirimiphos-methyl	955	770	20	38	822	673	3,279
<i>Fumigant</i>							
Aluminium phosphide	421	.	.	.	52	.	473
<i>Spray</i>							
Chlorpyrifos-methyl	8	.	.	71	367	.	446
Etrimfos	224	37	9	0	180	22	472
Fenitrothion	.	.	.	2	.	.	2
Pirimiphos-methyl	2,539	2,101	1293	211	1573	1,451	9,168
<i>Mist</i>							
D-phenothrin/tetramethrin	.	.	.	.	.	.	.
Etrimfos	.	.	.	.	30	.	30
Fenitrothion/permethrin/resmethrin	41	6	.	.	.	.	48
Pirimiphos-methyl	.	.	.	6	7	.	13
<i>Smoke</i>							
Gamma-HCH	25	.	.	.	.	.	25
Permethrin	.	.	.	.	1	.	1
Pirimiphos-methyl	315	185	89	71	23	64	782
Total	4,537	3,099	1,498	401	4,036	2,282	15,889

Table 6 *Distribution of fabric treatments – kg's of active substances used*

Active substance	Fabric	Equipment	Fabric/ Equipment	Total
<i>Dust</i>				
Etrimfos	.	.	10	10
Pirimiphos-methyl	45	21	133	199
<i>Spray</i>				
Chlorpyrifos-methyl	224	.	222	446
Etrimfos	377	.	94	472
Fenitrothion	2	.	.	2
Pirimiphos-methyl	5,416	25	1,180	6,622
<i>Mist</i>				
D-phenothrin/tetramethrin	.	.	<0.1	<0.1
Etrimfos	.	.	30	30
Fenitrothion/permethrin/resmethrin	.	.	48	48
Pirimiphos-methyl	.	.	13	13
<i>Smoke</i>				
Gamma-HCH	.	.	25	25
Permethrin	.	.	1	1
Pirimiphos-methyl	135	6	641	782
Total	6,201	52	2,397	8,650

Table 7 *Grain treatments - kg's of active substances used*

Active substance	Admixture	Surface	Total
Barley			
<i>Dust</i>			
Etrimfos	43	139	182
Pirimiphos-methyl	519	536	1,055
<i>Fumigant</i>			
Aluminium phosphide	.	52	52
<i>Spray</i>			
Pirimiphos-methyl	212	.	212
Barley - total	774	727	1,501
Linseed			
<i>Dust</i>			
Pirimiphos-methyl	.	25	25
<i>Spray</i>			
Pirimiphos-methyl	55	.	55
Linseed - total	55	25	79
Oats			
<i>Dust</i>			
Etrimfos	.	49	49
Pirimiphos-methyl	36	147	183
Oats - total	36	196	232
Oilseed rape			
<i>Dust</i>			
Etrimfos	.	246	246
Pirimiphos-methyl	120	92	212
<i>Spray</i>			
Pirimiphos-methyl	232	.	232
Oilseed rape - total	352	338	690
Peas			
<i>Spray</i>			
Pirimiphos-methyl	259	.	259
Wheat			
<i>Dust</i>			
Etrimfos	44	619	663
Pirimiphos-methyl	789	817	1,606
<i>Fumigant</i>			
Aluminium phosphide	.	421	421
<i>Spray</i>			
Pirimiphos-methyl	1,788	.	1,788
Wheat - total	2,621	1,857	4,478
Grand total	4,097	3,142	7,239

Table 8 *Grain treatments - tonnes of grain treated*

Active substance	Admixture	Surface	Total
Barley			
<i>Dust</i>			
Etrimfos	11,946	34,751	46,697
Pirimiphos-methyl	153,727	147,013	300,740
<i>Fumigant</i>			
Aluminium phosphide	.	6,065	6,065
<i>Spray</i>			
Pirimiphos-methyl	53,113	.	53,113
Barley - total	218,786	187,829	406,615
Linseed			
<i>Dust</i>			
Pirimiphos-methyl	.	3,080	3,080
<i>Spray</i>			
Pirimiphos-methyl	6,818	.	6,818
Linseed - total	6,818	3,080	9,898
Oats			
<i>Dust</i>			
Etrimfos	.	12,309	12,309
Pirimiphos-methyl	9,023	36,685	45,708
Oats - total	9,023	48,994	58,018
Oilseed rape			
<i>Dust</i>			
Etrimfos	.	24,583	24,583
Pirimiphos-methyl	14,948	27,446	42,394
<i>Spray</i>			
Pirimiphos-methyl	29,009	.	29,009
Oilseed rape - total	43,957	52,028	95,985
Peas			
<i>Spray</i>			
Pirimiphos-methyl	64,774	.	64,774
Wheat			
<i>Dust</i>			
Etrimfos	12,191	154,656	166,847
Pirimiphos-methyl	206,947	242,878	449,825
<i>Fumigant</i>			
Aluminium phosphide	.	59,066	59,066
<i>Spray</i>			
Pirimiphos-methyl	447,763	.	447,763
Wheat - total	666,901	456,600	1,123,501
Grand total	1,010,260	748,532	1,758,792

Table 9 *Farmer/contractor fabric applications kg's of active substance used*

Active substance	Farmer	Contractor	Total
<i>Dust</i>			
Etrimfos	10	.	10
Pirimiphos-methyl	199	.	199
<i>Spray</i>			
Chlorpyrifos-methyl	128	319	446
Etrimfos	346	126	472
Fenitrothion	.	2	2
Pirimiphos-methyl	5,901	720	6,622
<i>Mist</i>			
D-phenothrin/tetramethrin	< 1	.	< 1
Etrimfos	.	30	30
Fenitrothion/permethrin/resmethrin	48	.	48
Pirimiphos-methyl	.	13	13
<i>Smoke</i>			
Gamma-HCH	25	.	25
Permethrin	.	1	1
Pirimiphos-methyl	775	7	782
Total	7,432	1,218	8,650

Table 10 *Farmer/contractor applications to the grain - kg's of active substance used*

Active substance	Farmer	Contractor	Total
<i>Dust</i>			
Etrimfos	1,140	.	1,140
Pirimiphos-methyl	3,080	.	3,080
<i>Fumigant</i>			
Aluminium phosphide	.	473	473
<i>Spray</i>			
Pirimiphos-methyl	2,546	.	2,546
Total	6,766	473	7,239

RODENTICIDE USAGE IN FARM GRAIN STORES

This is the first report presenting the results of a fully co-ordinated survey of rodenticide usage throughout England and Wales on farms storing grain.

Data on rodenticides used in farm grain stores were collected at the same time as insecticidal treatments, with the sampling methodology and estimates of national usage being exactly the same. Where rodent contractors were employed these were contacted after the survey to establish their use of rodenticides at each store.

A total of 424 occurrences of different rodenticide usage were encountered indicating that some holdings used more than one product. The most extensively used rodenticides, in terms of number of occurrences, were difenacoum and bromadiolone. Excluding holdings where the product was unknown, these two active substances accounted for 70% of all recorded occurrences, with most of the following comparisons being made between these two principal rodenticides. All other rodenticides had only limited occurrence and information concerning their usage should be treated with caution as the data may have high standard errors.

In terms of the number of stores treated, rodenticides were used on 69% of farm grain stores in England and Wales in 1998/99 (Table 11). As previously stated difenacoum was the most commonly occurring rodenticide and was used on 27% of all farm grain stores, followed by bromadiolone at 10%.

A total of almost 74 kilogrammes of active substance and approximately 500 kilogrammes of bait were recorded in the current survey reflecting the extremely low percentage of active substance contained within rodenticide bait.

Eastern region accounted for 33%, by weight, of the total amount of the principal active substances used in England and Wales, with South Eastern and Northern region accounting for a further 29% and 21% respectively. Midlands and Western region accounted for a further 9% and South Western region 6%. Usage of rodenticides in farm grain stores was generally part of an all year round programme of pest control though seasonal usage showed a marked increase through the year. Spring usage accounted for 19% of the principal active substances used rising to 21% in summer, 30% in autumn and 31% in winter.

Rodenticides applied inside buildings and around buildings accounted for 44% and 40% respectively, of the total weight of bait applied, with only 15% being applied away from buildings. By weight, 80% of the principal active substances were purchased as ready-to-use baits, 9% as contact dust, 6% as sachets and 4% as concentrates (Table 12). Contractors applied 15% of the total weight of principal active substances used showing that most of the bait was applied by farm workers. Contractors were much more likely to use concentrates, having the facilities for mixing bait, with ready-to-use baits being preferred by grain store managers.

Table 11 *Total usage of rodenticides on farm grain stores in England and Wales 1999*

Active substance	Number of farms	Percentage of all farms	Amount of as used (kg)	Amount of bait applied (kg)
<i>Anticoagulant</i>				
*Brodifacoum	506	1.4	0.02	1,207
Bromadiolone	3,558	9.8	6.86	135,930
*Chlorophacinone	1,586	4.4	7.23	144,392
*Coumatetralyl	340	0.9	1.50	3,995
Difenacoum	9,799	26.9	11.33	194,435
*Diphacinone	818	2.2	0.36	7,195
*Flocoumafen	679	1.9	0.01	230
*Warfarin	653	1.8	1.43	3,107
<i>Hypercalcaemic/anticoagulant</i>				
*Calciferol/difenacoum	260	0.7	0.38	372
*Cholecalciferol/difenacoum	17	< 0.1	0.08	103
<i>Narcotic</i>				
*Alphachloralose	234	0.6	44.53	1,131
<i>Unknown rodenticide</i>	13,105	36	.	0
<i>Not treated</i>	11,456	31.4		
Principal rodenticides	13,357	36.7	18.19	330,365
Total¹	36,441		73.73	492,097

* Information based on less than 30 occurrences should be treated with caution as data may have high standard errors.

¹Estimated number of farms in England and Wales growing arable crops and storing grain in 1999

Table 12 *Formulation of rodenticides used on farm grain stores in England and Wales 1999 - kg as used*

Active substance	Concentrate	Contact dust	Gel	Ready to use bait	Sachets	Wax block	Total
<i>Anticoagulant</i>							
*Brodifacoum	.	.	.	0.02 (98)	.	< 0.01 (2)	0.02
Bromadiolone	0.06 (1)	0.06 (1)	.	6.18 (90)	0.55 (8)	.	6.86
Chlorophacinone	7.05 (98)	.	.	0.18 (2)	.	.	7.23
*Coumatetralyl	.	.	.	1.30 (87)	0.20 (13)	.	1.50
Difenacoum	0.69 (6)	1.66 (15)	< 0.01 (< 1)	8.32 (73)	0.62 (5)	0.05 (< 1)	11.33
*Diphacinone	.	.	.	< 0.01 (2)	.	0.35 (98)	0.36
*Flocoumafen	.	.	.	.	.	0.01 (100)	0.01
*Warfarin	.	.	.	1.43 (100)	.	.	1.43
<i>Hypercalcaemic/anticoagulant</i>							
*Calciferol/difenacoum	.	.	.	0.38 (100)	.	.	0.38
*Cholecalciferol/difenacoum	.	.	.	0.08 (100)	.	.	0.08
<i>Narcotic</i>							
*Alphachloralose	2.82 (6)	.	.	41.72 (94)	.	.	44.53
Total - principal rodenticides	0.75 (4)	1.72 (9)	< 0.01 (< 1)	14.50 (80)	1.17 (6)	0.05 (< 1)	18.19
Total - all rodenticides	10.61 (14)	1.72 (2)	< 0.01 (< 1)	59.61 (81)	1.37 (2)	0.42 (1)	73.73

* Information based on less than 30 occurrences should be treated with caution as data may have high standard errors.

COMPARISON WITH PREVIOUS SURVEYS

The results of the current survey have been compared with those of the 1990/91 and 1994/95 surveys. Most comparisons are made between the current survey and the preceding survey, which was the first co-ordinated farm grain store survey in Great Britain.

The response rate to the preliminary questionnaire declined to 62% in the current survey, from 68% in 1994/95 and 78% in 1990/91.

The percentage of holdings storing grain remained comparable at 72% during 1998/99 and 71% in 1994/95. The total tonnage stored increased by 2% since 1994/95.

The total quantity of pesticide used in grain stores (grain treatments and fabric applications) had increased by less than one percent since the 1994/95 survey, in line with the small increase in grain stored. The smaller increase in weight applied compared with the amount stored may be attributed to pressure to limit pesticide use, from processors, consumers and for economic reasons. There has also been a decrease in the number of active substances used, mainly because of changes in approval, during the comparable survey periods from 13 individual active substances in 1990/91 to 9 in 1998/99 (Table 11). Since the last survey permethrin was the only "new" active substance recorded, it being recorded last in 1990/91. Methacrifos (withdrawn in 1993) and methyl bromide were not recorded in this survey.

In terms of weight of active substance applied, the use of fabric treatments decreased by 22% between 1994/95 and 1998/99. Grain treatments increased by 55% in terms of the weight of active substance applied and by 23% in terms of the weight of grain treated over the same period. This apparent anomaly is, in part, the result of applications of some products being made at reduced rates in the previous survey, full rate applications being the norm in the current survey.

Pirimiphos-methyl was again the principal active substance used in farm grain stores and showed a 9% increase in the total weight applied compared to 1994/95 and an 18% increase compared to 1990/91. The weight of aluminium phosphide used increased by almost three times over that encountered in the last survey and was almost twenty times greater than the amount used in 1990/91. Etrimfos use was 50% higher than in 1994/95 and 28% higher than in 1990/91. Chlorpyrifos-methyl use showed a decrease of 26% compared to 1994/95 and a 60% decrease compared to 1990/91. Use of all other active substances decreased in comparison to 1990/91.

Usage of three organophosphates, pirimiphos-methyl, chlorpyrifos-methyl and etrimfos together accounted for 97% of the weight of all active substances applied in 1998/99.

There had been a marked change in the use of contractors applying pesticides in grain stores. In the 1994/95 survey 4% of the total weight of pesticides used in fabric treatments was applied by contractors, this had increased to 14% in the present survey. In contrast, contractors, who applied 25% of the weight of active substances in 1994/95 as grain treatments, applied only 7% in 1998/99. However the majority of this latter reduction can be attributed to methyl bromide not being encountered in the current survey, applications of which may only be made by specialist contractors.

Table 13 *Estimated total quantities of pesticides used in farm grain stores in Great Britain - kg's of active substance*

Active substance	1990/91	1994/95	1998/99
<i>Pyrethroid</i>			
Alpha-cypermethrin	50	.	.
Permethrin	1	.	< 1
D-phenothrin/tetramethrin	.	< 1	< 1
<i>Phosphine generator</i>			
Aluminium phosphide	26	144	473
<i>Organophosphate</i>			
Chlorpyrifos-methyl	1,120	602	446
Etrimfos	1,293	1,099	1,652
Fenitrothion	339	7	2
Iodofenphos	3	.	.
Malathion	45	.	.
Methacrifos	124	75	.
Pirimiphos-methyl	11,270	12,129	13,242
<i>Organophosphate/pyrethroid</i>			
Chlorpyrifos-methyl/permethrin/pyrethrins	1	.	.
Fenitrothion/permethrin/resmethrin	353	690	48
<i>Organochlorine</i>			
Gamma-HCH	343	55	25
<i>Organobromine</i>			
Methyl bromide	.	998	.
Total	14,968	15,799	15,889

ACKNOWLEDGEMENTS

Thanks are due to all of the growers who willingly participated in this survey, providing invaluable information upon which this report is based. Many thanks are also due to Sean Crawford, John Kerr, Jeremy Snowden, Lynda Smith and Louis Thomas for their invaluable role in collecting the data, as well as to Gillian Parrish for her able assistance in data collation as well as keeping the surveyors on the road. Thanks are also due to Emma Maidment for her diligent and unstinting maintenance of the product database.

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Surveys which include data relating to Scotland are marked with *

Surveys which include data relating to Northern Ireland are marked with #

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