Agri-Food and Biosciences Institute

Department of Agriculture and Rural Development

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PESTICIDE USAGE IN NORTHERN IRELAND
SURVEY REPORT 209

Northern Ireland Sheep Treatments

2005

Agriculture, Fishing and Forestry

A National Statistics Publication

PESTICIDE USAGE SURVEY REPORT 209

Northern Ireland Sheep Treatments 2005

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The Agri-Food and Biosciences Institute (AFBI) was created on 1st April 2006 as the amalgamation of DARD Science Service and the Agricultural Research Institute of Northern Ireland.

CONTENTS

The County Regions of Northern Ireland

SUMMARY

This report presents information from a survey of the practices and types of control for ectoparasites on sheep in Northern Ireland in 2005. It will also provide comparative data to that obtained in the previous survey in 1997 (Jess *et al.*, 2000).

The total number of sheep in Northern Ireland decreased by 25% to 8,822 farms with a consequent 26% reduction in total sheep population to 2.1 million sheep compared with the previous survey in 1997. During this period, the number of sheep treated for ectoparasites decreased by 40%. The total quantity of organophosphates (OP) compounds used for ectoparasite control decreased by approximately 67% from 7.8 tonnes in 1997 to 2.6 tonnes in 2005, during which, an estimated 38% of all sheep treated for ectoparasites received the OP active ingredient diazinon.

The survey results indicate a decline in the practice of plunge-dipping sheep for ectoparasite control with the proportion of farms using this treatment method decreasing from 58% to 16% between 1997 and 2005. In 1997, an estimated 80% of all sheep treated for ectoparasites in Northern Ireland were plunge dipped, which reduced significantly to 28% in 2005. Conversely, the use of alternative methods have increased with pour-on formulations of insecticides, macrocyclic lactones and growth regulators being applied to 33% of all sheep treated in 2005 compared with 9% in 1997. Use of intramuscular or subcutaneous injections of macrocyclic lactones for ectoparasite control has also increased to 24% of all sheep treated in 2005 compared with 10% in 1997. The proportion of sheep treated in communal spray showers also increased from 1% in 1997 to 14% in 2005.

Control of blowfly maggots, (*Lucilia* spp.) and prevention of sheep scab (*Psoroptes ovis)* were the main reasons given by farmers for sheep treatments.

Of the farms that plunge-dipped, an estimated 68% of surplus dip wash was disposed of immediately after dipping took place, with 80% of farms emptying the dipping tanks using a vacuum tanker and 54% spreading the dip wash directly onto land. An estimated 35% of farmers mixed the dip wash with slurry pre-disposal.

The survey suggests that the products used for spray showers are those recommended for plunge-dipping as there are no contemporary products recommended for use in spray showers. Macrocyclic lactone injections recorded in the survey had the dual function of controlling both endo- and ectoparasites.

INTRODUCTION

As a participant in the UK Working Party on Pesticide Usage Surveys, the Agri-Food and Biosciences Institute (AFBI) on behalf of the Department of Agriculture and Rural Development for Northern Ireland (DARDNI), conducts a program of surveys to examine pesticide usage in all sectors of the agriculture and horticultural industry. Principally, the data collected provides information for consideration by the Advisory Committee on Pesticides. In addition, the information may be used by those involved in residue testing, for public information and to evaluate the impact of policy and trends in pesticide usage.

The annual output value of the Northern Ireland sheep industry is approximately £60 million, comprising a population of approximately 2.1 million sheep and 8,822 farms (Anon., 2005). Previous surveys of pesticide usage in the Northern Ireland sheep industry have demonstrated that considerable quantities of active ingredients were applied during annual ectoparasite control practices (Jess and Marks, 1986), (Foy *et al.*, 1995) and (Jess *et al.*, 2000). Data from the most recent of these surveys are included in the report for comparative purposes.

The revocation of compulsory sheep dipping in 1993 impacted significantly on subsequent ectoparasite control methods and consequent pesticide usage (Jess *et al.*, 2000). Since the previous survey in 1997, issues of concern relating to the rural environment, health, safety and animal welfare led the government to introduce a code of practice for both the safe operation of dipping practices and disposal of the spent chemicals (Anon., 2001). In addition, the available number and range of products recommended for the control of ectoparasites have continually decreased. Furthermore, the application methods for these products may also undergo change. Therefore, it is essential that these husbandry practices, which may impact on the local environment, are monitored to facilitate the formulation of policy for ectoparasite control on agricultural livestock.

METHODS

Using the Northern Ireland Agricultural Census, June 2004 (Anon., 2005), a sample of holdings to be surveyed was selected from each of the six counties. The sample was further stratified into six size groups based on the number of breeding ewes. Holdings were selected at random. Farms selected in the original sample which were unable to provide data were replaced with those from the same county and size group. A total of 291 farms were selected (representing approximately 3% of the sheep farm population in Northern Ireland) and visited between November 2005 and February 2006, (Table 1).

The purpose of the survey was explained to selected growers in preliminary correspondence and data were collected by personal interview. The data collected related to the number of breeding ewes, replacement ewes, rams and lambs produced in 2005. Animal husbandry practices, treatment methods, applicator types, application rates and disposal practices were also recorded. The farmers' perceived reasons for treatment were also included, but may not always seem appropriate. The collected data were analysed using Microsoft Excel and SPSS software.

RESULTS

Overall, a majority of sheep farms in the province controlled ectoparasites by applying treatments as pour-on (39%) or injectable (34%) formulations (Table 2). Fewer farms employed plunge-dipping (16%) or communal spraying (10%) methods for ectoparasite control on sheep. The use of the different control methods was more evenly distributed in County Tyrone, whereas farmers in Counties Down and Londonderry used pour-on treatments most frequently. Farmers in County Armagh preferred injectable treatments but also maintained a relatively high level in the use of plunge-dipping.

An estimated 28% of the sheep population treated for ectoparasites received plunge-dipping while 33% and 24% received pour-on and injectable treatments, respectively (Table 3). A further 14% of sheep treated received spray applications in a mobile spray facility operated by local contractors. A greater proportion of sheep received plunge-dipping treatments in Counties Fermanagh (48%), Armagh (37%) and Antrim (35%). In counties Down (48%) and Londonderry (40%), proportionally more sheep received pour-on treatments and 37% of sheep in County Armagh were also treated by this application method. Communal spray treatments were principally applied to sheep in Counties Tyrone and Antrim.

Pour-on treatments were used more frequently on farms with smaller flock sizes of less than 200 sheep and an estimated 50% of all applications in flock sizes of less than 50 sheep were pour-on treatments (Tables 4&5). Frequencies of injectable and spray shower treatments were more evenly distributed across all flock size categories with a tendency for more spray shower treatments on farms with flock sizes of 200-250 sheep. Plunge-dipping was used most frequently within the larger flock sizes and, in particular, flock sizes exceeding 500 sheep. Nonetheless, more than 20% of sheep farms in the 50-100 and 100-200 flock size categories used this application method for sheep treatment.

Plunge-dipping accounted for 62% of the total quantity of pesticide active ingredient applied to sheep during ectoparasite control treatments. A further 22% was applied during communal spray showers and 15% applied in pour-on treatments (Table 6). Owing to the relatively low recommended dose rates for injectable formulations, treatments in this category represented only 0.4% of the total pesticide active ingredients.

Regionally, County Antrim, which represented 28% of the total sheep population, accounted for 40% of the total quantity of pesticide active ingredients used, including 44% and 51% of the quantities of active ingredients used for plunge-dipping and communal spray showers, respectively. County Londonderry, representing 16% of the total sheep population accounted for 43% of the quantity of active ingredients used for pour-on applications.

Overall, the quantity of pesticide used for the control of ectoparasites on sheep approximated to flock size (Table 7). However, farms with flock sizes of 100-200 sheep accounted for 37% of the quantity of pesticides used in plunge-dipping and 42% of that used for pour-on treatments.

TREATMENT TYPES

An estimated 28% of all sheep treated in Northern Ireland in 2005 received plunge-dip treatment (Table 8). A further 14% received treatments using a spray shower while 33% received pour-on treatments and 24% received injections to control ectoparasites.

Of those sheep dipped, 84% received treatments containing organophosphate active ingredients while the remaining 16% were treated in dips containing Pyrethroids. Products containing organophosphate active ingredients were also most commonly used in spray showers accounting for 94% of all sheep treated by this method with products containing pyrethroids accounting for the remaining 6%.

An estimated 77% of pour-on formulations applied to sheep contained pyrethroid active ingredients. A further 23% received products containing growth regulators and less than 1% of sheep were treated with pour-ons containing avermectins. For those sheep receiving injections to control ectoparasites, an estimated 62% were administered avermectins with the remaining 38% getting milbmycin products.

The organophosphate diazinon accounted for an estimated 95% of active ingredients used for dipping sheep and 99% of those used in spray showers (Table 9). The growth regulator cyromazine represented 84% of the quantity of active ingredients applied in pour-on treatments. An estimated 23% of sheep treated with pour-ons received products containing growth regulators accounting for 93% of the pour-on active ingredients applied. Cyromazine (90%) and dicyclanil were the only two growth regulator active ingredients used by farmers during this period. Conversely, the remaining 77% of sheep received pour-on treatments containing pyrethroid formulations, accounting for 7% of the quantity of pour-on active ingredients used.

Avermectins represented 79% of the quantity (62% of sheep treated) of active ingredients applied by injection, with Ivermectin the most commonly used. The only milbmycin recorded used in this survey was moxidectin.

Overall, when pyrethroids were applied, the active ingredient alphacypermethrin was the most frequently used (55% of sheep treated with pyrethroids), accounting for only 1% of the quantity of pyrethroid active ingredients used. Conversely high-cis Cypermethrin was used on 15% of the sheep treated with pyrethroids and accounted for 62% of the quantity of all pyrethroids applied.

OP active ingredients were most frequently used in plunge-dipping treatments (Table 10). Of the farms that used OP products in plunge-dippers and spray showers, 37% were used in County Tyrone and 32% in County Antrim. Synthetic pyrethroid products were not used for dipping / showering sheep in all counties. County Antrim accounted for 33%, County Down for 25%, County Tyrone for 23% and County Londonderry for 20% of usage of pyrethroid dipping products used for ectoparasite control.

An estimated 80% of sheep dipping treatments containing dip products were used on farms with flock sizes of less than 200 sheep (Table 11).

REASONS FOR USE

Blowfly maggots (52%) and scab prevention (37%) were the main reasons given by farmers for applying treatments to sheep (Figure 1, Table 12). Of the farms that used dips / showers as a method of treatment for ectoparasites, 68% were treating to control blowfly maggots, with 24% of farms citing scab prevention as a reason for use of OPs. An estimated 86% of all injectable treatments were for scab prevention. An estimated 83% of all pour-ons were applied to control blowfly maggots. Diazinon was the most frequently used active ingredient, principally to control blowfly maggots and was applied to control all ectoparasite types (Table 13). Alphacypermethrin was also frequently used to control blowfly maggots. Doramectin and moxidectin were the main active ingredients given for scab prevention / control.

Treatments to prevent or control scab were applied in every month of the year with 69% of the treatments occurring in the autumn months of September, October and November. An estimated 92% of all treatments given to control blowfly maggots were applied in the summer months of June, July and August.

DIPPING PRACTICES

An estimated 68% of plunge-dippers are emptied immediately after use (Table 14). Approximately 49% of farmers disposed of spent dip unto designated areas, 46% unto permanent pasture and 3% unto wasteland (Tables 15 &16). After emptying the dipper, 54% of farmers spread the dip wash directly unto land, 4% stored it in a dedicated tank to dispose of at a later date, 31% disposed of it into a slurry / dirty water tank to be disposed of unto land later and the remaining 11% used

other methods of disposal (Table 17). An estimated 80% of all plunge-dippers were emptied using vacuum tankers, 15% were emptied manually, 1% using pump and 2% used a plug to empty the dipper (Tables 18 and 19).

Approximately 73% of farms who used plunge-dippers undertook their own disposal, with 21% used a contractor and 6% allowed a neighbour to dispose of the dip wash. An estimated 24% of farmers had been contacted by the Department of Environment Environment Heritage Service (EHS) officials, 64% had not and 13% were non- respondents.

COMPARISON WITH PREVIOUS SURVEY IN 1997

The total number of sheep farms in NI decreased by 25% between 1997 and 2005 with a similar decline in total sheep population. Between the two survey periods, the number of sheep treated with plunge-dips or spray showers decreased by 79% and the quantity of active ingredients used by 77%. Conversely, the numbers of sheep treated with pour-ons increased by over 100% and the quantity of associated active ingredients increased by 11%. The number of sheep treated by injection and quantity of active ingredients administered by this treatment method increased by 38% and 40% respectively, compared with 1997 (Table 20).

The proportion of sheep dipping or spraying treatments containing OPs increased from 79% to 84% while those containing pyrethroids increased from 9% to 16% between the two survey periods. An estimated 77% of pour-on treatments in 2005 contained pyrethroid active ingredients, compared with 25% in 1997. Conversely, 23% pour-on treatments in 2005 contained growth regulators compared with 63% in 1997. While fewer sheep were treated with growth regulators in 2005 compared with 1997, the quantity of these active ingredients increased, suggesting either repeat applications or applications at higher rates.

The overall proportion of sheep receiving injections containing milbmycin increased from 4% in 1997 to 38% in 2005. There was a consequent reduction in sheep numbers treated with avermectins in 2005 compared with 1997 (Table 20).

DISCUSSION

Since the previous survey on sheep treatments in this region was undertaken in 1997 (Jess *et al.*, 2000) there have been a number of changes in the sheep industry. During the intervening period, the number of sheep farms and the total sheep population have decreased by 25%. In addition, environmental, health and food safety concerns have led to a reduction in chemicals available to control ectoparasites and increased restrictions on methods of disposal of spent chemicals.

The findings of this report suggest that sheep farmers in this region are disengaging from the traditional use of plunge-dipping for control of ectoparasites, particularly in the smaller farm size groups. Initial evidence of this trend was recorded in a previous survey and it was considered that the amendment in 1993 of the Sheep Scab Order (Northern Ireland) 1970 was impacting on ectoparasite control practices (Jess *et al.*, 2000). Subsequently, the temporary withdrawal of marketing authorisations for the distribution of sheep dip concentrates containing organophosporus compounds in December 1999 and more recently those containing pyrethroid compounds in February 2006 may also have had an effect. In addition, the introduction of stricter legislation on the disposal of spent sheep dip chemicals, for which farmers are required to have a groundwater authorisation from the environment agencies before disposal of spent dip on their land, is another contributory factor (Anon., 2001). This may be particularly problematic for smaller farm sizes where suitable land for disposal is limited.

When compared with results from the previous survey in 1997, this report suggests not only a decline in plunge-dipping but an increase in other methods of applications particularly pour-ons. The data indicated that the smaller farm size groups used pour-ons as the main application method, possibly due to the ease of application. However, the increase in pesticide usage associated with pour-ons may also be due, in part, to repeated applications. The efficacy of pour-ons is not well established with farmers, who expressed mixed opinions when discussing adequacy of coverage and persistence. However, contrary to some farmers' beliefs, pour-ons are effective against blowfly maggots and 60% of all treatments applied for blowfly maggots were pour-on formulations. An estimated 23% of the pour-ons used were insect growth regulators which have proven efficacy against blowfly maggots giving protection for 10 to 16 weeks depending on type. Avermectins accounted for <1% of pour-ons, with the remainder comprising synthetic pyrethroids. Alphacypermethrin, applied as a pour-on was the active ingredient most frequently used, after diazinon, for blowfly maggot control providing protection for 8 to 10 weeks.

The increased use of communal spray showers is possibly as a direct result of the disposal problem associated with spent plunge-dipping chemicals. As the units are mobile, this method is also more convenient for farmers with small flock numbers to use. Communal spray showers are designed to re-cycle excess pesticide throughout the spraying operation. Consequently, less pesticide is used during treatment with a subsequent reduction in the disposal requirements. The chemicals approved for plunge-dipping in the UK were not approved for use in spray shower equipment during the period of this report All spray showering recorded in this survey was undertaken by contractors.

The OP diazinon was the most commonly used active ingredient to control ectoparasites on sheep. However, since the previous survey in 1997, the number of farms overall using OPs have reduced.

Principally, it is those farms with larger flock sizes groups that continue to use dips containing OPs suggesting that this is the most effective control method available to this particular group. This concurs with the findings by (Bates, 1993) who concluded that farmers with large flocks are more inclined to use OP dips as they offer the only effective method of controlling scab and have a broad spectrum of activity against other ectoparasites.

The use of injections of macrocyclic lactones with sheep farms in the region has also increased compared with the previous survey in 1997. One possible reason for this is that owing to the anthelmintic activity of macrocyclic lactones it is more cost effective for farmers, particularly those with small flocks, to use a single treatment to control both endoparasites and ectoparasites in their flocks.

As sheep scab is a notifiable disease in Northern Ireland, farmers were reluctant to acknowledge using treatments to 'control' scab and therefore their principal reason for treatment was as a preventative measure. Previously, the principal method for the prevention or control of this disease was to plunge-dip sheep in a solution containing OPs. The survey indicates a definite trend away from this practice towards the use of alternative methods including spray showers, pour-on formulations and injectable compounds.

The incidence of sheep scab disease in Northern Ireland flocks is relatively low but has been increasing since 2001. Should this trend continue, it may be necessary to review the effectiveness and sustainability of current control practices for ectoparasites of sheep.

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The authors are grateful to the farmers who participated in the survey, without whose cooperation completion of the report would not have been possible. The assistance of Mr Thomas Keatings, Ms Heather Knowles and Ms Trudy-Ann Kelly during data collection and analyses was invaluable.

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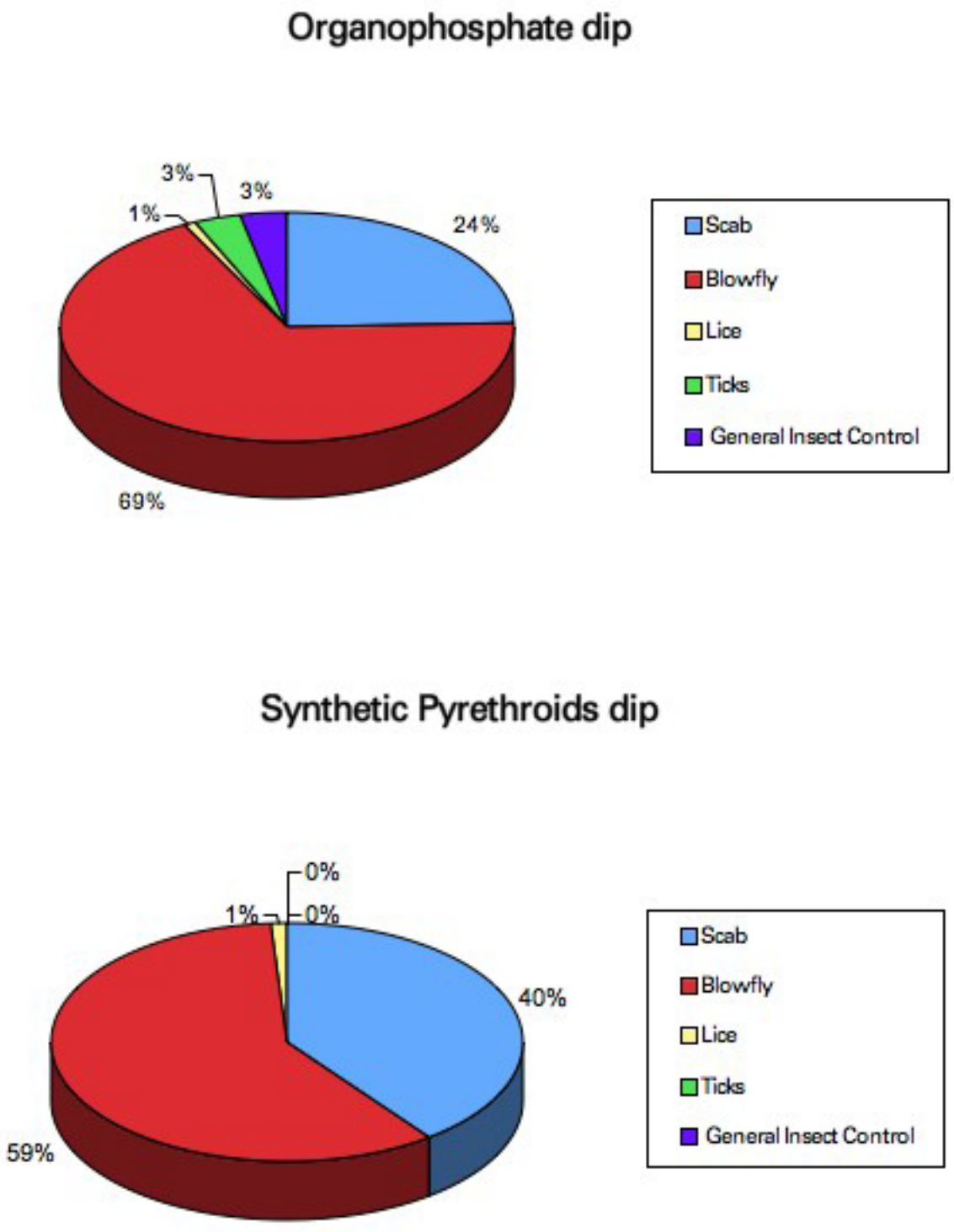
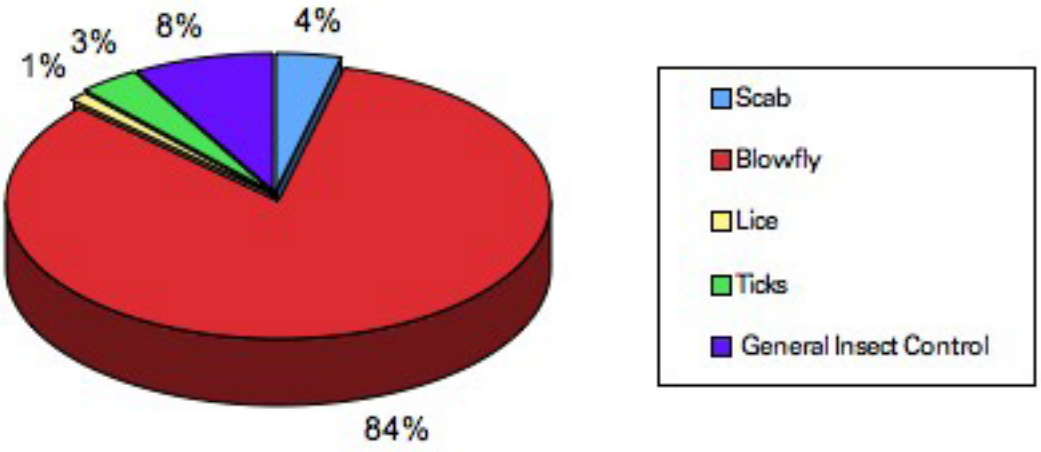
Figure 1: Reasons for use of treatments for ectoparasites on sheep categorised by product types.



Pour-ons



Injectables

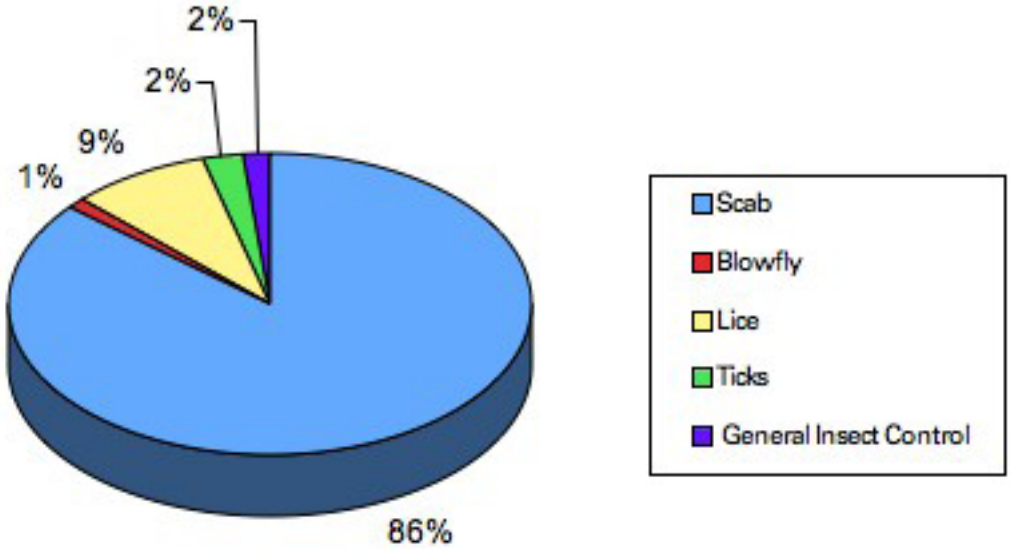


Table 1: Total number of sheep farms surveyed, categorised by flock size class of breeding ewes (number of farms surveyed in parentheses).

	Size class (number of breeding ewes)													
County	<50		50 < 100		100 <200		200 < 250		250 < 500		500+		Total	
Antrim	705	(6)	488	(8)	462	(17)	112	(7)	184	(25)	65	(17)	2,016	(80)
Armagh	409	(3)	176	(5)	104	(4)	14	(0)	32	(5)	3	(1)	738	(18)
Down	826	(5)	546	(12)	421	(17)	68	(6)	110	(9)	22	(9)	1,993	(58)
Fermanagh	262	(3)	119	(0)	78	(3)	11	(0)	24	(4)	8	(0)	502	(10)
Londonderry	549	(3)	402	(6)	394	(19)	93	(8)	145	(15)	41	(11)	1,624	(62)
Tyrone	827	(6)	491	(9)	397	(21)	83	(3)	115	(15)	36	(9)	1,949	(63)
Northern Ireland	3,578	(26)	2,222	(40)	1,856	(81)	381	(24)	610	(73)	175	(47)	8,822	(291)

Table 2: Regional distribution of sheep farms, employing different treatment methods for the control of ectoparasites on sheep.

	County						
Treatment method	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Northern Ireland
Plunge Dip	563	154	411	38	179	526	1,871
Mobile spray shower	416	3	14	46	78	581	1,138
Pour-on	1,143	101	1,476	202	1,152	555	4,631
Injection	967	311	1,014	463	798	445	3,999
Spray treatments	.	.	25	.	10	55	89
All treatment methods	3,090	570	2,940	749	2,217	2,162	11,727
Population	*2,022*	*759*	*2,024*	*488*	*1,625*	*1,951*	*8,869*

Table 3: Regional distribution of sheep receiving treatment to control ectoparasites, categorised by treatment method.

	County						
Treatment method	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total sheep treated
Plunge Dip	272,727	41,526	100,957	66,140	119,287	131,835	732,471
Mobile spray shower	133,987	1,650	7,467	16,003	41,488	158,964	359,560
Pour On	210,218	41,990	251,710	21,673	228,358	88,183	842,132
Injectable	152,018	27,874	144,103	34,499	161,396	86,320	606,210
Spray treatments	.	.	18,078	.	14,500	218	32,797
All treatment methods	768,950	113,039	522,315	138,316	565,029	465,519	2,573,169
Population	*620,424*	*115,529*	*437,360*	*92,932*	*488,643*	*470,519*	*2,225,407*

Table 4: Distribution of sheep farms, categorised by flock size of breeding ewes, employing different treatment methods for the control of ectoparasites on sheep.

	Size class (number of breeding ewes)						
Treatment method	< 50	50 < 100	100 < 200	200 < 250	250 < 500	500 +	Total Farms
Plunge Dip	303	559	578	94	256	81	1,871
Mobile spray shower	393	231	274	106	101	33	1,138
Pour-on	2,200	970	947	172	262	80	4,631
Injection	1,502	962	921	195	329	89	3,999
Spray treatments	.	55	25	.	10	.	89
All treatment methods	4,398	2,776	2,746	567	957	283	11,727

Table 5: The total number of sheep in each flock size group receiving treatment for ectoparasites, categorised by treatment method.

	Size class (number of breeding ewes)						
Treatment method	< 50	50 < 100	100 < 200	200 < 250	250 < 500	500 +	Total sheep treated
Plunge Dip	10,826	89,792	237,301	47,024	192,439	155,089	732,471
Mobile spray shower	37,841	48,127	86,628	31,735	79,566	75,663	359,560
Pour-on	134,637	133,561	271,770	65,458	149,479	87,229	842,132
Injectable	58,808	85,887	168,218	65,709	153,471	74,117	606,210
Spray	.	218	18,078	.	14,500	.	32,797
All treatment methods	242,112	357,586	781,995	209,925	589,455	392,098	2,573,169

Table 6: Regional distribution of pesticide usage (kilograms of active ingredients) on sheep farms, categorised by treatment method.

	County						
Treatment method	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total quantity (kg)
Plunge Dip	875.5	151.8	250.4	190.1	218.9	283.9	1,970.6
Mobile spray shower	353.4	5.0	14.4	11.5	55.6	253.4	693.3
Pour-on	46.1	17.1	131.3	11.1	198.5	60.7	464.6
Injectable	5.6	0.5	3.5	0.6	2.6	1.4	14.1
Spray	.	.	7.2	.	30.3	14.7	52.2
All treatment methods	1,280.6	174.4	406.8	213.2	505.8	614.1	3,194.9
Population of farms	*2,022*	*759*	*2,024*	*488*	*1,625*	*1,951*	*8,869*

Table 7: The quantity of pesticides (kilograms of active ingredients) used in each flock size class, categorised by treatment method.

	Size class (number of breeding ewes)						
Treatment method	< 50	50 < 100	100 < 200	200 < 250	250 < 500	500 +	Total quantity (kg)
Plunge Dip	34.3	287.0	735.0	145.0	357.0	412.3	1,970.6
Mobile spray shower	72.0	126.1	157.4	57.4	145.3	135.1	693.3
Pour-on	30.7	105.8	197.4	26.4	37.5	66.7	464.6
Injectable	0.9	1.6	4.2	2.5	3.7	1.4	14.1
Spray	.	14.7	7.2	.	30.3	.	52.2
All treatment methods	138.0	535.2	1101.1	231.3	573.8	615.4	3,194.9

Table 8: Regional distribution of sheep treated with pesticide formulations, categorised by method of application.

Treatment type and formulation	County						Total sheep treated
	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	
Plunge-dipping treatments							
Organophosphate dips							
Diazinon	240,740	41,526	86,048	66,140	73,639	107,355	615,447
All organophosphate dips	*240,740*	*41,526*	*86,048*	*66,140*	*73,639*	*107,355*	*615,447*
Pyrethroid dips							
Cypermethrin	12,505	.	12,302	.	.	.	24,807
High Cis Cypermethrin	17,571	.	2,607	.	45,648	24,480	90,306
All pyrethroid dips	*30,076*	.	*14,909*	.	*45,648*	*24,480*	*115,113*
Other dips							
Phenols	1,912	.	.	.	.	.	1,912
All other dips	*1,912*	.	.	.	.	.	*1,912*
All dipping treatments	*272,727*	*41,526*	*100,957*	*66,140*	*119,287*	*131,835*	*732,471*
Mobile spray shower treatments							
Organophosphate sprays							
Diazinon	118,469	1,650	7,467	16,003	36,283	158,964	338,836
All organophosphate sprays	*118,469*	*1,650*	*7,467*	*16,003*	*36,283*	*158,964*	*338,836*
Pyrethroid sprays							
Cypermethrin	11,471	.	.	.	.	.	11,471
High Cis Cypermethrin	4,048	.	.	.	5,205	.	9,253
All pyrethroid sprays	*15,519*	.	.	.	*5,205*	.	*20,724*
All spray shower treatments	*133,987*	*1,650*	*7,467*	*16,003*	*41,488*	*158,964*	*359,560*
Pour-on treatments							
Pyrethroid pour-ons							
Alphacypermethrin	117,057	24,235	176,929	16,033	83,343	23,644	441,240
Cypermethrin	29,518	13,275	3,715	2,080	7,880	18,434	74,902
Deltamethrin	46,119	.	15,330	.	58,602	10,729	130,780
All pyrethroid pour-ons	*192,694*	*37,510*	*195,974*	*18,113*	*149,825*	*52,807*	*646,923*
Growth regulator pour-ons							
Cyromazine	11,531	4,480	47,564	3,560	74,616	24,904	166,655
Dicyclanil	5,994	.	8,172	.	3,918	7,604	25,687
All growth regulator pour-ons	*17,524*	*4,480*	*55,736*	*3,560*	*78,533*	*32,508*	*192,342*
Avermectin pour-ons							
Abamectin	.	.	.	.	.	2,867	2,867
All avermectin pour-ons	.	.	.	.	.	*2,867*	*2,867*
All pour-on treatments	*210,218*	*41,990*	*251,710*	*21,673*	*228,358*	*88,183*	*842,132*

Table 8 (cont): Regional distribution of sheep treated with pesticide formulations, categorised by method of application.

Treatment type and formulation	County						Total sheep treated
	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	
Injectable treatments							
Avermectin injections							
Doramectin	46,222	17,742	35,202	26,987	83,989	45,553	255,695
Ivermectin	46,453	1,866	24,764	.	36,308	8,375	117,765
All avermectin injections	*92,674*	*19,607*	*59,966*	*26,987*	*120,297*	*53,928*	*373,459*
Milbmycin injections							
Moxidectin	59,344	8,267	84,137	7,513	41,098	32,392	232,750
All milbmycin injections	*59,344*	*8,267*	*84,137*	*7,513*	*41,098*	*32,392*	*232,750*
All injectable treatments	*152,018*	*27,874*	*144,103*	*34,499*	*161,396*	*86,320*	*606,210*
Spray treatments							
Organophosphate sprays							
Diazinon	.	.	.	.	14,500	218	14,718
All organophosphate sprays	.	.	.	.	*14,500*	*218*	*14,718*
Pyrethroid sprays							
High Cis Cypermethrin	.	.	18,078	.	.	.	18,078
All pyrethroid sprays	.	.	*18,078*	.	.	.	*18,078*
All spray treatments	.	.	*18,078*	.	*14,500*	*218*	*32,797*
All treatments	768,950	113,039	522,315	138,316	565,029	465,519	2,573,169

Table 9: Regional distribution of pesticide usage (kilograms of active ingredients) on sheep farms, categorised by method of application.

Treatment type and formulation	County						Total quantity (kg)
	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	
Plunge-dipping treatments							
Organophosphate dips							
Diazinon	824	152	242	190	190	268	1,867
All organophosphate dips	*824*	*152*	*242*	*190*	*190*	*268*	*1,867*
Pyrethroid dips							
Cypermethrin	6	.	6	.	.	.	12
High Cis Cypermethrin	14	.	2	.	29	16	61
All pyrethroid dips	*20*	.	*8*	.	*29*	*16*	*73*
Other dips							
Phenols	31	.	.	.	.	.	31
All other dips	*31*	.	.	.	.	.	*31*
All dipping treatments	*876*	*152*	*250*	*190*	*219*	*284*	*1,971*
Mobile spray shower treatments							
Organophosphate sprays							
Diazinon	350	5	14	12	53	253	687
All organophosphate sprays	*350*	*5*	*14*	*12*	*53*	*253*	*687*
Pyrethroid sprays							
Cypermethrin	2	.	.	.	.	.	2
High Cis Cypermethrin	2	.	.	.	3	.	5
All pyrethroid sprays	*3*	.	.	.	*3*	.	*6*
All spray shower treatments	*353*	*5*	*14*	*12*	*56*	*253*	*693*
Pour-on treatments							
Pyrethroid pour-ons							
Alphacypermethrin	0	0	1	0	0	0	1
Cypermethrin	10	6	2	0	2	3	24
Deltamethrin	2	.	1	.	2	1	6
All pyrethroid pour-ons	*12*	*6*	*3*	*0*	*5*	*4*	*31*
Growth regulator pour-ons							
Cyromazine	25	11	112	11	185	46	389
Dicyclanil	9	.	16	.	9	11	45
All growth regulator pour-ons	*34*	*11*	*128*	*11*	*194*	*57*	*434*
Avermectin pour-ons							
Abamectin	.	.	.	.	.	0	0
All avermectin pour-ons	.	.	.	.	.	*0*	*0*
All pour-on treatments	*46*	*17*	*131*	*11*	*199*	*61*	*465*

Table 9 (cont.): Regional distribution of pesticide usage (kilograms of active ingredients) on sheep farms, categorised by method of application.

Treatment type and formulation	County						Total quantity (kg)
	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	
Injectable treatments							
Avermectin injections							
Doramectin	1	0	1	0	1	1	4
Ivermectin	4	0	2	0	1	0	7
All avermectin injections	*5*	*0*	*3*	*0*	*2*	*1*	*11*
Milbmycin injections							
Moxidectin	1	0	1	0	1	0	3
All milbymycin injections	*1*	*0*	*1*	*0*	*1*	*0*	*3*
All injectable treatments	*6*	*0*	*4*	*0*	*3*	*1*	*14*
Spray treatments							
Organophosphate sprays							
Diazinon	.	.	.	.	30	15	45
All organophosphate sprays	.	.	.	.	30	15	45
Pyrethroid sprays							
High Cis Cypermethrin	.	.	7	.	.	.	7
All pyrethroid sprays	.	.	7	.	.	.	7
All spray treatments	.	.	*7*	.	*30*	*15*	*52*
All treatments	**1,281**	**174**	**407**	**213**	**506**	**614**	**3195**

Table 10: Regional distribution of sheep farms categorised by treatment method.

	County						
Treatment method	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total
Organophosphate dip*	896	157	376	83	221	1,095	2,829
Sythetic Pyrethroids dip*	95	.	73	.	57	66	291
Other dips	4	.	.	.	.	.	4
Pour-ons	1,143	101	1,476	202	1,152	555	4,631
Injectables	967	311	1,014	463	798	445	3,999
Total	3,105	570	2,940	749	2,228	2,162	11,753

* includes spray shower products as all products used were Plunge-dipping products

Table 11: Distribution of sheep farms categorised by size class and treatment method.

	Size class (number of breeding ewes)						
Treatment method	< 50	50 < 100	100 < 200	200 < 250	250 < 500	500 +	Total
Organophosphate dip*	696	729	828	189	293	95	2,829
Sythetic Pyrethroids dip*	0	116	70	11	71	23	291
Other dips	0	0	0	0	0	4	4
Pour-ons	2,200	970	947	172	262	80	4,631
Injectables	1,502	962	921	195	329	89	3,999
Total	4,398	2,776	2,767	567	955	291	11,753

* includes spray shower products as all products used were Plunge-dipping products

Table 12: Reasons for use of treatments for ectoparasites on sheep, categorised by treatment method.

	Reason for use					
Treatment method	Scab	Blowfly	Lice	Ticks	General Insect Control	Total
Plunge Dip	579	1,463	34	109	117	2,302
Mobile spray shower	407	1,031	.	7	.	1,446
Pour-on	190	3,952	55	162	402	4,760
Injection	3,537	54	356	95	71	4,114
Spray treatments	.	89	.	.	.	89
Total	*4,714*	*6,589*	*444*	*373*	*589*	*12,711*

Table 13: Reasons for use of treatments for ectoparasites by active ingredient applied.

	Reason for use					
Active ingredient	Scab	Blowfly	Lice	Ticks	General Insect Control	Total
Abamectin	8	.	.	.	.	8
Alphacypermethrin	130	2,002	.	42	192	2,366
Cypermethrin	15	442	.	69	19	544
Cyromazine	46	779	.	.	46	870
Deltamethrin	.	790	55	62	145	1,052
Diazinon	849	2,368	31	112	117	3,477
Dicyclanil	7	90	.	.	.	99
Doramectin	1,706	7	159	2	28	1,904
High Cis Cypermethrin	122	157	4	.	.	283
Ivermectin	518	16	143	16	.	693
Moxidectin	1,404	31	63	77	43	1,618
Phenols	.	.	.	4	.	4
Total	*4,805*	*6,681*	*454*	*384*	*589*	*12,915*

Table 14: Regional distribution of the timing of dipwash disposal following sheep dipping in Northern Ireland.

	County						
Timing of emptying	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total
Immediately after dipping	62%	69%	79%	21%	62%	70%	68%
Immediately before next dipping	6%	27%	6%	79%	15%	1%	8%
Sometime before next dipping	32%	4%	15%	0%	23%	30%	24%

Table 15: Regional frequency of use of sites for disposal of spent sheep dips in Northern Ireland.

	County						
Method of disposal	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total
Designated area	52%	58%	25%	0%	80%	53%	49%
Permanent pasture	38%	42%	75%	21%	20%	46%	46%
Vegetated wasteland	5%	0%	0%	79%	0%	0%	3%
Other	5%	0%	0%	0%	0%	1%	2%

Table 16: Frequency distribution of sites used for dip disposal within different flock size groups in Northern Ireland

	Size class (number of breeding ewes)			
Site of disposal	< 100	100 < 250	250 +	Total
Designated area	28%	68%	62%	49%
Permanent pasture	72%	19%	35%	46%
Vegetated wasteland	0%	8%	0%	3%
Other	0%	4%	2%	2%

Table 17: Regional distribution of spent dip disposal methods in Northern Ireland 2005.

	County						
Method of disposal	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total
Directly unto land	55%	96%	33%	21%	37%	65%	54%
Dedicated tank	11%	0%	0%	0%	10%	0%	4%
Slurry/dirty water tank	26%	4%	26%	79%	52%	35%	31%
Other	8%	0%	40%	0%	0%	0%	11%

Table 18: Methods of emptying sheep dipping tanks employed regionally in Northern Ireland.

	County						
Method of emptying tank	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Total
Vacuum tanker	88%	100%	46%	100%	73%	94%	80%
Pump	1%	0%	0%	0%	0%	1%	1%
Manually	3%	0%	54%	0%	12%	4%	15%
Plug	6%	0%	0%	0%	0%	0%	2%
Other	1%	0%	0%	0%	15%	1%	2%

Table 19: Methods of emptying sheep dipping tanks employed in different flock size groups.

	Size class (number of breeding ewes)			
Method of emptying tank	< 100	100 < 250	250 +	Total
Pump	0%	0%	4%	1%
Manually	24%	5%	10%	15%
Plug	0%	4%	2%	2%
Other	0%	3%	6%	2%

Table 20: Comparison of number of sheep treated and quantity of active ingredients (kg) used, categorised by treatment type.

	Number of sheep treated		Quantity (kg)	
	1997	2005	1997	2005
Treatment type				
Plunge-dipping treatments				
Pyrethroid	301,838	115,113	253	73
Organophosphate	2,749,146	615,447	7,769	1,867
Other	428,227	1,912	470	31
All dipping treatments	3,479,211	732,471	8,492	1,971
Pour-on treatments				
Macrocyclic lactone	16,562	2,867	1	<1
Growth regulator	250,449	192,342	379	434
Pyrethroid	99,600	646,923	23	31
Organophosphate	22,451	*	16	*
All pour-on treatments	398,888	842,132	419	465
Injectable treatments				
Avermectin	422,287	373,459	10	11
Milbymycin	16,285	232,750	1	3
All injectable treatments	438,572	606,210	10	14

APPENDIX 1

Northern Ireland Pesticide Usage Survey Published reports

Report No.	Report title	ISBN
99	Grassland & Fodder Crops 1989	1-855 27 079 X
105	Arable Crops 1990	1-855 27 130 3
106	Soft Fruit Crops 1990	1-855 27 149 4
109	Vegetable Crops 1991	1-855 27 137 0
110	Protected Crops 1991 (edible & ornamental)	1-855 27 283 0
111	Mushroom Crops 1991	1-855 27 150 8
117	Arable Crops 1992	1-855 27 193 1
118	Top Fruit Crops 1992	1-855 27 194 X
124	Grassland & Fodder crops 1993	1-855 27 221 0
131	Forestry 1993	1-855 27 282 2
132	Arable Crops 1994	1-855 27 314 4
139	Vegetable Crops 1995	1-855 27 346 2
140	Mushroom Crops 1995	1-855 27 347 0
146	Arable Crops 1996	1-855 27 469 8
147	Top fruit 1996	1-855 27 470 1
156	Grassland and Fodder Crops 1997	1-855 27 506 6
157	Sheep Treatments 1997	1-855 27 425 6
167	Soft Fruit 1998	1-855 27 540 6
168	Arable Crops 1998	1-855 27 536 8
169	Vegetable Crops 1999	1-855 27 561 9
170	Mushroom Crops 1999	1-855 27 549 X

Report No.	Report title	ISBN
177	Arable Crops 2000	1-855 27 670 4
178	Top Fruit Crops 2002	1-855 27 618 6
194	Arable Crops 2002	1-855 27 674 7
198	Grassland & Fodder Crops 2003	1-855 27 797 2
199	Hardy Nursery Stock Crops 2003	1-855 27 789 1
201	Protected Ornamental Crops 2003	1-855 27 739 5
206	Arable Crops 2004	1-855 27 833 2
207	Vegetable crops 2004	1-855 27 869 3

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