

# **PESTICIDE USAGE SURVEY REPORT 154**

## **RODENTICIDE USAGE ON FARMS IN GREAT BRITAIN GROWING GRASSLAND AND FODDER CROPS**

**1997**

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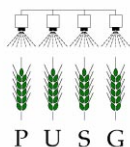
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## DEFINITIONS

- a) "Occurrence" is used throughout this report to mean the use of a unique rodenticide formulation on a farm. One occurrence would include repeat applications of that product on a farm but the same active substance used. If two different formulations (products) were used on one farm it would count as two occurrences.
- b) Tables 5 - 9 are presented in two formats. Table (a) shows the actual amount in kilogrammes of active substance used, along with row percents in parentheses whilst table (b) shows the amount of bait used when made up, along with row percents. Where farmers or contractors have not stipulated the amount of bait made from concentrates, the amount which would have been made up at recommended rates has been assumed. Because of the large variation in the weight applied of each active substance it is relevant to compare the percentages of each used.
- c) Throughout all tables, data based on less than 30 occurrences are clearly marked (\*) and should be treated with caution as they may have an unacceptably high standard error.
- d) "Principal rodenticides" is a phrase used to describe those active substances where 30 or more occurrences have been encountered in a survey. Because of the large variation in the weight applied of each active substance it would be incorrect to rank the relative importance of rodenticides by the total weight of active substance applied.
- e) The term "rodents" refers throughout this report to rats and mice only.

## 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 error 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, amongst 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 the tables are prepared by computer once the data set is considered correct, thus eliminating transcription and typographical errors.

## SUMMARY

This is the second report presenting the results of a fully co-ordinated survey of rodenticide usage throughout Great Britain on farms growing grassland and fodder crops, the first being conducted in 1993. Previous reports have been published by MAFF containing data for England and Wales (1989) and by SOAEFD containing data for Scotland.

A survey of rodenticide usage on 869 holdings growing grassland and fodder crops in Great Britain in 1997 provided data which have been raised to give an estimate of national usage on such holdings. The most extensively used rodenticides, in terms of occurrences were difenacoum, bromadiolone, chlorophacinone and coumatetralyl. These four active substances accounted for 91% of all occurrences excluding holdings where the product was unknown, and the report concentrates on the comparison of usage between these four 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.

Scotland accounted for 32%, by weight, of the total amount of the principal active substances used in Great Britain, with Eastern, Northern and South Western regions accounting for a further 19%, 16% and 14% respectively. The majority of the principal rodenticides were applied in the winter (41%). Rodenticides applied inside buildings accounted for 39% of the total weight of the principal rodenticide bait applied. By weight, 61% of the principal active substances were purchased as ready-to-use baits and farmers applied 84% of the total weight of principal active substances used.

The number of farms using rodenticides had changed very little from 1993, with 82% of all farms using one or more rodenticides during the year. In 1993 this figure was 80%.

The weight of all rodenticide active substances was almost a third of that used in 1993. Much of the decline is due to the reduced usage of sodium cyanide which fell from a total of 48 kg used in 1993 to 6 kg in 1997. Similarly the usage of the principal rodenticides declined by 45% between the two survey years. Difenacoum usage was similar in both years accounting for 45% of occurrences, where the product was known, in 1993 and 48% in 1997. Bromadiolone usage increased from 27% of all occurrences, where the product was known, in 1993 to 32% in 1997.

In 1993 usage of the principal rodenticides was concentrated in Eastern region, accounting for 53% of the total, whilst in 1997 it fell to 19%. Usage in Scotland increased from 27% in 1993 to 32% in 1997 and in Northern region from 12% to 16% whilst usage in the South Western region decreased from 17% to 14% over the same period.

Seasonally, usage was still highest during autumn and winter months, with autumn usage of the principal rodenticides increasing from 34% to 35% between 1993 and 1997 and winter usage increasing from 31% to 41% over the same period. The use of the principal rodenticide active substances inside, around and away from buildings changed very little between 1993 and 1997 with the amount being used inside buildings decreasing from 57% to 54%.

There has been a marked reduction in the purchase and application of concentrates, in 1993 concentrates accounted for 36% of the principal active substances used. In 1997 this proportion was reduced to just 5%, while ready to use formulations became favoured, the proportion acquired rising from 24% in 1993 to 43% in 1997.

There has also been a change in the role of contractors in rodent control. In 1993 farmers applied 84% of the principal six active substances, whilst in 1996 this had risen to 88%.

## INTRODUCTION

The Advisory Committee on Pesticides advises government in the formulation of policy of all aspects of pesticide use. In order to discharge this function the Committee must regularly monitor the usage of all pesticides. It needs accurate data on individual pesticides, including trends in usage.

As part of the ongoing process for obtaining data, the Pesticide Usage Survey Team (PUS) of the Central Science Laboratory, an executive agency of the Ministry of Agriculture, Fisheries and Food and the Scottish Agricultural Science Agency, an agency of the Scottish Office, Agriculture and Fisheries Department, conducted a survey of rodenticide usage on farms growing grassland and fodder crops in 1996/1997 by visiting holdings throughout Great Britain during the winter of 1997/1998.

This is the second fully co-ordinated survey of rodenticide usage on grassland and fodder farms in Great Britain, the first being conducted in 1993 (Olney *et al.*, 1994). Previous on-farm surveys of rodenticide use carried out by the PUSG have been on arable farms in England in 1988 (Olney *et al.* 1991a), on grassland farms in England & Wales in 1989 (Olney *et al.* 1991b) and on arable farms in England in 1990 (Olney & Garthwaite, 1992). Surveys of rodenticide use throughout Great Britain on arable farms have also be conducted in 1992 (Olney & Garthwaite, 1994), 1994 (Thomas & Wild, 1996) and 1996 (De'Ath *et al.*, 1999). A postal survey of local authority rodenticide usage was also carried out in 1989 (Davis *et al.*, 1991) and 1993 (Thomas *et al.*, 1996).

Some information on rodenticide usage has previously been collected during surveys of pesticide usage in farm grain stores and was reported for 1984 (Taylor & Sly, 1986). Similarly rodenticide usage in commercial grain stores was previously reported by Garthwaite *et al.* (1987). Rodenticide usage was collected in Scotland during surveys of pesticide usage in farm grain stores in 1982/83, commercial grain stores in 1983/84, animal and poultry feed mills in 1985/86 and maltings in 1985/86. These surveys are summarised in a review of pesticide usage in Scotland over the period 1978-1986 (Hosie & Bowen, 1990).

A list of the most recently published survey reports is shown in the Appendix. A more comprehensive list of survey reports, together with further information about the work of the survey team, can be found on the CSL Internet site at [www.csl.gov.uk/environment/level3/pusg.htm](http://www.csl.gov.uk/environment/level3/pusg.htm)

## **METHODS**

### ***Sample***

Data were collected concerning the use of rodenticides in 1997 from a stratified sample of 869 farms (Table 2) during a survey of field pesticide usage on holdings growing grassland and fodder crops throughout Great Britain (Garthwaite *et al.*, 1999). The farms were grouped according to the area of fodder crops grown, whilst the number of farms sampled in each region was representative of the total area of crops grown in each region. The data were collected during a personal interview with the farmer or obtained from the contractor responsible for rodent control on the farm.

The data collected from each holding were raised by a factor dependent on the size group and region, based on information from the Agricultural Census Returns, June 1997 for England & Wales (Anon., 1998a) or Scotland (Anon., 1998b). These figures were used to give an estimate of regional and national rodenticide usage on those farms growing fodder crops.

## RESULTS AND DISCUSSION

### *Extent of Rodenticide Usage*

A total of 997 occurrences of usage of different rodenticide products on farms were encountered (Table 3), indicating that some holdings used more than one product. Two anticoagulants accounted for 74% of occurrences, the most frequently encountered rodenticide being difenacoum (44%) followed by bromadiolone (30%). The two other “principal rodenticides”, coumatetralyl and chlorophacinone, accounted for a further 6% and 4% respectively.

When raised to give estimates of national usage, rodenticides were used on 82% of farms growing grassland and fodder crops in Great Britain (Table 4). Difenacoum was the most commonly occurring rodenticide, used on 45% of farms, followed by bromadiolone on 26%, coumatetralyl on 6% and chlorophacinone on 4%. These four accounted for 96% of the total amount of bait applied on farms growing grassland and fodder crops in 1997. The data for all other rodenticides should be treated with caution as fewer than 30 occurrences were recorded and they may have unacceptably high standard errors.

The potency of modern rodenticides, particularly second generation anticoagulants, is highlighted by the low amounts of active substances used, illustrated in Table 1 below:

Table 1 *Average amounts of active substance (a.s.) and bait used per farm and average concentration in bait (principal 4 rodenticides only), excluding contact dusts*

<b>Active Substance</b>	<b>Average amount a.s. used per farm (g)</b>	<b>Average amount of bait applied per farm (kg)</b>	<b>Average concentration (mg a.s./kg bait)</b>
<b><i>1st Generation anti-coagulant</i></b>			
Chlorophacinone	3.89	69.6	56
Coumatetralyl	6.86	4.2	375
<b><i>2nd Generation anti-coagulant</i></b>			
Bromadiolone	1.25	24.5	50
Difenacoum	0.69	14.1	49

### *Regional Usage*

Fig. 1 shows the counties in each MAFF region of England & Wales and the regions of Scotland. Overall, 32% by weight of the total amount of the principal active substances was used in Scotland, 19% in Eastern Region, 16% in Northern Region, 14% in South Western region and 10% in Midlands & Western region (Table 5a). Difenacoum was most frequently used in the Midlands & Western (24%) and South Western (24%) regions. The active substance chlorophacinone was most commonly employed in Eastern region where it accounted for over 80% of the total use of that active substance applied in 1996/97 survey period, whilst in Scotland and Northern region coumatetralyl was the most commonly employed active substance. The amounts of bait applied followed broadly similar patterns (Table 5b).

### ***Seasonal Usage***

Rodenticide usage on farms is essentially part of an all year programme of pest control. Usage of the principal rodenticides was spread throughout the year, though generally least was used in spring (March-May, 12%) and summer (June-August, 12%) with use increasing through the autumn (September-November, 35%) as rodents move indoors from the fields, leading to maximal usage through the winter (December-February, 41%) (Table 6a).

Usage of the gas generators, aluminium phosphide and sodium cyanide, also appears to correlate to season, being applied mainly to burrows around and outside buildings, mainly during the spring (aluminium phosphide) or winter (sodium cyanide), when vegetation levels are low.

Alphachloralose, which acts by slowing down the metabolism of the rodent, causing death by hypothermia, is most effective at temperatures below 15°C. Usage was therefore confined mainly to the colder months, all use being recorded in autumn and winter.

The amount of bait material applied throughout the year (Table 6b) similarly reflects these patterns of usage. However the product applied and the type of formulation may differ through the year leading to slight differences in the seasonal pattern of bait applied.

### ***Location of Usage***

The term "around buildings" refers to usage in the vicinity of farm buildings *i.e.* the farmyard. Similarly the term "away from buildings" refers to baiting away from farm buildings *i.e.* field boundaries and woods. Generally, 54% of the usage of the principal rodenticides was indoors with 33% of bait applied around buildings and only 12% away from buildings (Table 7a). The total of all active substances applied away from buildings amounted to only 7kg, of which aluminium phosphide accounted for 56%. This pattern of usage was roughly the same when considering the amount of bait applied, where only 16% of the principal rodenticides was used away from buildings, 44% around buildings and 39% inside buildings (Table 7b).

Coumatetralyl, which has approval for indoor and outdoor use, was found to be applied predominantly inside buildings (60%) with only 10% being used away from buildings. Three active substances alphachloralose, brodifacoum and flocoumafen, are only approved for use inside buildings, although there was limited use (3%) of brodifacoum baits outside buildings.

### ***Formulation of Rodenticides Used***

Rodenticides are available in several different formulations. Edible baits carry the rodenticide in a range of cereal baits, pellets or wax blocks made from compressed wheat, flour, wax or soft wax baits. Loose cereal baits, either cut or whole, are often better accepted by rodents. However, the use of pellets or blocks is advantageous in some situations. Often they are less prone to damp and subsequent mould growth and therefore remain palatable longer. Both grain and pellet baits are available in sachets to allow ease of placement where loose bait is difficult to use. They have the advantage of remaining fresh until opened by the rodent. Some blocks also have holes in them allowing attachment to walls or other structures, thus reducing loss.

Liquid baits are useful in dry conditions or where water supply may be restricted. Rats require freely available water though mice will also drink water if it is available. Such baits should only be used, however, where access is severely restricted, to avoid ingestion by non-target species.

Contact dusts are laid along runs and deposited on the fur as the rodent moves along. Subsequent grooming results in the ingestion of a lethal dose. In a similar way, mouse tubes pass the rodenticide onto the fur of the mouse from an impregnated wick built into the tube. Mice running through the tube collect a dose of rodenticide, which they subsequently ingest, but the wick is protected from non-target species by the tube. These are particularly suitable for situations where dusts or baits are inappropriate.

Of the principal rodenticides, considering the weight of active substance applied, less than five percent of all the active substances used were purchased as concentrates and made up to bait by farmers or contractors. Ready-to-use baits accounted for 43%, contact dusts for 28% and sachets for 23% of the total amount of active substance used (Table 8a).

In terms of the amount of bait applied (Table 8b) ready-to-use baits account for 61% of the total weight of those baits applied containing the principal rodenticides, followed by sachets (30%). Contact dusts, 92% of which contained coumatetralyl, comprised less than 1% of the total weight of bait material applied.

The use of gels, pastes and wax blocks accounted for less than one percent of both the total amounts of active substance and bait material used.

Within the individual rodenticides bromadiolone (64%), chlorophacinone (58%) and difenacoum (60%) were purchased predominantly as ready-to-use baits (Table 8b), while over a half (53%) of coumatetralyl baits applied were purchased as sachets.

### *Status of User*

Rodenticides were far more commonly applied by farmers, applying 89% of the total amount of all active substances used, while contractors applied only 11% (Table 9a). Considering the principal rodenticides, the percentage of active substance applied by contractors rose to 12%. All alphachloralose and gas-generating compounds were applied by farmers.

The amount of bait applied by farmers or contractors (Table 9b) showed little difference from that of active substance, with 83% being applied by farmers and 17% by contractors. However, all brodifacoum and flocoumafen baits were applied by contractors.

Figure 1 Counties in MAFF regions of England and Wales and regions covered by the Scottish Office of Agriculture, Environment and Fisheries Department (SOAEFD) in Scotland

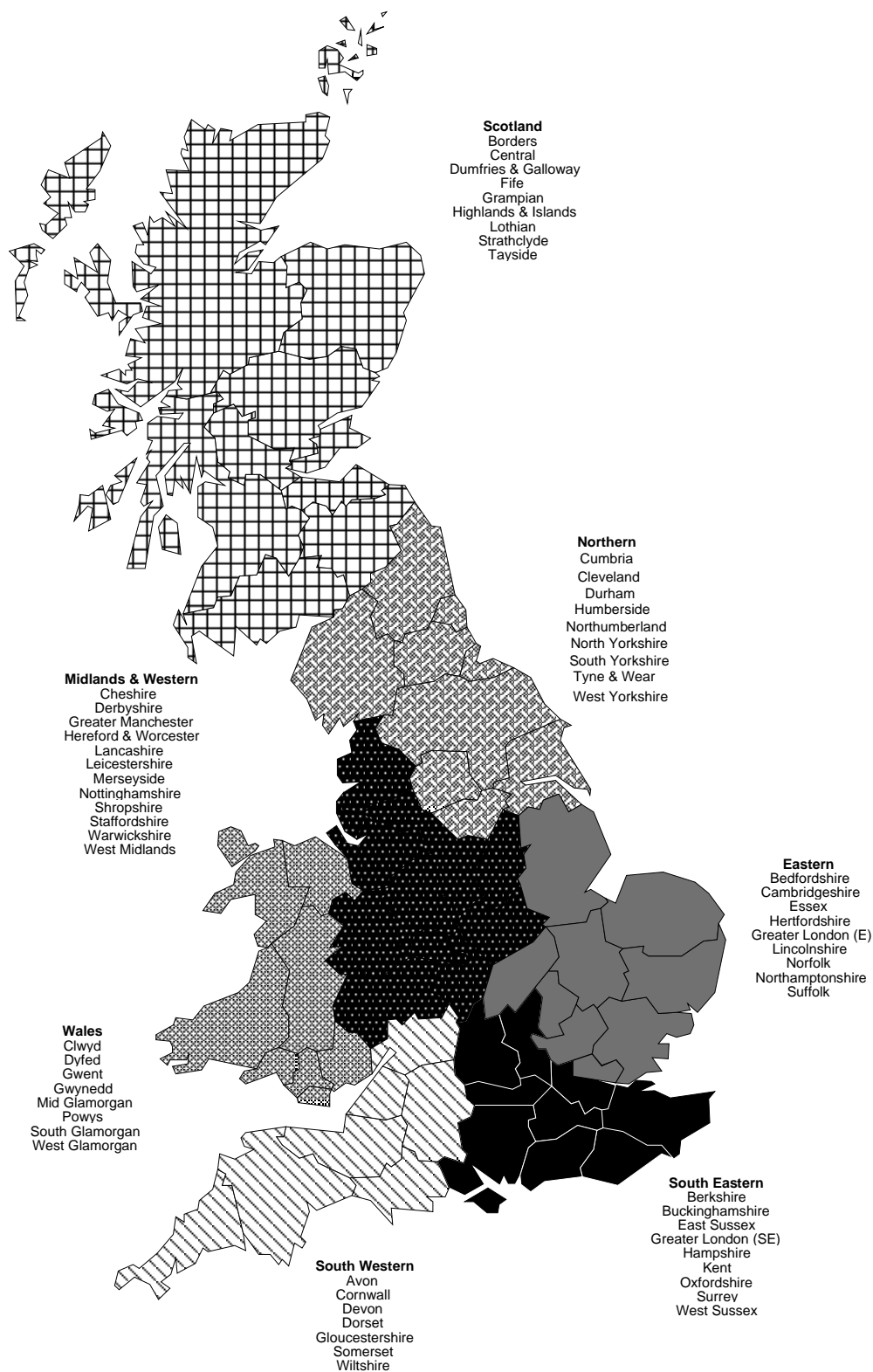


Table 2 *Regional breakdown by size group for grassland and fodder farms in rodenticide survey, Great Britain 1997*

	Size group (hectares)					Total
	0 - 20	20 - 50	50 - 75	75 - 150	> 150	
<b>Region</b>	<b>Number of farms surveyed</b>					
Eastern	7	10	10	3	14	44
Midlands & Western	9	24	30	21	32	116
Northern	13	8	4	4	16	45
South Eastern	2	9	8	17	29	65
South Western	41	53	62	39	83	278
Wales	8	7	6	6	7	34
Scotland	110	80	52	20	25	287
Total	190	191	172	110	206	869

Table 3 *Active substances - number of occurrences of individual products on holdings visited*

Active substance	Total
<b><i>Anticoagulant</i></b>	
Brodifacoum	20
Bromadiolone	299
Chlorophacinone	42
Coumatetralyl	62
Difenacoum	439
Diphacinone	14
Flocoumafen	2
Warfarin	16
<b><i>Gas generating compound</i></b>	
Aluminium phosphide	2
Sodium cyanide	1
<b><i>Hypercalcaemic/anticoagulant</i></b>	
Calciferol/difenacoum	19
Cholecalciferol/difenacoum	2
<b><i>Narcotic</i></b>	
Alphachloralose	3
<b><i>Unspecified rodenticide</i></b>	
	76
Total – all known occurrences	997

Table 4 Total usage of rodenticides on grassland and fodder farms in Great Britain 1997

Active substance	Number of farms	Percentage of all farms	Amount of a.s. used (kg)	Amount of bait applied (kg)
<i>Anticoagulant</i>				
*Brodifacoum	418	2	0.05	1,986
Bromadiolone	5,380	25.7	6.72	131,926
Chlorophacinone	908	4.3	3.54	63,192
Coumatetralyl	1,281	6.1	8.79	5,328
Difenacoum	9,511	45.5	6.65	134,240
*Diphacinone	348	1.7	0.27	5,434
*Flocoumafen	55	0.3	< 0.01	91
*Warfarin	219	1	2.22	5,964
<i>Gas generating compound</i>				
*Aluminium phosphide	20	< 0.1	3.97	7
*Sodium cyanide	31	0.1	6.11	15
<i>Hypercalcaemic/anticoagulant</i>				
*Calciferol/difenacoum	259	1.2	0.86	840
*Cholecalciferol/difenacoum	44	0.2	0.05	64
<i>Narcotic</i>				
*Alphachloralose	53	0.3	3.25	82
<i>Unspecified rodenticides</i>	1,811	8.7	.	.
<i>No rodenticides used</i>	3,724	17.8	.	.
<b>Total</b>	<b>20,911</b>		<b>42.48</b>	<b>349,170</b>

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

<sup>1</sup> total number of farms in Great Britain growing grassland and fodder crops in 1997.

Table 5a *Regional usage of rodenticides on farms in Great Britain 1997 - kg a.s. used (% by active substance)*

Active substance	Northern	Midlands & Western	Eastern	South Eastern	South Western	Wales	Scotland	Total
<b>Anticoagulant</b>								
*Brodifacoum	< 0.01 (< 1)	< 0.01 (6)	< 0.01 (16)	< 0.01 (< 1)	0.03 (64)	.	< 0.01 (14)	0.05
Bromadiolone	1.14 (17)	0.81 (12)	0.81 (12)	1.44 (21)	1.32 (20)	0.03 (< 1)	1.17 (17)	6.72
Chlorophacinone	0.07 (2)	0.05 (1)	2.89 (82)	0.03 (1)	0.20 (6)	.	0.30 (8)	3.54
Coumatetralyl	2.12 (24)	0.07 (1)	0.16 (2)	.	0.54 (6)	.	5.90 (67)	8.79
Difenacoum	0.73 (11)	1.59 (24)	1.09 (16)	0.68 (10)	1.57 (24)	0.19 (3)	0.80 (12)	6.65
*Diphacinone	0.02 (6)	.	0.03 (12)	0.02 (8)	.	0.01 (4)	0.19 (71)	0.27
*Flocoumafen	.	.	< 0.01 (11)	< 0.01 (89)	.	.	.	< 0.01
*Warfarin	0.17 (8)	.	.	0.02 (1)	1.95 (88)	0.08 (4)	.	2.22
<b>Gas generating compound</b>								
*Aluminium phosphide	2.16 (55)	1.80 (45)	.	.	.	.	.	3.97
*Sodium cyanide	.	.	.	.	.	.	6.11 (100)	6.11
<b>Hypercalcaemic/anticoagulant</b>								
*Calciferol/difenacoum	< 0.01 (1)	0.15 (18)	0.22 (26)	0.43 (49)	0.05 (6)	.	.	0.86
*Cholecalciferol/difenacoum	.	.	.	.	0.05 (95)	.	< 0.01 (5)	0.05
<b>Narcotic</b>								
*Alphachloralose	.	.	.	1.84 (57)	0.54 (17)	.	0.87 (27)	3.25
Principal rodenticides	4.07 (16)	2.52 (10)	4.94 (19)	2.15 (8)	3.63 (14)	0.23 (1)	8.17 (32)	25.70
<b>Total - all rodenticides</b>	<b>6.43 (15)</b>	<b>4.48 (11)</b>	<b>5.21 (12)</b>	<b>4.45 (10)</b>	<b>6.24 (15)</b>	<b>0.32 (1)</b>	<b>15.35 (36)</b>	<b>42.48</b>

Table 5b *Regional usage of rodenticides on farms in Great Britain 1997 - kg bait/material used (% by bait/material)*

Active substance	Northern	Midlands & Western	Eastern	South Eastern	South Western	Wales	Scotland	Total
<b>Anticoagulant</b>								
*Brodifacoum	8 (< 1)	100 (5)	221 (11)	8 (< 1)	1,460 (74)	.	188 (9)	1,986
Bromadiolone	22,817 (17)	16,190 (12)	16,264 (12)	28,766 (22)	25,596 (19)	670 (< 1)	21,622 (16)	131,926
Chlorophacinone	1,209 (2)	909 (1)	50,770 (80)	698 (1)	3,954 (6)	.	5,652 (9)	63,192
Coumatetralyl	291 (5)	176 (3)	426 (8)	.	1,444 (27)	.	2,991 (56)	5,328
Difenacoum	14,650 (11)	31,897 (24)	22,061 (16)	13,533 (10)	31,567 (24)	3,956 (3)	16,577 (12)	134,240
*Diphacinone	341 (6)	.	645 (12)	408 (8)	.	209 (4)	3,833 (71)	5,434
*Flocoumafen	.	.	10 (11)	81 (89)	.	.	.	91
*Warfarin	344 (6)	.	.	33 (< 1)	5,357 (90)	230 (4)	.	5,964
<b>Gas generating compound</b>								
*Aluminium phosphide	4 (55)	3 (45)	.	.	.	.	.	7
*Sodium cyanide	.	.	.	.	.	.	15 (100)	15
<b>Hypercalcaemic/anticoagulant</b>								
*Calciferol/difenacoum	7 (< 1)	149 (18)	219 (26)	415 (49)	50 (6)	.	.	840
*Cholecalciferol/difenacoum	.	.	.	.	61 (95)	.	3 (5)	64
<b>Narcotic</b>								
*Alphachloralose	.	.	.	46 (56)	14 (16)	.	23 (28)	82
Principal six rodenticides	38,967 (12)	49,171 (15)	89,520 (27)	42,997 (13)	62,561 (19)	4,626 (1)	46,843 (14)	334,686
<b>Total - all rodenticides</b>	<b>39,671 (11)</b>	<b>49,424 (14)</b>	<b>90,615 (26)</b>	<b>43,988 (13)</b>	<b>69,502 (20)</b>	<b>5,064 (1)</b>	<b>50,905 (15)</b>	<b>349,170</b>

Table 6a *Seasonal usage<sup>1</sup> of rodenticides on farms growing grassland and fodder crops in Great Britain 1997 - kg a.s. used (% by active substance)*

Active substance	Spring	Summer	Autumn	Winter	Total
<b>Anticoagulant</b>					
*Brodifacoum	< 0.01 (22)	< 0.01 (21)	0.01 (23)	0.02 (34)	0.05
Bromadiolone	1.16 (17)	1.13 (17)	1.99 (30)	2.43 (36)	6.72
Chlorophacinone	0.25 (7)	0.24 (7)	1.47 (42)	1.55 (44)	3.54
Coumatetralyl	0.61 (7)	0.87 (10)	3.14 (36)	4.16 (47)	8.79
Difenacoum	1.00 (15)	0.89 (13)	2.29 (34)	2.47 (37)	6.65
*Diphacinone	0.06 (23)	0.06 (21)	0.07 (26)	0.08 (30)	0.27
*Flocoumafen	< 0.01 (25)	< 0.01 (25)	< 0.01 (25)	< 0.01 (25)	< 0.01
*Warfarin	0.42 (19)	0.36 (16)	0.41 (19)	1.03 (46)	2.22
<b>Gas generating compound</b>					
*Aluminium phosphide	3.97 (100)	.	.	.	3.97
*Sodium cyanide	.	.	.	6.11 (100)	6.11
<b>Hypercalcaemic/anticoagulant</b>					
*Calciferol/difenacoum	0.14 (16)	0.14 (16)	0.31 (36)	0.21 (25)	0.86
*Cholecalciferol/difenacoum	0.01 (24)	0.01 (24)	0.01 (29)	0.01 (24)	0.05
<b>Narcotic</b>					
*Alphachloralose	.	.	2.33 (72)	0.92 (28)	3.25
Principal rodenticides	3.02 (12)	3.12 (12)	8.89 (35)	10.62 (41)	25.70
<b>Total</b>	<b>7.63 (18)</b>	<b>3.70 (9)</b>	<b>12.04 (28)</b>	<b>18.99 (45)</b>	<b>42.48</b>

Table 6b *Seasonal usage<sup>1</sup> of rodenticides on farms growing grassland and fodder crops in Great Britain 1997 - kg bait/material used (% by bait/material)*

Active substance	Spring	Summer	Autumn	Winter	Total
<b>Anticoagulant</b>					
*Brodifacoum	455 (23)	441 (22)	478 (24)	612 (31)	1,986
Bromadiolone	22,744 (17)	22,210 (17)	39,157 (30)	47,524 (36)	131,926
Chlorophacinone	4,873 (8)	4,687 (7)	25,663 (41)	27,501 (44)	63,192
Coumatetralyl	632 (12)	305 (6)	2,961 (56)	1,430 (27)	5,328
Difenacoum	20,180 (15)	17,905 (13)	46,151 (34)	49,903 (37)	134,240
*Diphacinone	1,234 (23)	1,121 (21)	1,402 (26)	1,651 (30)	5,434
*Flocoumafen	22 (25)	22 (25)	23 (25)	23 (25)	91
*Warfarin	927 (16)	804 (13)	953 (16)	3,280 (55)	5,964
<b>Gas generating compound</b>					
*Aluminium phosphide	7 (100)	.	.	.	7
*Sodium cyanide	.	.	.	15 (100)	15
<b>Hypercalcaemic/anticoagulant</b>					
*Calciferol/difenacoum	134 (16)	133 (16)	299 (36)	207 (25)	840
*Cholecalciferol/difenacoum	15 (24)	15 (24)	19 (29)	15 (24)	64
<b>Narcotic</b>					
*Alphachloralose	.	.	59 (72)	23 (28)	82
Principal rodenticides	48,430 (14)	45,107 (13)	113,931 (34)	126,357 (38)	334,686
<b>Total - all rodenticides</b>	<b>51,224 (15)</b>	<b>47,643 (14)</b>	<b>117,165 (34)</b>	<b>132,183 (38)</b>	<b>349,170</b>

<sup>1</sup> where more than one season was given for any product, usage was apportioned equally between those seasons given.

Table 7a Location of rodenticides used on farms in Great Britain 1997 - kg a.s. used (% by active substance)

Active substance	Inside buildings	Around buildings	Away from buildings	Total
<b>Anticoagulant</b>				
*Brodifacoum	0.04 (98)	< 0.01 (2)	.	0.05
Bromadiolone	2.60 (39)	3.02 (45)	0.86 (13)	6.72
Chlorophacinone	0.99 (28)	1.29 (36)	1.23 (35)	3.54
Coumatetralyl	7.37 (84)	1.01 (11)	0.41 (5)	8.79
Difenacoum	2.85 (43)	3.19 (48)	0.59 (9)	6.65
*Diphacinone	0.23 (83)	0.04 (14)	< 0.01 (2)	0.27
*Flocoumafen	< 0.01 (100)	.	.	< 0.01
*Warfarin	1.06 (47)	1.14 (51)	0.03 (1)	2.22
<b>Gas generating compound</b>				
*Aluminium phosphide	.	.	3.97 (100)	3.97
*Sodium cyanide	.	6.11 (100)	.	6.11
<b>Hypercalcaemic/anticoagulant</b>				
*Calciferol/difenacoum	0.55 (63)	0.29 (33)	0.03 (3)	0.86
*Cholecalciferol/difenacoum	0.05 (100)	.	.	0.05
<b>Narcotic</b>				
*Alphachloralose	2.06 (63)	1.19 (37)	.	3.25
Principal rodenticides	13.81 (54)	8.51 (33)	3.09 (12)	25.70
<b>Total - all rodenticides</b>	<b>17.79 (42)</b>	<b>17.27 (41)</b>	<b>7.12 (17)</b>	<b>42.48</b>

Table 7b Location of rodenticides used on farms in Great Britain 1997 - kg bait/material used (% by bait/material)

Active substance	Inside buildings	Around buildings	Away from buildings	Total
<b>Anticoagulant</b>				
*Brodifacoum	1,933 (97)	53 (3)	.	1,986
Bromadiolone	51,119 (39)	59,521 (45)	17,059 (13)	131,926
Chlorophacinone	17,301 (27)	23,139 (37)	22,283 (35)	63,192
Coumatetralyl	3,208 (60)	1,569 (29)	550 (10)	5,328
Difenacoum	57,517 (43)	64,262 (48)	11,992 (9)	134,240
*Diphacinone	4,527 (83)	780 (14)	127 (2)	5,434
*Flocoumafen	91 (100)	.	.	91
*Warfarin	2,997 (50)	2,883 (48)	83 (1)	5,964
<b>Gas generating compound</b>				
*Aluminium phosphide	.	.	7 (100)	7
*Sodium cyanide	.	15 (100)	.	15
<b>Hypercalcaemic/anticoagulant</b>				
*Calciferol/difenacoum	532 (63)	281 (33)	28 (3)	840
*Cholecalciferol/difenacoum	64 (100)	.	.	64
<b>Narcotic</b>				
*Alphachloralose	53 (64)	30 (36)	.	82
Principal rodenticides	129,146 (39)	148,492 (44)	51,885 (16)	334,686
<b>Total - all rodenticides</b>	<b>139,344 (40)</b>	<b>152,534 (44)</b>	<b>52,130 (15)</b>	<b>349,170</b>

Table 8a Formulation of rodenticides used on farms in Great Britain 1997 - kg a.s. used (% by active substance)

Active substance	Concentrate	Contact dust	Pellet/tablet	Gel/paste	Ready to use bait	Sachets	Wax block	Total
<b>Anticoagulant</b>								
*Brodifacoum	.	.	.	.	0.04 (87)	.	< 0.01 (13)	0.05
Bromadiolone	0.08 (1)	0.13 (2)	.	< 0.01 (< 1)	4.24 (63)	2.27 (34)	< 0.01 (< 1)	6.72
Chlorophacinone	1.28 (36)	.	.	.	2.18 (62)	0.08 (2)	.	3.54
Coumatetralyl	0.02 (< 1)	7.15 (81)	.	.	0.57 (6)	1.06 (12)	.	8.79
Difenacoum	0.04 (1)	.	.	< 0.01 (< 1)	4.02 (60)	2.58 (39)	0.01 (< 1)	6.65
*Diphacinone	.	.	.	.	0.22 (81)	.	0.05 (19)	0.27
*Flocoumafen	.	.	.	.	.	.	< 0.01 (100)	< 0.01
*Warfarin	0.70 (32)	.	.	.	1.52 (68)	.	.	2.22
<b>Gas generating compound</b>								
*Aluminium phosphide	.	.	3.97 (100)	.	.	.	.	3.97
*Sodium cyanide	.	.	6.11 (100)	.	.	.	.	6.11
<b>Hypercalcaemic/anticoagulant</b>								
*Calciferol/difenacoum	.	.	.	.	0.86 (100)	.	.	0.86
*Cholecalciferol/difenacoum	.	.	.	.	0.05 (100)	.	.	0.05
<b>Narcotic</b>								
*Alphachloralose	.	.	.	.	3.25 (100)	.	.	3.25
Principal rodenticides	1.41 (5)	7.28 (28)	.	< 0.01 (< 1)	11.01 (43)	5.98 (23)	0.02 (< 1)	25.70
<b>Total - all rodenticides</b>	<b>2.11 (5)</b>	<b>7.28 (17)</b>	<b>10.07 (24)</b>	<b>&lt; 0.01 (&lt; 1)</b>	<b>16.94 (40)</b>	<b>5.98 (14)</b>	<b>0.08 (&lt; 1)</b>	<b>42.48</b>

Table 8b Formulation of rodenticides used on farms in Great Britain 1997 - kg bait/material used (% by bait/material)

Active substance	Concentrate	Contact dust	Pellet/tablet	Gel/paste	Ready to use bait	Sachets	Wax block	Total
<b>Anticoagulant</b>								
*Brodifacoum	.	.	.	.	1,862 (94)	.	125 (6)	1,986
Bromadiolone	1,543 (1)	86 (< 1)	.	30 (< 1)	84,795 (64)	45,413 (34)	58 (< 1)	131,926
Chlorophacinone	25,539 (40)	.	.	.	36,351 (58)	1,302 (2)	.	63,192
Coumatetralyl	47 (1)	953 (18)	.	.	1,514 (28)	2,814 (53)	.	5,328
Difenacoum	728 (1)	.	.	11 (< 1)	80,384 (60)	51,614 (38)	1,502 (1)	134,240
*Diphacinone	.	.	.	.	4,393 (81)	.	1,041 (19)	5,434
*Flocoumafen	.	.	.	.	.	.	91 (100)	91
*Warfarin	2,812 (47)	.	.	.	3,152 (53)	.	.	5,964
<b>Gas generating compound</b>								
*Aluminium phosphide	.	.	7 (100)	.	.	.	.	7
*Sodium cyanide	.	.	15 (100)	.	.	.	.	15
<b>Hypercalcaemic/anticoagulant</b>								
*Calciferol/difenacoum	.	.	.	.	840 (100)	.	.	840
*Cholecalciferol/difenacoum	.	.	.	.	64 (100)	.	.	64
<b>Narcotic</b>								
*Alphachloralose	.	.	.	.	82 (100)	.	.	82
Principal rodenticides	27,857 (8)	1,039 (< 1)	.	41 (< 1)	203,045 (61)	101,143 (30)	1,560 (< 1)	334,686
<b>Total - all rodenticides</b>	<b>30,669 (9)</b>	<b>1,039 (&lt; 1)</b>	<b>22 (&lt; 1)</b>	<b>41 (&lt; 1)</b>	<b>213,438 (61)</b>	<b>101,143 (29)</b>	<b>2,817 (1)</b>	<b>349,170</b>

Table 9a Contractor/farmer usage of rodenticides on farms in Great Britain 1997 - kg a.s. used (% by active substance)

Active substance	Contractor	Farmer	Total
<b>Anticoagulant</b>			
*Brodifacoum	0.05 (> 99)	< 0.01 (< 1)	0.05
Bromadiolone	1.62 (24)	5.11 (76)	6.72
Chlorophacinone	0.38 (11)	3.15 (89)	3.54
Coumatetralyl	0.28 (3)	8.51 (97)	8.79
Difenacoum	0.84 (13)	5.81 (87)	6.65
*Diphacinone	< 0.01 (1)	0.27 (99)	0.27
*Flocoumafen	< 0.01 (100)	.	< 0.01
*Warfarin	1.36 (61)	0.87 (39)	2.22
<b>Gas generating compound</b>			
*Aluminium phosphide	.	3.97 (100)	3.97
*Sodium cyanide	.	6.11 (100)	6.11
<b>Hypercalcaemic/anticoagulant</b>			
*Calciferol/difenacoum	0.28 (33)	0.58 (67)	0.86
*Cholecalciferol/difenacoum	.	0.05 (100)	0.05
<b>Narcotic</b>			
*Alphachloralose	.	3.25 (100)	3.25
Principal rodenticides	3.13 (12)	22.57 (88)	25.70
<b>Total - all rodenticides</b>	<b>4.82 (11)</b>	<b>37.66 (89)</b>	<b>42.48</b>

Table 9b Contractor/farmer usage of rodenticides on farms in Great Britain 1997 - kg bait/material used (% by bait/material)

Active substance	Contractor	Farmer	Total
<b>Anticoagulant</b>			
*Brodifacoum	1,978 (100)	8 (< 1)	1,986
Bromadiolone	30,121 (23)	101,804 (77)	131,926
Chlorophacinone	7,646 (12)	55,546 (88)	63,192
Coumatetralyl	447 (8)	4,882 (92)	5,328
Difenacoum	16,874 (13)	117,365 (87)	134,240
*Diphacinone	40 (1)	5,394 (99)	5,434
*Flocoumafen	91 (100)	.	91
*Warfarin	2,710 (45)	3,253 (55)	5,964
<b>Gas generating compound</b>			
*Aluminium phosphide	.	7 (100)	7
*Sodium cyanide	.	15 (100)	15
<b>Hypercalcaemic/anticoagulant</b>			
*Calciferol/difenacoum	275 (33)	565 (67)	840
*Cholecalciferol/difenacoum	.	64 (100)	64
<b>Narcotic</b>			
*Alphachloralose	.	82 (100)	82
Principal rodenticides	55,088 (16)	279,597 (84)	334,686
<b>Total - all rodenticides</b>	<b>60,183 (17)</b>	<b>288,987 (83)</b>	<b>349,170</b>

## COMPARISON OF RODENTICIDE USAGE ON FARMS GROWING GRASSLAND AND FODDER CROPS 1993 & 1997

The data from the 1997 rodenticide survey were compared with the previous survey of rodenticide usage on farms growing grassland and fodder crops in 1993 (Table 10). The total number of occurrences increased from 835 in 1993 to 997 in 1997, in line with the increased number of holdings visited. However, when data are raised to give national estimates, rodenticide usage increased from 80% of farms using rodenticides in 1993 to 82% in 1997.

In line with changes in the use of rodenticides on arable farms (De'Ath *et. al.*, 1999) there has been a decrease in the number of rodenticide products used on individual grassland and fodder holdings. The number of different products used decreased from 1.32 per holding in 1993 to 1.15 in 1997. All four principal rodenticides used in 1997 were also used in 1993, however brodifacoum, which was a principal rodenticide in 1993, had fewer than 30 occurrences in 1997.

The total weight of all rodenticide active substances used was almost a third of that used in 1993. Much of the decline is due to the reduced usage of sodium cyanide, which fell from a total of 48 kg used in 1993 to 6 kg in 1997. However, usage of the principal rodenticides also declined (by 45%) between the two survey years.

In 1997 the principal active substances accounted for 91% of all the occurrences of rodenticide (excluding instances where the product was unknown), compared to 92% in 1993 (Olney, *et.al.*, 1994). Difenacoum usage was similar in both years accounting for 45% of all occurrences where the product was known in 1993 and 48% in 1997. Bromadiolone usage increased from 27% of all occurrences where a product was known in 1993 to 32% in 1997.

Comparing the two surveys there have been some significant changes in regional use. In 1993 usage of the principal rodenticides was concentrated in Eastern region, accounting for 53% of the total, whilst in 1997 it fell to 19%. Usage in Scotland increased from 27% in 1993 to 32% in 1997 and in Northern region from 12% to 16% whilst usage in the South Western region decreased from 17% to 14% over the same period.

In 1997 over eighty percent of chlorophacinone usage was in Eastern region compared with 40% in 1993. The usage of coumatetralyl in Scotland increased from 35% of the total in 1993 to 67% in 1997.

Seasonally, usage was still highest during autumn and winter months, with autumn usage of the principal rodenticides increasing from 34% to 35% between 1993 and 1997 and winter usage increasing from 31% to 41% over the same period.

The use of the principal rodenticide active substances inside, around and away from buildings changed very little between 1993 and 1997 with the amount being used inside buildings only decreasing from 57% to 54%. There were corresponding one percent increases of the principal rodenticides used around and away from buildings.

There has been a marked reduction in the purchase and application of concentrates. In 1993 concentrates accounted for 36% of the principal active substances used. In 1997 this proportion was reduced to 5%, while ready-to-use formulations became favoured, the proportion acquired rising from 24% in 1993 to 43% in 1997. The popularity of using sachets has also increased with the amount of active substance purchased in this form increasing from 5% of the principal rodenticides used in 1993 to 23% in 1997, while usage of wax blocks has remained minimal.

There has also been a decrease in the role of contractors in rodent control. In 1993 farmers applied 84% of the principal active substances, whilst in 1997 this had risen to 88%. This may be attributable to the increasing cost of employing a contractor as well as the convenience of “ready-to-use” formulations available in the market such as sachets and wax blocks, and the lack of availability of concentrates.

Table 10 *Comparison of rodenticide usage on farms growing grassland and fodder crops 1993 & 1997*

	<b>1993</b>	<b>1997</b>
Number of holdings sampled	709	869
Number of sampled holdings using rodenticides	606	772
Percentage of sampled holdings using rodenticides	85	89
Number of occurrences <sup>1</sup>	835	997
Total number of grassland and fodder holdings in Great Britain	21,622	20,911
Estimated number of grassland and fodder holdings using rodenticides	17,373	17,187
Average number of different products used on holdings using rodenticides	1.32	1.15

<sup>1</sup> see Definitions page iii

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## PESTICIDE USAGE SURVEY REPORTS

## APPENDIX

Surveys which include data relating to Scotland are marked with \*

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

### PUBLISHED REPORTS

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## **Chairman's brief – ACP 74 (269/99)**

This is the second report presenting the results of a fully co-ordinated survey of rodenticide usage throughout Great Britain on farms growing grassland and fodder crops, the first being conducted in 1993.

The survey provided data which have been raised to give an estimate of national usage on such holdings during 1997. The most extensively used rodenticides, in terms of occurrences were difenacoum, bromadiolone, chlorophacinone and coumatetralyl. These four active substances accounted for 93% of all occurrences excluding holdings where the product was unknown, and the report concentrates on the comparison of usage between these four 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.

Scotland accounted for 32%, by weight, of the total amount of the 4 principal active substances used in Great Britain, with Eastern, Northern and South Western regions accounting for a further 18%, 16% and 14% respectively. The majority (42%) of the principal rodenticides were applied in the winter. Rodenticides applied inside buildings accounted for 39% of the total weight of bait applied. By weight, 62% of the principal active substances were purchased as ready-to-use baits and farmers applied 89%, the remainder being applied by contractors.

The number of farms using rodenticides had changed very little from 1993, with 87% of all farms using one or more rodenticide products during the year. In 1994 this figure was 85%.

The weight of all rodenticide active substances was almost a third of that used in 1993. However, because of the potency of modern anti-coagulants and consequent small amounts used, changes in weight are easily dominated by small changes in the use of other products. Much of the current change is due to the reduced usage of sodium cyanide, which fell from a total of 48 kg used in 1993 to 6 kg in 1997. However, by weight usage of the principal rodenticides also declined by 46% between the two survey years.

In 1993 usage of the principal rodenticides was concentrated in Eastern region, accounting for 53% of the total, whilst in 1997 it fell to 18%. Usage in Scotland increased from 27% in 1993 to 32% in 1997 and in Northern region from 12% to 16% whilst usage in the South Western region decreased from 17% to 14% over the same period.

Seasonally, usage was still highest during the autumn and winter months, as in 1993. Use of the principal rodenticides inside, around and away from buildings changed also very little between the two surveys.

There has been a marked reduction in the purchase and application of concentrates, in 1993 concentrates accounted for 36% of the principal active substances used. In 1997 this proportion was reduced to just 4%, while ready to use formulations became favoured, the proportion acquired rising from 24% in 1993 to 43% in 1997.

There has also been a change in the role of contractors in rodent control. In 1993 farmers applied 84% of the principal active substances, whilst in 1997 this had risen to 89%.