

The Influence of Ectoparasites on Welsh Sheep Farms

Report funded by Welsh Assembly Government through Farming Connect

Delivered by Hybu Cig Cymru



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EXECUTIVE SUMMARY

Ectoparasites cost the Welsh sheep industry several million pounds each year and yet can be relatively easily controlled. This project aimed to establish current information on the prevalence of, and treatments for, ectoparasites on sheep farms in Wales and to provide recommendations on how the influence of ectoparasites on the Welsh sheep industry can be reduced.

Three surveys were completed by producers and vets during the winter of 2006/7. These surveys were funded by the Welsh Assembly Government (WAG) through Farming Connect and delivered by Hybu Cig Cymru (HCC), and with support from the British Wool Marketing Board. The ectoparasites covered by the surveys included sheep scab, blowfly strike, ticks and lice. Since effective control methods rely upon accurate diagnosis, timely treatment and adequate control, the surveys were designed to understand if diagnosis, treatments and control procedures were correct.

The survey of producers achieved a response rate of 16.7% with 2,070 useable returns. The prevalence of sheep scab, blowfly strike, ticks and lice was 11.6%, 57.5%, 11.1% and 15.0% respectively. These results for the percentage of flocks with ectoparasite problems were lower than previous studies, however, this survey revealed that the use of inappropriate products for the treatment of sheep scab, blowfly strike, ticks and lice was 9.0%, 2.6%, 18.6% and 17.1% respectively.

When data was analysed from those producers who had identified a scab problem, the proportion of hill farms in the dataset increased. This was accompanied by an increase in the number of hill breeds represented and an increase in the use of common grazing.

When the responses from organic producers were analysed separately there was an increase in the incidence of ectoparasite infections when compared to the entire dataset; the prevalence of sheep scab, blowfly strike, ticks and lice being 16.7%, 66.9%, 16.1% and 23.9% respectively. There were limited differences in the proportion of producers treating stock when organic and conventional producers were compared. For the organic sector, the use of inappropriate products for the treatment of sheep scab, blowfly strike, ticks and lice was 10.2%, 2.2%, 14.3% and 21.8% respectively. These findings clearly show that education is needed on appropriate treatments for ectoparasites in all sectors.

The survey of vets achieved a response rate of 27.6% overall, but responses were obtained from **all** of the large animal practices surveyed. The results showed that vets thought that scab and ticks affected between 1-10% of their clients, while lice affected between 11-20% and blowfly strike affected over 50%. These results mirrored the prevalence figures from the producer survey. Vets believed that less than 10% of their clients quarantine bought-in or returning stock suggesting that producers may not be as good at quarantining animals as they had stated. It was also found that vets might need to increase the amount of information they give to their clients about the threat of resistance developing to both ecto- and endoparasites.

Vets conducted a third survey as they visited interested producers who believed they had scab on their farm. Fifty five% (55) of the samples taken on the farm were found to be positive for scab and further evidence of inappropriate treatments being used by producers was revealed. This survey also showed that a significant number of producers do not have a written health plan (about 37%).

The results from the surveys clearly demonstrates that there is a demand for scab control programmes from both producers and vets, and about 95% of producers are keen to work with their neighbours to control scab in the future. Therefore, this may be an opportune time to

instigate a coordinated control programme across Wales. Simple methods can be implemented by producers and can have dramatic effects on the prevalence of ectoparasites, especially permanent ones. It is important that basic best practice is re-emphasised, in conjunction with SCOPS and the Welsh Parasitology Steering Group (facilitated by HCC), to ensure that Welsh producers are to cope with the challenge.

The recommendations for activities coming from this report are:

- Recommended treatment list for conventional and organic enterprises, e.g. list of products for scab produced for the pre-tupping period, which was highlighted as the most popular time for scab treatment
- Publish best practice guidelines, in conjunction with SCOPS and the Welsh Parasitology Steering Group (facilitated by HCC), e.g. biosecurity and quarantine. This should include specific recommendations/advice for organic farms
- Develop programmes to encourage and allow producers to coordinate their ectoparasite control
- HCC to continue its on-going activity to help farmers develop written health plans
- Involve vets to ensure that they pass on the best messages to their clients, e.g. particularly the threat of resistance

INTRODUCTION

Control of ectoparasites is essential as they can have a major influence on the profitability of Welsh sheep farming, for example it can be estimated that sheep scab costs the Welsh industry £2.3 million per year while blowfly strike costs £0.8 million (adapted from Nieuwhof and Bishop, 2006) in terms of reduction in performance, prevention and cost of treatments. It has also been reported by hill producers that tick-borne diseases can kill 20% of their lamb crop (Bates, 2007).

Effective control methods need to take into consideration the lifecycle of the ectoparasite and how sheep become infected, for example the green- or bluebottles that are responsible for fly strike are capable of flying several miles, while scab is transmitted by contact with infected sheep or objects, as these will affect the approach used. Control will be based on the correct diagnosis, appropriate treatment and adequate control, e.g. quarantine for the permanent ectoparasites.

This report presents the results of three surveys funded by the Welsh Assembly Government (WAG) through Farming Connect and delivered by Hybu Cig Cymru (HCC), and with support from the British Wool Marketing Board, on the prevalence and treatments for sheep ectoparasites in Wales, which were completed during the winter of 2006/7.

The four ectoparasites covered in this report fall into both the permanent and semi-permanent categories. The mite that causes sheep scab and lice are classed as permanent ectoparasites as they spend their entire life cycle on the sheep, while the flies that cause blowfly strike and ticks are semi-permanent ectoparasites, which means they spend at least one life stage away from sheep (Bates, 2007).

The objectives of this study were:

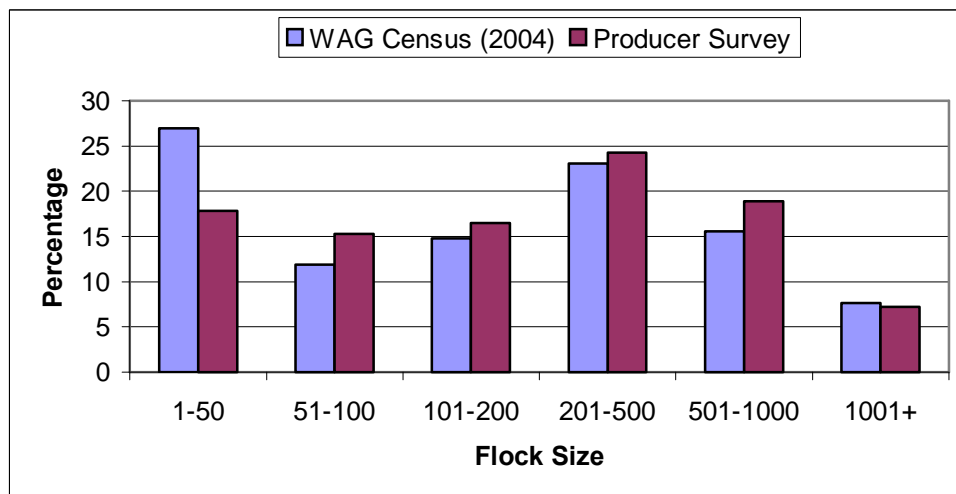
1. To investigate the prevalence of scab, blowfly strike, ticks and lice in Wales
2. To achieve a higher sample size than previous studies to provide a more representative view of the influence of ectoparasites in Wales
3. To ask vets to assess the sheep producers in their practice and also individual producers, which they visited as part of the project, to understand the current impact of ectoparasites in Wales
4. To produce recommendations so the influence of ectoparasites on the Welsh Industry can be reduced

MATERIALS AND METHODS

Three surveys were used in this study. The first survey (Producers) was sent to all Welsh sheep producers (12,400) in November 2006, and contained 21 questions relating to ectoparasites over three pages. The producers were asked if they wanted to be involved in a free vet visit (funded by the study) to confirm the diagnosis and discuss prevention/control methods. The second survey (Vet Practices) was sent to 98 vet practices in Wales in November 2006 and contained 11 questions over two pages. The vet practice survey also asked if the vet wanted to be involved in farm visits. The third survey (Farm Visit) was completed by the vet during the funded visit to interested producers, and it contained 27 questions over five pages. These farm visits were conducted between December 2007 and March 2007.

The response rate for useable producer surveys was 16.7% (2,070), which is comparable to the response rate of 17.8% for Wales recorded by Bisdorff *et al.* (2006). No reminders were sent out, so this could have been one way to boost the response rate. However comparing the number of respondents (2,070 in this survey and 89 in Bisdorff *et al.* (2006)) it can be assumed that the results from this survey will be more representative. It can be seen from Figure 1 that there was a similar pattern between the information from the WAG census in 2004 and the results from the respondents in terms of holdings by flock size. This indicates that the respondents to the producer survey are representative of the Welsh sheep industry. There is a lower number of farms with 1-50 breeding ewes represented in the survey results than the national average, but a higher number of farms with between 51 and 1000 ewes in terms of flock size.

Figure 1: Percentage of Welsh breeding ewe holdings by flock size according to WAG Census in 2004 and the respondents to the producer survey.



The results from the returned surveys were entered into Microsoft Excel and descriptive statistics were produced for all three surveys.

RESULTS

PRODUCER SURVEY

Breeds

The average number of ewes per farm was 553. It can be seen from Table 1 that a majority of the respondents had Welsh Mountain (pure or cross) sheep, with Mules (including Welsh mules) and Beulahs also being important. If the categories are changed to fit with Geoff Pollott's survey¹ of the Welsh Industry in 2004 (see Figure 2), it can be seen that the major changes between the respondents and the industry survey is less Beulahs, Speckled Faces, Welsh Mules and Welsh Halfbreeds, and more Other Cross Breeds. There are differences in the proportion of breeds between the survey and Pollott's results, but the changes are quite small.

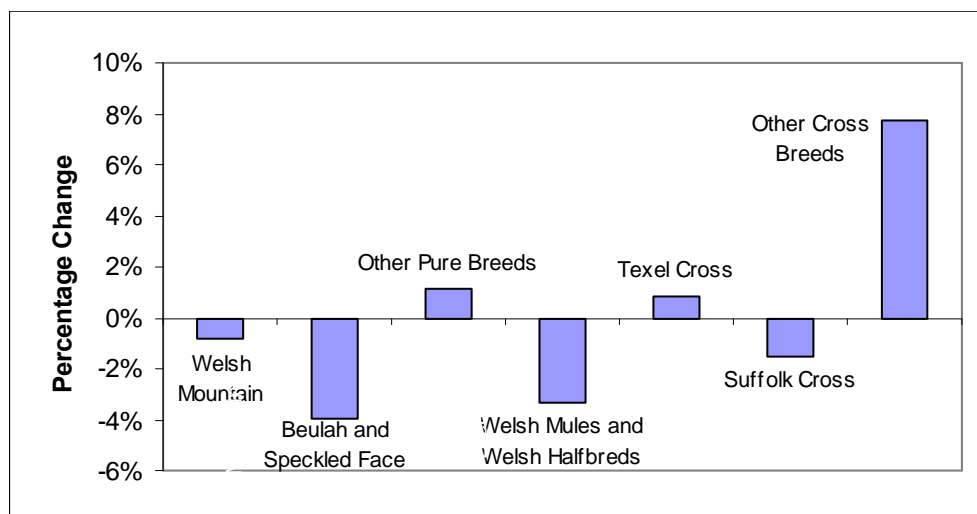
Table 1: Breakdown of the respondents in terms of breed and number of sheep.

Breed	Number of sheep	% of respondents
Welsh Mountain (and X)	277,953	38.5%
Mule	122,811	17.0%
Beulah (and X)	78,693	10.9%
Texel (and X)	67,405	9.3%
Suffolk (and X)	52,459	7.3%
Cross breeds	41,751	5.8%
Lleyn (and X)	27,348	3.8%
Other	21,591	3.0%
Cheviot (and X)	14,219	2.0%
Hardy Speckled Face	12,834	1.8%
Charollais (and X)	4,392	0.6%
TOTAL	721,456	100.0%

86 breeds (pure and crosses) were included in the responses. The average number of breeds per farm was 1.7. 49.8% (1,012/2,032) of respondents had 1 breed, 31.9% (648) of respondents had 2 breeds and 18.3% (372) of respondents had 3 or more breeds.

¹ Geoff Pollott's survey refers to the Defra report on The Breeding Structure of the British Sheep Industry in 2003, which was written by G. Pollott and D.G. Stone. A survey was sent to 60% of the sheep producers registered with the British Wool Marketing Board and asks for information on the breed and number of sheep present on the respondent's farm. The Welsh respondents were separated to provide a report covering only the Welsh industry for HCC.

Figure 2: The percentage change between the respondents' breeds and the breeding structure of the Welsh Industry described by Geoff Pollott¹ in 2004.



Note: Hardy Speckled Face and Beulah were aggregated as it was difficult to establish which breed was being described. Source: Geoff Pollott's survey commissioned by DEFRA and HCC¹.

Farm Type

The results presented in Table 2 shows that the majority of respondents were not organic (91.6%). Approximately 4% of Welsh sheep producers are currently organic, so there may be an over-representation within this survey as 8.4% of respondents classed themselves as organic (although a higher response rate from this sector would indicate how seriously they consider this issue to be). The highest number of respondents classed their farms as being upland (41.8%), then hill (28.0%) and then lowland (27.8%). This distribution is slightly different to one found in the WAG census (June 2004) with 32.2% of Welsh flocks being classed as upland, 45.6% being hill and 22.2% being lowland. Therefore, it appears that in this survey there is an under-representation of hill farms.

Table 2: Breakdown of the respondents by farm type and organic status.

Type of farm	Organic?		Total
	Yes	No	
Lowland	2.4% (47)	25.4% (506)	27.8% (554)
Upland	2.6% (52)	39.2% (781)	41.8% (833)
Hill	3.3% (65)	24.8% (494)	28.0% (559)
All	0%	0.2% (3)	0.15% (3)
Hill/Upland	0%	1.1% (21)	1.1% (21)
Upland/Lowland	0.1% (1)	0.8% (15)	0.8% (16)
Hill/Lowland	0.1% (1)	0.4% (7)	0.4% (8)
TOTAL	8.4% (167)	91.6% (1827)	1994

Common Grazing

83.1% (1,710/2,059) of respondents did not graze their sheep on common ground. For the 16.9% of respondents who did graze their sheep on common ground, the average proportion of sheep that will be grazed on common ground was 51.7%, with 31.2% (99/317) of the respondents grazing more than 75% of their sheep on common ground. The average period that common ground was grazed was 6.0 months, with the most common times being May through to September.

Closed Flocks

A closed flock is defined as a system where replacements are home-bred, so it should only be necessary to bring in rams. 54.8% (1,144/2,052) of respondents stated that they operated a closed flock system. 68.3% of the respondents who operated a closed flock bought in or borrowed rams. Only 17.7% of all respondents actually operated a completely closed flock, i.e. bought in no stock. 68.2% (1,377/2,020) of respondents had purchased or borrowed rams.

From the respondents who were not operating a closed flock, the greatest proportion had purchased stock from markets (74.3%), with the least popular option being from a dealer (19.7%) (see Table 3).

Table 3: The source of the sheep for the respondents without a closed flock.

	Yes	No	TOTAL
Direct from farm	74.3% (341)	25.7% (118)	459
From a market	89.1% (529)	10.9% (65)	594
From a dealer	19.7% (41)	80.3% (167)	208
From a breed sale	76.5% (322)	23.5% (99)	421

Treatment for Ectoparasites

The prevalence of ectoparasites was estimated as the percentage of producers who reported a problem with ectoparasites and also as the percentage of sheep affected by ectoparasites on each farm. To allow for seasonal variation in sheep numbers and occurrence of ectoparasites producers were asked to provide details on sheep numbers in December 2006, March 2007, June 2007 and September 2007. These data could be used to estimate the average number of sheep affected during the year.

It can be seen from Table 4 that the prevalence of scab, fly strike, ticks and lice was 11.6%, 57.5%, 11.1% and 15.0% respectively.

Table 4: The respondents who reported problems with ectoparasites and the percentage of sheep affected on these farms.

	Respondents with problem in flock (prevalence)	Average percentage of sheep affected
Scab	11.6% (238)	22.9%
Fly strike	57.5% (1,169)	5.8%
Ticks	11.1% (225)	26.5%
Lice	15.0% (303)	23.0%

The majority of respondents routinely treat for ectoparasites (see Table 5).

Table 5: The respondents who routinely treat for ectoparasites.

	Routinely treat for ectoparasites
Scab	72.5% (1,149)
Fly strike	94.7% (1,852)
Ticks	69.5% (1,469)
Lice	72.4% (1,100)

When details were asked on the timing of treatment (Table 6) it was found that the most common time for treatment for sheep scab is pre-tupping, while for blowfly strike it is at shearing, which probably relates to the treatment of lambs or for the prevention of strike in ewes after weaning. Treatments for ticks and lice are most commonly combined with other practices.

Table 6: The timing of treatment for ectoparasites.

Ectoparasite	Timing of treatment					TOTAL
	At weaning	At shearing	Before housing	Pre tugging	During other routine practices	
Sheep Scab	11.3% (153)	18.5% (251)	9.3% (127)	35.1% (477)	25.9% (352)	1360
Blowfly Strike	19.2% (402)	45.6% (954)	2.0% (41)		33.2% (695)	2092
Ticks	13.9% (162)	28.3% (331)	5.8% (68)	18.4% (215)	33.6% (393)	1169
Lice	12.9% (162)	25.1% (316)	8.9% (112)	20.3% (255)	32.8% (412)	1257

Note: Grey boxes indicate the most popular timing for treatment, black box indicates a question that was not asked.

The producers were asked which products they use for the treatment of ectoparasites (see Table 7). The most commonly used chemical in the control of scab is Doramectin (35.8%), for blowfly strike it is Cyromazine (38.0%), while for ticks and lice it is Cypermethrin pour-on (43.8% and 45.0% respectively).

If all the products listed by the respondents were considered, i.e. additional data to the figures in Table 7, it was found that the use of inappropriate products for the treatment/prevention of scab, blowfly strike, ticks and lice was 9.0% (83/920), 2.6% (44/1,698), 18.6% (106/571) and 17.1% (113/662) respectively. There is significant use of the incorrect chemical, for example the use of Doramectin and Cyromazine for the control of ticks and lice (see shaded boxes in Table 7). It is difficult to know whether this is purely down to a lack of knowledge, but it is an area that should be targeted due to the extra veterinary and medicine costs associated with overuse and the risk of resistance developing.

It is worth noting that some respondents described the use of wormers for the treatment/prevention of blowfly strike, which is a potential strategy as wormers may prevent scouring. However, wormers do not target the ectoparasite, and since scouring is not only caused by worms and considering the risk of wormer resistance developing these treatments were considered to be inappropriate.

Table 7: The treatment used for ectoparasites.

Chemical	Example products	Method	Treat	% used for Scab	% used for Blowfly strike	% used for Ticks	% used for Lice
Alphacypermethrin	Dysect	Pour-on	Blowfly Strike Ticks Lice	0.6% (6)	2.1% (37)	4.9% (34)	3.4% (27)
Cypermethrin (high cis)	Ecofleece Robust Auriplak	Dip	Scab Blowfly Strike Ticks Lice	6.9% (64)	2.5% (43)	6.5% (45)	6.2% (49)
Cypermethrin (high cis)	Crovect	Pour-on	Blowfly Strike Ticks Lice	3.2% (30)	25.1% (434)	43.8% (301)	45.0% (354)
Diazinon (organophosphate)	Coopers Gold Fleece Paracide	Dip	Scab Blowfly Strike Ticks Lice	33.2% (310)	12.0% (207)	27.6% (190)	29.2% (230)
Doramectin	Dectomax	Injection	Scab	35.8% (334)	0.8% (14)	4.8% (33)	5.2% (41)
Ivermectin	Ivomec Panomec Virbamec	Injection	Scab	6.4% (60)	0.4% (7)	2.5% (17)	2.5% (20)
Moxidectin	Cydectin	Injection	Scab	11.3% (105)	0.6% (11)	1.2% (8)	1.4% (11)
Cyromazine	Vetrazin	Pour-on	Blowfly Strike	1.6% (15)	38.0% (657)	5.8% (40)	4.6% (36)
Dicyclanil	Clik	Pour-on	Blowfly Strike	1.0% (9)	18.5% (319)	2.9% (20)	2.4% (19)

Notes: The shaded boxes indicate inappropriate use according to Noah's Compendium (2007). The grey boxes indicate the most popular treatment. Table 7 only contains data from the respondents who mentioned a product or chemical name, for example respondents who entered only spot-on or dip was excluded as it was unclear what product was used.

Quarantine

47.1% (933/1,982) of respondents said that they use their vet for advice and diagnosis, with 68.5% (1,253/1,828) of respondents quarantining bought-in or returning sheep. 52.2% (610) treat sheep for ectoparasites whilst they are in quarantine. In terms of what they use to isolate animals: 77.2% (939/1,216) used isolation fields, 17.7% (215) used isolation sheds, while 5.1% (62) used both types.

The most popular treatment during quarantine was Doramectin (37.2%), which treats only scab (see Table 8). It has the advantage that it will also treat some internal parasites, but careful use is necessary.

Table 8: The treatments used during quarantine.

Treatment	% of treatments
Alphacypermethrin	2.0% (11)
Cypermethrin (high cis)	20.8% (113)
Diazinon	7.7% (42)
Doramectin	37.2% (202)
Ivermectin	6.1% (33)
Moxidectin	14.7% (80)
Cyromazine	8.1% (44)
Dicyclanil	3.3% (18)

Note: The grey box indicates the most popular treatment.

59.7% (1,194/1,999) of respondents have a written health plan; with 89.9% (1,017/1,131) of the written health plans covering preventing and treating ectoparasites.

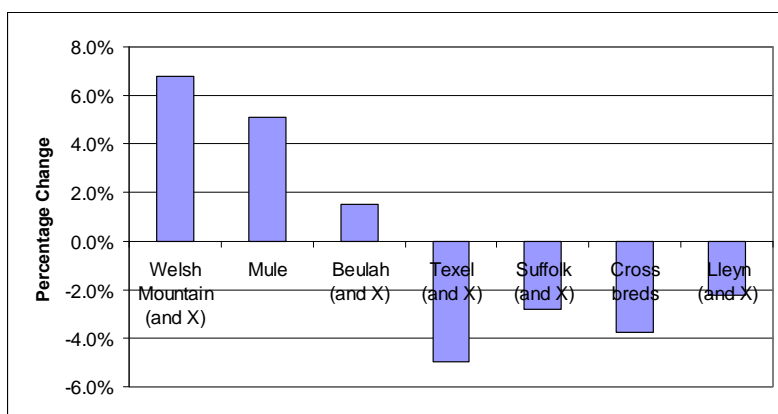
Focus on Scab

One of the aims of this study was to understand if producers could accurately diagnose sheep scab, as the correct diagnosis is crucial in determining the correct treatment. 83.0% (1,663/2,004) of the respondents were confident in their ability to accurately diagnose sheep scab. Unfortunately only 59.5% (1,183/1,989) of the respondents were aware that resistance to scab treatment was developing. However 73.8% (1,436/1,947) of the respondents think that compulsory treatment for scab should return and, encouragingly, 96.0% (1,920/1,999) of the respondents would cooperate with neighbours to control scab in their area.

It was decided to focus on the respondents that believed they had scab and to look at factors, such as breeds present, farm type and the use of common grazing, within this scab-affected dataset (respondents with scab).

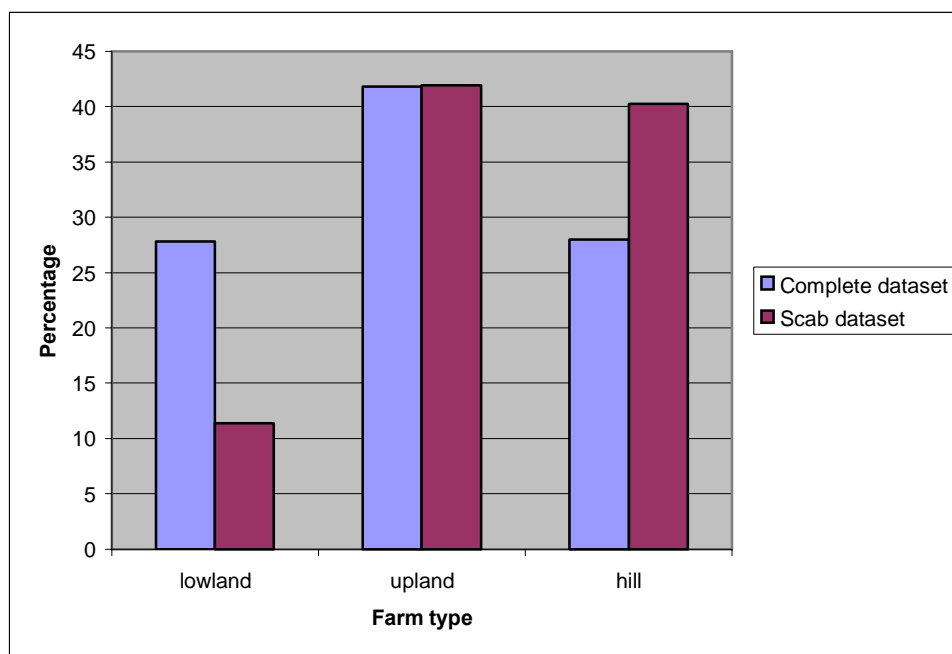
It can be seen from Figure 3 that for the respondents with scab there was an increase in the percentage of Welsh Mountains (and X), Mules and Beulahs (and X) present in the dataset, while there was a decrease in the percentage of Texels, Suffolks, Lleyns and their crosses, and crossbreds.

Figure 3: The percentage difference between respondents with scab and all respondents for breeds present on the farm (positive values indicate a higher representation in the scab dataset).



When the farm type was analysed for the respondents with scab, there was an increase in the percentage of hill farms (40.6% from 28.0% for both) and an increase in the percentage of organic farms (12.7% from 8.4%). Figure 4 further shows limited changes for the percentage of upland farms, while the percentage of lowland farms represented in the respondents with scab dropped.

Figure 4: The proportion of the respondents from each farm type in the complete dataset compared to those with scab.



When all respondents were analysed, 16.9% (349/2,059) grazed sheep on common ground. However when the respondents who had a scab problem were analysed the figure was 39.2% (93/237). This was likely to be affected by the increased representation of hill producers in the group with scab (see Figure 4). It is difficult to understand if common grazing causes an increase in scab, or whether hill systems generally have more common grazing than other systems and that is why it increases in the scab affected dataset.

The change in the percentage of respondents operating a closed flock system was very small; 54.4% (1,117/2,052) when all respondents were considered, compared with 51.1% (120/235) of the respondents in the scab affected dataset.

There was an increase in the percentage of respondents who purchased or borrowed rams, from 68.2% (1,388/2,035) when all respondents were considered to 78.4% (185/236) of the respondents in the scab affected dataset.

Focus on Organic Production

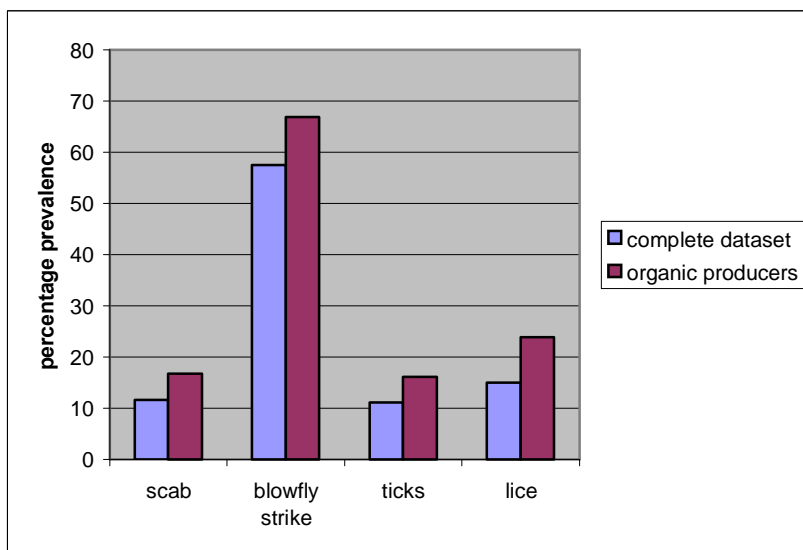
The responses obtained from organic producers were also analysed as a separate dataset examining factors such as the amount of scab present, treatments used and quarantine procedures so that the results could be used to develop specific advice for the organic sector.

The average numbers of ewes on the organic farms were 262 (compared to 553 in the full dataset). A similar proportion of organic sheep producers, 84.5% (142/168), did not graze their sheep on common ground. For the 15.5% of respondents who did graze their sheep on common ground, the average proportion of sheep that will be grazed on common ground was 36.0%, with 15.4% (4/26) of the respondents grazing more than 75% of their sheep on common ground. The average number of months that common ground was grazed was 5.4 months, with the most common times being May through to September.

A higher proportion of organic respondents (72.0% - 121/168) stated that they operated a closed flock system compared to the full dataset, however a similar proportion of these respondents (66.1% - 80/121) bought in or borrowed rams. Only 23.2% of all organic respondents actually operated a completely closed flock, i.e. bought in no stock.

The prevalence of ectoparasites was 16.7%, 66.9%, 16.1% and 23.9% for scab, blowfly strike, ticks and lice respectively in the organic dataset. It can be seen from Figure 5 (due to the positive values) that the prevalence was higher when compared to the entire dataset.

Figure 5: The percentage difference between organic respondents and all respondents for the number of producers with ectoparasite problems in the flock.



The treatments used by organic producers to control ectoparasites were very similar to those identified in the full dataset; the most commonly used chemical in the control of scab on organic farms is Doramectin (36.9%), for blowfly strike it is Cyromazine (54.3%), while for ticks and lice it is Cypermethrin pour-on (51.3% and 46.3% respectively) (see Table 9).

If all of the products listed by the organic respondents were considered, i.e. additional data to the figures in Table 9, the use of inappropriate products for the treatment/prevention of scab, blowfly strike, ticks and lice on organic farms was 10.2% (5/49), 2.2% (3/138), 14.3% (6/42) and 21.8% (12/55) respectively. These results are very similar to those found in the entire dataset for the use of inappropriate products, demonstrating that organic producers also need further education

on ectoparasite control within the framework of organic principles and standards. The implications of these treatments on organic farms is highlighted in the Discussion.

Table 9: The treatment used for ectoparasites by organic sheep producers.

Chemical	Example products	Method	Treat	% used for Scab	% used for Blowfly strike	% used for Ticks	% used for Lice
Alphacypermethrin	Dysect	Pour-on	Blowfly Strike Ticks Lice	0%	1.4% (2)	7.7% (3)	3.7% (2)
Cypermethrin (high cis)	Ecofleece Robust Auriplak	Dip	Scab Blowfly Strike Ticks Lice	12.5% (6)	4.2% (6)	10.3% (4)	9.3% (5)
Cypermethrin (high cis)	Crovect	Pour-on	Blowfly Strike Ticks Lice	6.3% (3)	20.3% (28)	51.3% (20)	46.3% (25)
Diazinon (organophosphate)	Coopers Gold Fleece Paracide	Dip	Scab Blowfly Strike Ticks Lice	10.4% (5)	6.5% (9)	20.5% (8)	20.4% (11)
Doramectin	Dectomax	Injection	Scab	36.9% (19)	0.7% (1)	2.6% (2)	1.9% (4)
Ivermectin	Ivomec Panomec Virbamec	Injection	Scab	6.3% (3)	0%	2.6% (1)	1.9% (1)
Moxidectin	Cydectin	Injection	Scab	22.9% (11)	0.7% (1)	0%	1.9% (1)
Cyromazine	Vetrazin	Pour-on	Blowfly Strike	2.1% (1)	54.3% (75)	0%	7.4% (4)
Dicyclanil	Clik	Pour-on	Blowfly Strike	0%	11.6% (16)	2.6% (1)	2.6% (1)

The proportion of respondents that had listed products used for the treatment of ectoparasites was inferred to mean the proportion that treated their animals. When the responses from conventional and organic producers were compared, 40.5% of organic producers and 55.0% of conventional producers listed products for scab, for blowfly strike it was 82.1% and 82.8%, for ticks it was 33.3% and 40.0% and for lice it was 44.0% and 45.4%. Therefore, there were only major differences for scab and tick treatments when the proportion of organic producers was lower.

A high proportion of organic producers (80.0% - 112/140) stated that they quarantined bought-in or returning sheep (compared to 68.5% in the full dataset) although a smaller proportion (39.5% - 45/119) of organic producers treat sheep for ectoparasites whilst they are in quarantine. 70.4% (114/168) of respondents were found to have a written health plan; with 94.4% (101/107) of the written health plans covering the prevention and treatment of ectoparasites.

VET PRACTICE SURVEY

All 27 large animal vet practices responded to the survey. The returned surveys covered 6,805 sheep producers. The average number of sheep producers per practice was 252.0 (min = 20, max = 800). When asked what percentage of farms had given ectoparasite infestation as the main reason for the visit, the average response was 20.7% (min = 0, max = 100).

The results presented in Table 10 show that both scab and ticks were generally considered by vets to be a small problem for their clients (1-10% affected), while lice was a slight problem (11-20% of clients affected) and fly strike was a major problem (>50% of clients affected).

Table 10: The percentage of clients that experienced problems with ectoparasites between October 2005 and October 2006.

	Not a problem (0% affected)	Small problem (1-10% affected)	Slight problem (11-20% affected)	Moderate problem (21-50% affected)	Major problem (>50% affected)
Scab	0%	44.4% (12)	11.1% (3)	29.6% (8)	7.4% (2)
Fly strike	3.7% (1)	18.5% (5)	22.2% (6)	22.2% (6)	25.9% (7)
Ticks	25.9% (7)	40.7% (11)	11.1% (3)	14.8% (4)	0%
Lice	7.4% (2)	37.0% (10)	40.7% (11)	7.4% (2)	0%

Note: Grey boxes indicate the most common response

The vets were asked what treatments they recommend for the control of ectoparasites. For scab the most recommended treatment was Diazinon (OP dip), for blowfly strike it was Cyromazine, for ticks it were Alphacypermethrin and Cypermethrin, and for lice it was Cypermethrin (see Table 11).

Table 11: The treatments recommended by vets for the control of ectoparasites.

Chemical	Example products	Method	Treat	% used for Scab	% used for Blowfly strike	% used for Ticks	% used for Lice
Alphacypermethrin	Dysect	Pour-on	Blowfly Strike Ticks Lice	0%	20.8% (10)	35.3% (12)	23.1% (9)
Cypermethrin (high cis)	Ecofleece Robust Auriplak	Dip	Scab Blowfly Strike Ticks Lice	0%	2.1% (1)	0%	0%
Cypermethrin (high cis)	Crovect	Pour-on	Blowfly Strike Ticks Lice	0%	14.6% (7)	35.3% (12)	51.3% (20)
Diazinon (organophosphate)	Coopers Gold Fleece Paracide	Dip	Scab Blowfly Strike Ticks Lice	32.7% (16)	16.7% (8)	29.4% (10)	25.6% (10)
Doramectin	Dectomax	Injection	Scab	26.5% (13)	0%	0%	0%
Ivermectin	Ivomec Panomec Virbamec	Injection	Scab	16.3% (8)	0%	0%	0%
Moxidectin	Cydectin	Injection	Scab	24.5% (12)	0%	0%	0%
Cyromazine	Vetrazin	Pour-on	Blowfly Strike	0%	27.1% (13)	0%	0%
Dicyclanil	Clik	Pour-on	Blowfly Strike	0%	18.8% (9)	0%	0%

Notes: The shaded boxes indicate inappropriate use according to Noah's Compendium. The grey boxes indicate the most popular treatment

37.0% (10/27) of the vets thought that scab had become more of a problem in the year between October 2005 and October 2006 and 85.2% (23/27) of the vets thought that compulsory dipping should return.

Tables 12 and 13 refer to the quarantining of sheep and suggest that although vets are generally advising between 21 and 50% of their clients on the importance of quarantine, less than 10% of their clients are actually quarantining sheep.

Table 12: The percentage of clients advised by vets on the importance of quarantine.

Percentage of clients advised on the importance of quarantine	<10%	11-20%	21-50%	>50%
	25.9% (7)	14.8% (4)	40.7% (11)	18.5% (5)

Note: Grey box indicates the most common response

Table 13: The percentage of clients that quarantine sheep.

Percentage of clients quarantine sheep	<10%	11-20%	21-50%	>50%	Don't know
	63.0% (17)	18.5% (5)	11.1% (3)	0%	7.4% (2)

Note: Grey box indicates the most common response

Tables 14 and 15 refer to advice given on resistance developing to endoparasite and ectoparasite treatments. The results suggest that vets are only advising 11-20% of their clients on the development of anthelmintic resistance in endoparasites and less than 10% of clients are being advised on the development of resistance in ectoparasites.

Table 14: The percentage of clients advised on resistance to endoparasite treatments.

Percentage of clients advised on resistance to endoparasite treatments	<10%	11-20%	21-50%	>50%
	3.7% (1)	40.7% (11)	18.5% (5)	37.0% (10)

Note: Grey box indicates the most common response

Table 15: The percentage of clients advised on resistance to ectoparasite treatments.

Percentage of clients advised on resistance to ectoparasite treatments	<10%	11-20%	21-50%	>50%
	48.1% (13)	29.6% (8)	18.5% (5)	3.7% (1)

Note: Grey box indicates the most common response

FARM VISIT SURVEY

Forty surveys were completed during farm visits undertaken by 24 vets between December 2006 and March 2007. The survey covered a total of 23,860 sheep (including 3,921 lambs). The average breeding ewe flock size was 486 (min =35, max = 2,000).

The farms included in the survey covered 5110 hectares. The average grazing area per farm was 596.5 hectares, with the average stocking density (for ewes and rams) being 0.68 GLU/hectare (4.5 sheep per hectare or 1.9 sheep per acre). 52.5% (21) of the producers have sheep on other grazing or premises at any time of the year. 28.6% (6) of producers who graze elsewhere use common grazing during the summer, 52.4% (11) graze rented land and 38.1% (8) winter sheep away.

Twenty-four different types of breeds were represented and the survey covered 19,532 ewes, with a majority being Welsh Mountain (pure or crosses) (see Table 16). Welsh Mountain rams were the most popular breed of ram (see Table 17).

Table 16: The ewe breeds represented in the Farm Visit survey.

Breed	Number of ewes	% of respondents
Welsh Mountain (and X)	10,884	56.0%
Mule	2,905	14.9%
Hardy Speckled Face and Beulah	2,489	12.7%
Cheviot (and X)	1,030	5.3%
Texel (and X)	780	4.0%
Other	708	3.6%
Suffolk (and X)	474	2.4%
Lleyn (and X)	162	0.8%
Cross breeds	100	0.5%
Charollais (and X)	0	0.0%
TOTAL	19,532	100.0%

Note: Hardy Speckled Face and Beulah were aggregated, as it was difficult to establish which breed was being described.

Table 17: The ram breeds represented in the Farm Visit survey.

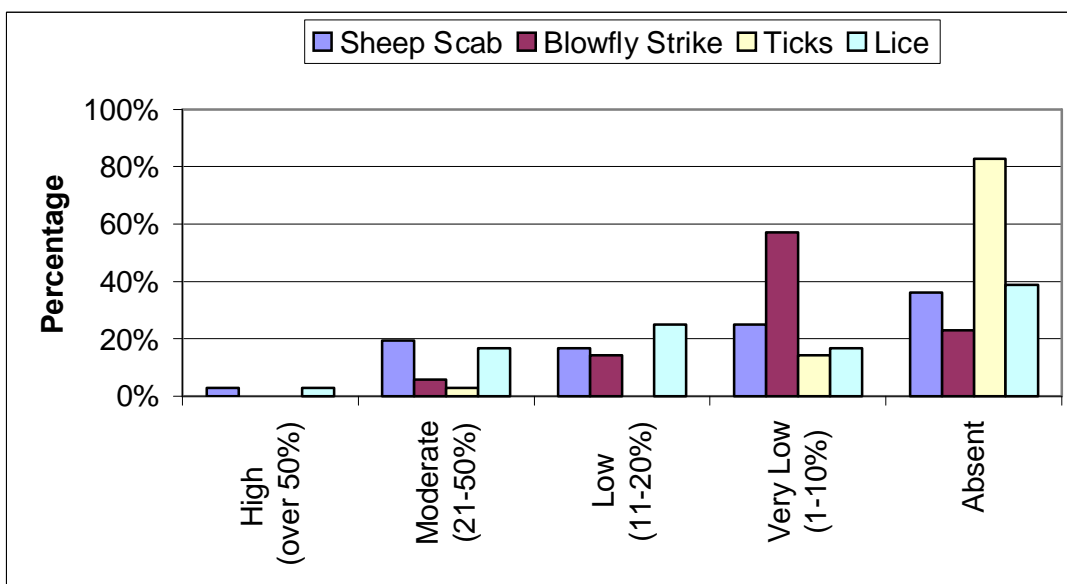
Breed	Number of rams	% of respondents
Welsh Mountain (and X)	235	46.4%
Suffolk (and X)	45	8.9%
Texel (and X)	45	8.9%
Hardy Speckled Face	43	8.5%
Charollais	32	6.3%
Other	30	5.9%
Cheviot (and X)	28	5.5%
Blue Faced Leicester	25	4.9%
Mule	12	2.4%
Lleyn (and X)	6	1.2%
Beltex	3	0.6%
Poll Dorset (and X)	3	0.6%
TOTAL	507	100.0%

Ectoparasites

84.2% (32) of the vets believed that the producer visited was able to recognise if he had a problem with scab or lice.

The prevalence of ectoparasites in the flocks assessed by the vets was generally very low or absent, according to the most popular options in the survey (see Figure 6). If the absent category is ignored, then there tends to be low-moderate incidence of scab and lice on farms, compared to very low-low incidence of blowfly strike and very low incidence of ticks.

Figure 6: The proportion of the flock affected by ectoparasites between October 2005 and October 2006 according to the vet from information obtained from previous visits and the visit associated with this project.



The producers were asked what treatments had been used between October 2005 and October 2006. For scab, Doramectin once per year was the most popular treatment (see Table 18) and it was generally given to the entire flock during routine treatment (see Table 19). For blowfly strike, Cyromazine once per year was the most popular treatment (see Table 20) and it was generally given to the entire flock during routine treatment (see Table 21). For ticks, Diazinon (OP) and Cypermethrin (high cis) once per year were the most popular treatments (see Table 22) and it was generally given to the entire flock during routine treatment (see Table 23). For lice, Cypermethrin (high cis) once per year were the most popular treatments (see Table 24) and it was generally given to the entire flock during routine treatment (see Table 25).

Table 18: The type and frequency of use for treatments to control scab.

Treatment	Number of Treatments Per Year					Total
	1	2	3	4	5+	
Doramectin	26.7% (8)	13.3% (4)	3.3% (1)	0%	0%	13
Moxidectin	6.7% (2)	10.0% (3)	6.7% (2)	0%	3.3% (1)	8
Diazinon (OP)	16.7% (5)	3.3% (1)	3.3% (1)	0%	0%	7
Ivermectin	3.3% (1)	3.3% (1)	0%	0%	0%	2
Total	16	9	4	0	1	30

Note: Grey box indicates the most common response

Table 19: The type of animal treated and conditions of treatment for scab.

Animals treated	When treated	
	Routine	After Diagnosis
Ewes only	16.7% (5)	16.7% (5)
All flock	46.7% (14)	6.7% (2)
Proportion of flock	0%	13.3% (4)

Note: Grey box indicates the most common response

Table 20: The type and frequency of use for treatments to control blowfly strike.

Treatment	Number of Treatments Per Year			Total
	1	2	Unknown	
Cyromazine	26.3% (10)	15.8% (6)	2.6% (1)	17
Cypermethrin (high cis)	15.8% (6)	5.3% (2)	0%	8
Dicyclanil	15.8% (6)	0%	2.6% (1)	7
Diazinon (OP)	13.2% (5)	2.6% (1)	0%	6
Total	27	9	2	38

Note: Grey box indicates the most common response

Table 21: The type of animal treated and conditions of treatment for blowfly strike.

Animals treated	When treated	
	Routine	After Diagnosis
All lambs	31.6% (12)	2.6% (1)
All flock	55.3% (21)	2.6% (1)
Proportion of flock	5.3% (2)	2.6% (1)

Note: Grey box indicates the most common response

Table 22: The type and frequency of use for treatments to control ticks.

Treatment	Number of Treatments Per Year		Total
	1	2	
Diazinon (OP)	36.4% (4)	9.1% (6)	5
Cypermethrin (high cis)	36.4% (4)	0%	8
Cyromazine	18.2% (2)	0%	2
Total	10	6	11

Note: Grey box indicates the most common response

Table 23: The type of animal treated and conditions of treatment for ticks.

Animals treated	When treated	
	Routine	After Diagnosis
All lambs	9.1% (1)	0%
All flock	63.6% (7)	0%
Proportion of flock	18.2% (2)	9.1% (1)

Note: Grey box indicates the most common response

Table 24: The type and frequency of use for treatments to control lice.

Treatment	Number of Treatments Per Year		Total
	1	2	
Cypermethrin (high cis)	46.2% (12)	11.5% (3)	15
Diazinon (OP)	15.4% (4)	3.8% (1)	5
Cyromazine	7.7% (2)	0%	2
Spot-on	7.7% (2)	0%	2
Ivermectin	3.8% (1)	3.8% (1)	2
Total	21	5	26

Note: Grey box indicates the most common response

Table 25: The type of animal treated and conditions of treatment for lice.

Animals treated	When treated	
	Routine	After Diagnosis
All ewes	20.0% (5)	20.0% (5)
All flock	40.0% (10)	8.0% (2)
Proportion of flock	0%	12.0% (3)

Note: Grey box indicates the most common response

The producers were asked what they believed to be the most effective treatments; for scab it was Diazinon (OP), for blowfly strike it was Cyromazine, for ticks it was Cypermethrin (high cis) and Diazinon (OP), and for lice it was Diazinon (OP) (see Table 26).

Table 26: The most effective treatments for ectoparasites according to producers.

Chemical	Example products	Method	Treat	% used for Scab	% used for Blowfly strike	% used for Ticks	% used for Lice
Cypermethrin (high cis)	Crovect	Pour-on	Blowfly Strike Ticks Lice	0%	20.6% (7)	50% (5)	50.0% (13)
Diazinon (organophosphate)	Coopers Gold Fleece Paracide	Dip	Scab Blowfly Strike Ticks Lice	48.1% (13)	20.6% (7)	50% (5)	38.5% (10)
Doramectin	Dectomax	Injection	Scab	37.0% (10)	0%	0%	0%
Ivermectin	Ivomec Panomec Virbamec	Injection	Scab	0%	0%	0%	7.7% (2)
Moxidectin	Cyductin	Injection	Scab	14.8% (4)	0%	0%	3.8% (1)
Cyromazine	Vetrazin	Pour-on	Blowfly Strike	0%	35.3% (12)	0%	0%
Dicyclanil	Clik	Pour-on	Blowfly Strike	0%	23.5% (8)	0%	0%

Notes: The shaded boxes indicate inappropriate use according to Noah Compendium. The grey boxes indicate the most popular treatment

Three producers suggested products that are not licensed/appropriate for the treatment of lice.

21.6% (8) of vets suggested that there was suspicion of products failing on the farms they visited. One out of the 8 was confirmed by lab tests, while five were based on observations of the product not working, which could be linked to incorrect application.

Disease prevention

89.2% (33/37) of producers use tailing to control blowfly strike. 27.7% (10/36) of producers use their own dip facilities, while 17.1% (6/35) use mobile contractors.

55.3% (21/38) of producers had a written health plan, 7.9% (3/38) were in the process of writing one, while 36.8% (14/38) do not have a health plan. However, 100% (21) of the producers with a written health plan had a section covering the treatment programme for endoparasites, with 90.5% (19/21) of the producers having a section covering the treatment programme for ectoparasites. 73.7% (28/38) of the vets believed there were adequate biosecurity measures for quarantining bought-in or returning sheep.

The majority of producers used their own experience to diagnose blowfly strike, ticks and lice, while there is an increased reliance on vets for the diagnosis of scab (see Table 27).

Table 27: The aids producers use to diagnose ectoparasite problems.

Ectoparasite	Technique					
	Experience	Vet	Advisor	Books/ Leaflets	Farming Press	Neighbour
Sheep Scab	31.6% (25)	45.6% (36)	2.5% (2)	12.7% (10)	6.3% (5)	1.3% (1)
Blowfly Strike	67.9% (38)	10.7% (6)	0%	14.3% (8)	7.1% (4)	0%
Ticks	65.7% (23)	11.4% (4)	0%	14.3% (5)	8.6% (3)	0%
Lice	41.7% (25)	40.0% (24)	0%	15.0% (9)	3.3% (2)	0%

Note: Grey boxes indicate the most common response

Focus on Scab

The average number of years that scab has been present on the farms visited is 3.7 years or 44 months (min = 2 weeks, max = 25 years). The diagnosis has been confirmed by a vet at 73.7% (28/38) of these farms, with 80.0% (16/20) of vets being called in the last 6 months. The main reason for calling a vet was ~~tick~~ itchy sheep at 71.4% (10/14), with the funded visits through this project being the second most common reason at 21.4% (3/14).

67.6% (23/34) of the producers believed that scab had come from neighbours sheep, and 18.8% (6/32) of the producers believed that scab had come from bought in sheep, with no producers believing that it came from infected transport. From the Other option, 63.6% (7/11) specified common grazing while 36.4% (4/11) did not know.

The vets believed that 94.9% (37/39) of the producers understood the route of infection.

When the producers were asked if they thought there was a scab problem in the area (10 mile radius) the most common answer was a moderate problem (see Table 28). It was interesting to see that a majority of producers had never cooperated with their neighbours to control the scab problem (see Table 29) but would be willing to in the future (see Table 30).

Table 28: *The degree that scab was a problem in the area (10 mile radius) between October 2005 and October 2006.*

Scab Problem?	% of respondents
Major problem	23.7% (9)
Moderate problem	50.0% (19)
Slight problem	21.1% (8)
Not a problem	5.3% (2)

Note: Grey box indicates the most common response

Table 29: *The degree that producers work closely with neighbours to deal with the scab problem at the moment.*

Work with Neighbours	% of respondents
Regularly	25.0% (10)
Occasionally	35.0% (14)
Never	40.0% (16)

Note: Grey box indicates the most common response

Table 30: *The degree that producers would be willing to work with neighbours to deal with the scab problem in the future.*

Work with Neighbours in the Future	% of respondents
Yes	95.0% (38)
Unsure	5.0% (2)
No	0%

Note: Grey box indicates the most common response

During the farm visit samples were taken to establish what ectoparasites were present. It was found that 50% of the samples were actually scab, with the second most common ectoparasite found being lice (see Table 31).

Table 31: *The results of the samples taken by the vet during the farm visit.*

Result of Lab Test	% of respondents
Scab	50.0% (20)
Lice	30.0% (12)
Scab and Lice	5.0% (2)
None	15.0% (6)

Note: Grey box indicates the most common response

It was decided to look at the farms that took part in the farm visit survey and evaluate if any factors were dominant. Both grazing elsewhere and using common land were classed as risk factors. The results presented in Table 32 demonstrate that the risk factors did not increase the likelihood of scab occurring, e.g. farms that grazed sheep elsewhere and used common land had a lower number of positive scab tests.

Table 32: The results from the samples analysed by risk factors for scab.

Result of Test	Grazed Elsewhere?		Common Land	
	Yes	No	Yes	No
Scab	45.0% (9)	55.0% (11)	22.2% (2)	77.8% (7)
Lice	66.7% (8)	33.3% (4)	37.5% (3)	62.5% (5)
Scab and Lice	0%	100% (2)		
None	66.7% (4)	33.3% (2)	25.0% (1)	75.0% (3)

DISCUSSION

These surveys produced a substantial amount of data on the prevalence of ectoparasites on sheep farms in Wales and the treatments being used to control them. The surveys have generated interesting results that can be used to target future activity, in terms of knowledge transfer and education of producers and vets.

Susceptibility

Breed differences in susceptibility to sheep scab has been shown experimentally, but it is thought to be more related to differences in how the immune system deals with the challenge; the greater the reaction, the more severe the outbreak (Huntley *et al.*, 2007). It is likely that, as with other traits, there is wide variation in immune reactions within breeds as well as between breeds. Due to genetic differences, there is a possibility to select for animals that are more resilient to scab infestation. However, management techniques can eliminate sheep scab, so an effective short-term solution to the sheep scab problem is to incorporate changes into current management systems.

It was difficult to investigate breed differences in this study, as it was not a controlled experiment. The surveys illustrated that hill farms tended to have a higher level of scab (see Figure 4) and that the proportion of hill breeds in the scab affected group increased (see Figure 3), but this finding was more likely to be system-related rather than purely related to the breed. Although the stocking density of the individual farms did not influence the occurrence of scab, it is likely that the density of sheep farms in the hill farm areas allows more mixing of sheep. Also it was shown that the amount of common ground used increased in the group with scab-affected farms. Scab can be relatively easily controlled by treatment, quarantine and biosecurity but grazing common ground makes treatment less effective. If treatment is not coordinated with neighbours, then potentially infected sheep can easily come into contact with the treated sheep through ineffective biosecurity, e.g. poorly maintained fences, shared rubbing posts. There was an increase in the proportion of producers using common grazing when only the respondents with scab were analysed, but it will be difficult to establish if this is due to the increased proportion of hill producers in the scab affected group or if common land contributes to more scab in hill areas.

The majority of producers operating a closed flock system bought or borrowed rams. This finding was also recorded by Fraser *et al.* (2006). It needs to be ensured that the need for quarantine is fully realised in closed flocks, since buying or borrowing rams will still have an effect on the health status of the flock.

Prevalence

The figures collected from this study on the prevalence of ectoparasites in the respondents' flocks were compared with other studies (see Table 33). The figures from other studies were higher although the patterns were similar. It is difficult to understand why the figures from this survey work were lower, as it is unlikely that the prevalence for all ectoparasites has dropped over time, e.g. Bisdorff *et al.*'s study was only one year before this survey but has higher prevalence figures. The survey conducted by the Scottish Sheep Scab Initiative asked respondents to record how many cases of scab they had had over the previous five years (2001-2006) whereas this survey was only investigating one calendar year.

Table 33: The proportion of flocks with ectoparasite problems from various studies.

Source	Ectoparasite			
	Sheep Scab	Blowfly Strike	Ticks	Lice
This work [Oct 05 . Oct 06]	11.6%^	57.5%^	11.1%^	15.0%^
SSSI Survey [2001 . 2006]	14%*			
Bisdorff <i>et al.</i> (2006) [March 03- April 04]	17%^	73%^		19%^
French <i>et al.</i> (1992) [1988]		77.5%\$		
French <i>et al.</i> (1992) [1989]		80.0%\$		
Fraser <i>et al.</i> (2006) [2002-2005]	35%\$			

Notes: Dates in square brackets [x] refer to the sampling period, ^ = Figure for Wales, * = Figure for Scotland, \$ = Figure for GB

If the proportion of sheep affected per flock is considered, rather than prevalence across the flock, the only comparable data found was for blowfly strike. For Welsh respondents, French *et al.* (1992) found 1.2% of sheep (ewes and lambs) in affected flocks had blowfly strike in 1988 and 1.5% in 1989, compared to 5.8% of sheep (ewes, lambs and rams) in this survey. Bisdorff *et al.* (2006) found 1.2% of ewes and lambs in affected flocks had been struck, while only 0.9% of rams were affected. Therefore, it appears that although the proportion of flocks affected in this survey is lower than other studies, the number of animals affected in individual flocks is higher. The result that blowfly strike only affects a small proportion was further supported by the results presented in Figure 6, which showed the proportion of the flock affected was generally between 1-10%.

The results on prevalence was supported by data from the vet practice survey (see Table 9) where, in terms of the percentage of clients experiencing problems, the order was blowfly strike (>50%), then lice (11-20%) and then both scab and ticks (1-10%). These results virtually mirror the figures shown in Table 10.

Treatment for Ectoparasites

The question about which treatment was used or recommended was asked four times over the three surveys. Cyromazine and Cypermethrin were consistently chosen as the treatment for blowfly strike and ticks respectively, while there was more variation for scab and lice (see Table 34). The importance of Diazinon (OP) was illustrated as it was chosen by producers as the most effective treatment for scab, ticks and lice, but there needs to be a balance between its effect on the environment and human health and its use to control ectoparasites. The high use of Cyromazine for blowfly strike was supported by results from Fraser *et al.* (2006). Given the limitation on the availability of cypermethrins and the restriction on the use of OPs on organic farms, these results clearly present a major cause for concern for the organic sector.

Table 34: Summary of the most commonly used/recommended treatments for ectoparasites.

<i>Ectoparasite</i>	Producer Survey <i>(treatment used – Table 7)</i>	Vet Practice Survey <i>(recommended by vets – Table 11)</i>	Farm Visit Survey <i>(treatment used – Tables 18, 20, 22, 24)</i>	Farm Visit Survey <i>(most effective treatment – Table 26)</i>
Scab	Doramectin	Diazinon (OP)	Doramectin	Diazinon (OP)
Blowfly Strike	Cyromazine	Cyromazine	Cyromazine	Cyromazine
Ticks	Cypermethrin (pour-on)	Cypermethrin Alphacypermethrin	Cypermethrin Diazinon (OP)	Cypermethrin Diazinon (OP)
Lice	Cypermethrin (pour-on)	Cypermethrin	Cypermethrin	Diazinon (OP)

The results from the survey conducted by Fraser *et al.* (2006) showed that Ivermectin (33%), Doramectin (28%) and Diazinon (17%) were the most commonly used treatments for scab, while Cypermethrin (27%), Diazinon (27%) and Doramectin (20%) were the most commonly used for lice. (NB Doramectin is not licensed to treat lice in sheep). Therefore, similar patterns can be seen between Fraser *et al.*'s results and the results from this study, except for Ivermectin for scab and Doramectin for lice.

This survey highlighted the use of inappropriate treatments (see Tables 7, 9 and 26). In the producer survey, it was found that 18.6% and 17.1% of the treatments for ticks and lice respectively were inappropriate. This finding was supported by results from Fraser *et al.* (2006) on Doramectin use for lice (discussed above). Some producers suggested that Ivermectin and Moxidectin were the most effective treatments for lice, however these products are not licensed for lice control in sheep but can be used in cattle for sucking lice.

The use of anthelmintics from the macrocyclic lactones (MLs) group (Doramectin, Ivermectin and Moxidectin), which also treat scab, accounted for 1.8%, 8.5% and 9.1% of the treatments used for blowfly strike, ticks and lice respectively (producer survey). It is likely that MLs are used to treat scab primarily and it is believed that they have activity against other ectoparasites. With concerns over the use of organophosphates, due to environment and human health consequences, and the sale and marketing of Cypermethrin (SP) dips being suspended in February 2006 (although current stocks can still be used) injections are likely to be important ways for controlling scab. This adds an extra dimension to the producers' control methods as the industry needs to ensure that MLs remain viable to control internal parasites as they are an important aspects of the SCOPS quarantine method to prevent wormer resistance worms entering the farm. The role that MLs play in the control of scab on organic farms also means that

greater emphasis must be placed on the correct use of MLs on organic farms so that an acceleration of the development of anthelmintic resistance on those enterprises can be avoided.

It is crucially important that the correct diagnosis is reached, perhaps by using a vet, to ensure that the treatment is appropriate. However, results from this study suggest that there may be more of a problem in deciding which product to use rather than actually diagnosing the problem. For example, 83% of the producers questioned were confident in their ability to diagnose sheep scab, vets believed that about 95% of producers understood the route of infection for scab and 84% of vets believed that the producer was able to recognise if they had a problem with scab or lice. These values were similar to the ones in the Scottish Sheep Strategy Initiative (SSSI) survey, where 87.5% of respondents were confident in their ability to accurately diagnose sheep scab. However, the results from the current survey were diminished when it was found that only 55% of the farms where the producers thought they had scab actually had scab (see Table 31). It is also difficult to explain why only 60% of producers (regularly and occasionally have been aggregated - see Table 29), compared to 62.5% in the SSSI survey, had actually worked with the neighbours at some point when they claim to understand the route of infection, i.e. they generally believed that scab is a moderate problem in their area (see Table 28) and the most common source of scab is neighbour's sheep. However it was encouraging that 95-96% of producers would cooperate with the neighbours in the future (results from both producer and farm visit surveys). In the SSSI survey, 78.6% would be willing to work with their neighbours in the future.

Control Measures

74% of producers and 85% of vets thought that compulsory dipping should return, which suggests there is a high demand for scab control. The UK was free from sheep scab between 1953 and 1973, and NZ and Australia have been scab free since the 19th Century. Therefore, it is possible to eradicate sheep scab, but this needs a coordinated and thorough approach.

Quarantine is one of the fundamental ways to reduce the occurrence of permanent ectoparasites in the flock. About 69% of producers suggested that they quarantined bought-in or returning sheep and they generally used isolation fields, with about 52% of producers treating quarantined sheep for ectoparasites. However when vets were asked how many of their clients quarantined their animals the majority thought it was less than 10%, while the majority of vets advised between 21 and 50% of their clients on the importance of quarantining stock (see Tables 12 and 13). The vet practice survey highlighted that the majority of vets are only advising 11-20% and less than 10% of their clients on the threat of resistance developing to endoparasite and ectoparasite treatments respectively. This is an area that needs addressing since the preservation of endoparasite treatments is reliant on the careful use of them for ectoparasite control, for example producers generally used Doramectin during quarantine (see Table 8).

The establishment and use of written health plans can be extremely helpful in planning and implementing control measures on farm. About 37% of the respondents do not have a written health plan. The health plans that were written were comprehensive in terms of covering endo- and ectoparasites. HCC is planning further work on health plans, and it is likely to include training and support to allow farmers to plan their strategies for controlling disease.

Focus on Organic Production

It was interesting to see that there were limited differences when organic producers were compared to other datasets, in terms of the percentage of respondents who grazed common ground, the number of months common ground was grazed, the most commonly used treatments for ectoparasites, the use of inappropriate treatments (especially for ticks and lice), and the percentage of producers treating for blowfly strike and lice.

However, for organic production the proportion of sheep that grazed on common ground was lower, the percentage of respondents who stated they were closed flocks was higher, as was the number of flocks who were actually closed (did not buy in or borrow rams). It was interesting to see that the prevalence of ectoparasites was higher in the organic flock when compared to the entire dataset. The percentage of organic producers treating (listing products) for scab and ticks were lower than for conventional producers, but according to Figure 5 scab and ticks are less of a problem than fly strike and lice for organic producers. In terms of quarantine, more organic producers tended to isolate bought-in or returning sheep, but generally fewer organic producers treated during quarantine. About 30% of organic producers did not have a written health plan compared to about 37% of all producers, but this area of flock management is still in need of improvement for all sectors.

CONCLUSIONS

The prevalence of ectoparasites in this study was not as high as found in previous studies nevertheless, the consequences are still high for the profitability of the Welsh industry. One major concern arising from this study was the high use of inappropriate treatments for ectoparasites that could reduce the sustainability of the industry through the development of resistant parasites.

Relatively simple methods can be implemented by producers and can have dramatic effects on the prevalence of ectoparasites, especially the permanent ones. It is important that basic best practice is re-emphasised, in conjunction with SCOPS and the Welsh Parasitology Steering Group (facilitated by HCC), to ensure that Welsh producers can cope with the challenge. Potentially this is the time to introduce a programme to coordinate the processes, similar to the Scottish Sheep Scab Initiative, to ensure that ectoparasites are effectively controlled across Wales.

RECOMMENDATIONS

- Recommended treatment list for conventional and organic enterprises, e.g. list of products for scab produced for the pre-tupping period, which was highlighted as the most popular time for scab treatment
- Publish best practice guidelines, in conjunction with SCOPS and the Welsh Parasitology Steering Group (facilitated by HCC), e.g. biosecurity and quarantine. This should include specific recommendations/advice for organic farms
- Develop programmes to encourage and allow producers to coordinate their ectoparasite control
- HCC to continue its on-going activity to help farmers develop written health plans
- Involve vets to ensure that they pass on the best messages to their clients, e.g. the threat of resistance in particular

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