Footrot and interdigital dermatitis in sheep: farmer satisfaction with current management, their ideal management and sources used to adopt new strategies

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Abstract

The aims of this research were to identify management practices that sheep farmers currently use to treat and prevent footrot in sheep and whether they consider that these are successful management tools and to find out how sheep farmers would ideally like to manage footrot in their flock. Over 80% of lameness in sheep in the UK is caused by *Dichelobacter nodosus*, which presents clinically as interdigital dermatitis (ID) alone or with separation of hoof horn (FR). A questionnaire was sent to 265 farmers to investigate their current management and their satisfaction with current management of the spectrum of clinical presentations of footrot. Farmers were also asked their ideal management of footrot and their interest in, and sources of information for, change. Approximately 160 farmers responded. Farmers satisfied with current management reported a prevalence of lameness ≤5%. These farmers caught and treated lame sheep within 3 days of first seeing them lame, and treated sheep with FR and ID with parenteral antibacterials. Farmers dissatisfied with their management reported a prevalence of lameness >5%. These farmers practised routine foot trimming, footbathing and vaccination against footrot. Whilst 89% of farmers said they were satisfied with their management of FR over 34% were interested in changing management. Farmers identified veterinarians as the most influential source for new information. Farmers reported that ideally they would control FR by culling / isolating lame sheep, sourcing replacements from non-lame parents, trimming feet less, using antibacterial treatments less and using vaccination more. Footbathing was a commonly used management that was linked with dissatisfaction that also was listed highly as an ideal management. Consequently, some of the ideal managements are in agreement with our understanding of disease control (culling and isolation, sourcing healthy replacements) but others are in contrast with our current knowledge of management and farmers self reporting of

satisfaction of management of footrot (less use of antibacterial treatment, footbathing and vaccination). One explanation for this is the theory of cognitive dissonance where belief follows behaviour i.e. farmers report that they believe an ideal which is what they are currently doing, even if the management is sub optimal.

Keywords: sheep; lameness; farmer opinion; flock management; correspondence analysis

1. Introduction

Sheep farmers in the United Kingdom have stated that lameness in sheep is their highest cause of concern for poor health (Goddard *et al.*, 2006). Footrot (FR) and interdigital dermatitis (ID) (both presentations of *Dichelobacter nodosus* infection) cause over 90% of lameness in sheep in the United Kingdom (Kaler and Green, 2008a). Over 90% of a random sample of 800 sheep farmers reported that they had sheep in their flock lame with FR and/or ID (Kaler and Green, 2008a) and these farmers estimated that 8–10% of sheep in their flocks were lame with FR or ID. These are similar estimates to those reported by Grogono-Thomas and Johnston (1997) and Wassink *et al.* (2003, 2004). FR has been estimated to cost the sheep industry in Great Britain £24 million per year (Nieuwhof and Bishop, 2005) or £80 million (Wassink *et al.*, in press).

In the UK, the focus for many decades has been to prevent lameness caused by FR and ID using whole flock managements of routine foot trimming, footbathing and vaccination (Morgan, 1987). However, there is now a series of observational studies that suggest that these practices are not beneficial and might be detrimental to the prevention or reduction of lameness in sheep. Routine foot trimming of sheep once or more than once a year has been associated with a higher flock-prevalence and -incidence of FR and ID compared with flocks where routine foot trimming is not practised (Wassink *et al.*, 2003; Green *et al.*, 2007; Kaler and Green, 2009).

Footbaths have been reported to give cures of 61% – 77% after 42 days in the UK (Parajuli and Goddard, 1989;Grogono-Thomas *et al.*, 1994), however, the use of footbathing has been associated with a high prevalence of footrot in ewes (Kaler and Green, 2009), probably because of the increased duration of FR disease compared with antibiotic treatment (see below) and only of benefit in the control of ID in lambs (Wassink *et al.*, 2004). At present, the only vaccine licensed for use against FR in the United Kingdom is the polyvalent serotype *D. nodosus* vaccine Footvax (Intervet / Schering-Plough Animal Health). The effectiveness of this vaccine is low because of antigenic competition (Schwartzkoff *et al.*, 1993; Raadsma *et al.*, 1994) and its use is recommended in combination with individual treatment of sheep with FR.

There is observational and experimental evidence that treatment of individual lame sheep is associated with a low prevalence of lameness in flocks. This treatment ideally includes isolation (Wassink *et al.*, 2003), but definitely requires treatment of sheep lame with FR or ID with parenteral and topical antibacterials within 3 days of first being seen lame (Wassink *et al.*, in press; Kaler and Green, 2008b). This treatment leads to > 95% recovery from FR or ID with a median time to recovery of 4 and 2 days respectively (Wassink et al., in press) if hoof horn is not trimmed / pared (Kaler et al., 2010).

Some farmers are using some or all of the individual managements listed above: from 2000 – 2004, 70% - 90% of farmers used parenteral antibiotics to treat at least some sheep lame with FR (Wassink *et al.*, 2003; Kaler and Green, 2009). Wassink *et al.* (2005) also reported that 60% of farmers considered parenteral antibiotics and topical foot sprays good or excellent treatments for FR. However, in 2006, whilst 38% of 178 farmers were treating sheep within 3 days of seeing them lame, 15% never treated individual lame sheep (Kaler and Green, 2008b). These results indicate that a group of farmers are promptly treating lame sheep. This is a labour

intensive approach to management of lameness and to understand whether the industry is likely to adopt such management it would be useful to know whether this group of farmers considers it time and money well spent and what an ideal management of lameness would be.

Rehman *et al.* (2007) highlighted that promotion of a new technology and transfer of knowledge need to take account of the beliefs and attitudes of potential adopters. Currently little is known about sheep farmers' attitudes to management of diseases. The Theory of Reasoned Action, subsequently the Theory of Planned Behaviour (Ajzen, 1991), has been adopted as a theoretical framework to understand how psychological factors impact on decisions (Willock *et al.* 1999). In many farming systems financial implications drive decision making because farms are businesses, however, normative theory, that farmers are simple profit maximisers often fails to fit the data when modelling farmer decisions (Willock et al., 1999). One explanation for this in the UK is that sheep farmers have been subsidised for decades and many are unaware of where they gain and lose income. Whilst there are fairly crude national estimates of costs of disease e.g. footrot costs the UK sheep industry between 24 and 80 million pounds sterling (Nieuwhof and Bishop, 2004; Wassink *et al.*, in press), there is only one estimate of loss of income from a within farm study (Wassink *et al.*, in press) of £6 per ewe mated. Consequently it is difficult for sheep farmers to estimate how endemic diseases impact on income on their farm. Another explanation is that there are other drivers for management of disease that are not financially motivated.

In this paper we used the 2006 managements of FR and ID to identify those which farmers thought most effective and compared farmer satisfaction with current managements. We then investigated farmers' ideal approaches to management and where they sourced new ideas to manage FR and ID.

2. Materials and Methods

In November 2006, a questionnaire was sent to 265 compliant English lowland farmers sourced from the 800 farmers who participated in Kaler and Green (2008a) to obtain information on farmers' current satisfaction with, and ideal management of, FR and ID. In addition, information was gathered on farmers' interest in change, and sources of information that farmers used to gather new ideas.

The questionnaire was developed using published literature and knowledge from the lameness research group at the University of Warwick. Participants were asked to estimate the prevalence of lameness in their ewes and lambs in 2005 and 2006. Farmers were asked to rank up to five practices that they currently used to prevent i) FR and ii) ID and up to three current practices that they used to treat i) FR and ii) ID from semi-open lists (e.g. Table 1) that were provided. Farmers were then asked to rank up to five managements that they would ideally use to prevent FR and ID and up to three ideal managements to treat these two conditions. Farmers were also asked their overall satisfaction with their current management of FR and ID on a 5-point Likert scale (O'Keefe, 2002) of 'very satisfied, satisfied, neither satisfied nor dissatisfied, unsatisfied, very unsatisfied', with a 'don't know' option and a 3-point scale of 'yes, possibly, no' on whether they would consider changing their management. Finally, farmers were asked to rank a maximum of five sources of information from which they gained new knowledge of management of lameness by currently used, ideally use and most influential again from a semi-open list.

Data were entered into Access 2003 and analysed in Stata 10 (StataCorp, USA). The ranked responses were weighted for importance; the management ranked number 1 by the farmer

was awarded 5 points, number 2 with 4 points, down to number 5 with 1 point. The management ranked number 1 always started with 5 points even if the farmer gave <5 managements. Within farmer differences between 'current' and 'ideal' management were tested using a Wilcoxon matched-pairs signed-rank test (Sheskin, 2000). An extension of the Wilcoxon rank-sum test was used to compare the prevalence of lameness between flocks owned by satisfied and dissatisfied farmers and between flocks where farmers were interested or not interested in change in management of FR and ID (Cuzick, 1985).

The prevalence of lameness in ewes was categorised at the median into a binary variable of ≥5% compared with <5%. Current managements were compared with the prevalence of lameness using binomial logistic regression analysis (Hosmer and Lemeshow, 2001). The variables with a crude likelihood ratio chi-squared probability <0.25 were tested in a multivariable model using backward elimination, to estimate adjusted levels of association. All the exposures excluded (for all levels of significance) were then re-tested in the final model (Cox and Wermuth, 1996) to ensure that any residual confounding was identified.

Associations between current management and binary codes for satisfaction, effectiveness, interest in change, value for money and time and whether the managements worked were investigated using multiple correspondence analysis (MCA) (Coelho *et al.*, 2008). A univariable binomial complementary (c) log-log regression analysis (Hilbe, 1996) was used to determine associations between attitudes and management of FR and ID. Variables with a crude likelihood ratio chi-squared probability <0.25 were tested in a multivariable log-log model using backward elimination, to estimate associations between attitudes and current management of FR and ID.

3. Results

The number of responses was 172 after two reminders, a response of 65%. Eleven questionnaires were not usable because farmers did not have any sheep or did not report the prevalence of lameness and consequently the overall useable response was 61%; not all respondents answered all questions. The median flock size was 275 (IQR: 120 – 550) with a mean of 397 in 2006. The farmer estimated mean and median percent lameness in ewes and lambs was 6.9% and 5 (IQR: 3 – 10) 7.0%, mean 5 (IQR: 2 – 10) respectively. Ninety-one (60%) respondents kept ≤ 4 ewes per acre.

3.1 Farmer current and ideal management of lameness

Overall 154 farmers listed at least one to five management practices used to prevent footrot, with 143 (88%) listing 5. The top five were foot trimming FR diseased feet, footbathing the flock, treating FR with topical sprays, treating FR with parenteral antibiotics and foot trimming the flock (Table 2). These managements still scored highly as ideal treatments but the scores for all five managements fell significantly. Managements that increased significantly in score were quarantine diseased sheep, cull lame sheep immediately, purchase sheep from farms with low levels of lameness, source replacements from non-lame ewes and vaccinate the flock once or twice per year (Table 2). Overall, 107 (66%) farmers indicated five managements to prevent ID. The current and ideal managements were the same (Table 2) but again, farmer current managements tended to fall in score. Ideal managements were the same as those for FR with the addition of quarantine new sheep and reduce stocking density (Table 2). The current and ideal managements to treat FR were foot trimming, topical antibiotics sprays and footbathing.

172 Vaccination had a significantly higher cumulative score as an ideal treatment than a current
173 treatment (Table 3).
174
175 *3.2 Associations between current management and prevalence of lameness*
176 Not all farmers answered every question. In the estimates below the number of farmers who
177 answered the question is used as the denominator. Eighty-seven (55%), 19 (12%), and 53 (33%)
178 farmers checked their flock for lameness every day, twice a week and once a week or less,
179 respectively. Nineteen (13%), 76 (50%), 49 (32%) and 7 (5%) farmers treated lame sheep on the
180 day they were first seen lame, within 3 days, within one week and within two weeks
181 respectively; nearly all farmers (158 (98%)) treated lame sheep with 70 farmers (49%) treating
182 when 1 or 2 were seen lame and 17 (12%) not treating individuals until 10 or more sheep in a
183 group were lame. Forty-six (28%) and 47 (29%) respondents did not catch lame sheep for
184 treatment when lambs were very young or rams were with ewes, respectively. Twenty-seven
185 (17%), 52 (33%) and 79 (50%) farmers routinely inspected the feet of all ewes on 0, 1 or ≥2
186 occasions respectively in 2006. Among the farmers who routinely inspected sheep feet, 31 (22%)
187 trimmed 100% of the ewes' feet and a further 22 (16%) trimmed >50%; 71 (46%) farmers
188 footbathed their flock on ≥3 occasions in 2006.
189 Results from the multivariable analysis (Table 4) with the outcome lameness ≥5% were
190 that footbathing ≥twice a year (OR=2.4), routine foot inspection ≥ once a year (OR=4.7),
191 rotational grazing (OR=2.8), purchasing rams from flocks with low levels of lameness (OR=5.1)
192 and > 3 days between seeing a sheep lame and treating it (OR=4.1) were associated with a
193 prevalence of lameness ≥5%. Replacing ewes with ewe lambs from non-lame ewes was
194 associated with a lower prevalence of lameness (OR=0.2).

3.3 Satisfaction of farmers with their current management of lameness and interest in change

The majority of respondents had a positive attitude to their management of lameness with only 11% of farmers very dissatisfied or dissatisfied (Table 5). The more dissatisfied farmers were, the higher the prevalence of lameness they reported in both ewes and lambs ($P<0.01$). When respondents were asked whether they thought that the managements they used made the best use of their time and money, 80 (49%) and 74 (46%) answered 'yes', and 75 (46%) and 64 (40%) answered 'to some extent' respectively whilst 80 (49%) thought the managements that they used worked and a further 80 (49%), thought they worked 'to some extent'. Fifty-three (34%) sheep farmers were interested in change.

There was a significant ($p<0.05$) positive association between very satisfied / satisfied with management and treatment in <3 days from observing sheep lame and treating sheep when only 1 or 2 in a group were lame. Treating lame sheep when only 1 or 2 were lame was also associated with 'management works' and 'makes best use of time'. Purchasing rams from farms with a low prevalence of lameness was positively associated with 'no' to interest in change in management. Vaccination of the flock once a year was associated with a lack of satisfaction with management and a negative response to management works and makes best use of money. Footbathing to prevent lameness was negatively associated with management made best use of money and footbathing to treat lameness was positively associated with an interest in change. Inspecting the feet of all the ewes more than once a year was negatively associated with best use of time, treating ewes with topical spray and culling lame sheep at weaning to prevent FR and ID were negatively associated with best use of money and a negative response to the management worked. Reduced stocking density for prevention was positively associated with best use of time.

Farmers who were very satisfied with their management of lameness were less likely to want to change management (Figure 1). Management works, makes good use of money and of time were associated with both satisfied and very satisfied with management of lameness. The reverse association was also present. Farmers who 'possibly want to change management' were dimensionally linked to satisfied and neither satisfied nor unsatisfied, indicating less association between interest in change and satisfaction with lameness; dimension 1 (x-axis) explained (94%) of the inertia.

3.3 Sources of knowledge for management of lameness

The highest ranked route for new knowledge in 2006, the most ideal and of greatest influence was veterinary consultation (Table 6). The next most used sources were 'The Farmers Weekly' and information from other farmers, with the latter regarded as relatively influential. In the ideal situation farmers said that they would use DEFRA (Department of Environment, Food and Rural Affairs), EBLEX (English Beef and Lamb Executive), the internet and farm visits more than currently used and 'The Farmers Weekly' and communication with other farmers less. Farmers who listed 'The Sheep Farmer' and attended a day meeting of sheep farmers in 2006 reported a significantly higher prevalence of lameness in their flock ($P<0.05$).

4. Discussion

This study contributes to our understanding of satisfaction with current managements of sheep lame with FR and ID: as such it is not a study of cause and effect, but of association, hence its cross sectional design that linked current management and current prevalence of lameness

with current satisfaction. Satisfaction with management of FR and ID nationally is likely to be less than the 68% in the current study, given the lower than national average prevalence of lameness (a good correlate to prevalence of FR and ID (Kaler and Green, 2009)). Although these farmers were not representative of all English sheep farmers, they provided a group of farmers, some of whom were managing lameness successfully, that we could use to compare management with satisfaction, interest in change and sources of information.

The results are generally as might be anticipated with those farmers who are using prompt individual treatment (as reported by themselves and the evidence base from research) satisfied with the efficacy and cost effectiveness of this approach and reporting a lower prevalence of lameness. Farmers' ideal managements also included isolation and culling of lame sheep and selecting replacements from unaffected stock, all likely to contribute to a low prevalence of lameness when in combination with prompt treatment (Skerman and Moorhouse, 1987; Wassink *et al.*, 2005; Green *et al.*, 2007; Wassink *et al.*, in press). In the UK, farmers are not able to transport lame sheep. This might be why farmers reported that 'ideally' they would cull lame sheep but presently they do not. In reality, they are not prepared to cull and lose the value of the sheep. In Australia there was a period of time at the start of the eradication programme in NSW when lame sheep could be sold to specific markets and only for slaughter. Transport of lame sheep is not likely to ever be legal in the UK and removing sheep that might be carriers of *D. nodosus* will be at a financial cost. This could be a stumbling block for removal of carrier sheep.

Whilst many ideal managements were in agreement with our understanding of the treatment and prevention of FR and ID some were counter intuitive: farmers ranked footbathing and vaccination higher in their ideal management of FR and ID than currently, although they

were still absolutely less popular than foot trimming and antibacterial treatments. One explanation for this inconsistency, or dissonance, between the farmer ideal and currently effective managements is that farmers have changed their attitude to fit their behaviour (Festinger and Carlsmith, 1959): farmers do not wish to appear irrational and so reinforce their current management by raising the management in their ranking. This is an example of cognitive dissonance (Festinger, 1957) where people change their beliefs to match their behaviour, even if they know that their behaviour is sub optimal, in this case, farmers endorse 'ideally' using footbathing and vaccination because they already use it, despite considering these managements poor use of time / money. Another explanation is that farmers would 'ideally' like to manage lameness using flock managements such as an effective vaccine or effective routine footbathing.

Flock managements that are ineffective rank highly in current and ideal managements suggesting, despite dissatisfaction, so a third explanation is that many farmers do not know what is effective and do not have access to correct information. This fits with farmers reporting veterinarians as the most influential, ideal and currently used source for information on management of lameness. Unfortunately from our data, changes that farmers made to management of lameness after veterinary advice were inconsistent and ranged from using vaccination and increasing foot trimming to stopping trimming feet and using antibacterials. Thus, the best practice management of lameness needs to be known by veterinarians to ensure that they use the most recent evidence base for providing advice. In the UK there are relatively few specialist sheep veterinarians, and relatively few sheep farmers on flock health contracts with vets or advisors where there is time and investment on both sides to ensure that current evidence is known and disseminated. Many of the farmers in this study would be using a non specialist sheep vet.

Farmers' scores indicated that they would ideally use fewer individual treatments, especially parenteral antibiotics and topical antibacterial sprays, despite the fact that the satisfied farmers in the current study used this management and it is perceived that these treatments are good or excellent in previous research (Wassink *et al.*, 2005). This may be because an individual treatment is less easy to include in a flock management programme and relies on close observation of the flock and responses to lame sheep at 'inconvenient times'. However, the 15% of farmers that did not treat individual lame sheep in the study by Kaler and Green (2008b) reported a median flock-prevalence of lameness of 15%, compared with a median of 5% among the 38% who treat mildly lame sheep within 3 days of observing them lame. This does highlight that at the present time, prompt treatment of lame sheep is the most effective in reducing the prevalence and incidence of lameness in a flock (Green *et al.*, 2007; Wassink *et al.*, in press; Kaler and Green, 2008a) and results from the current study.

The results from the current study highlight that careful thought needs to be put into knowledge transfer. Where we have infectious diseases (and lameness in sheep in the UK is primarily caused by *D. nodosus*), where good vaccines are not likely to be developed because of the nature of the pathogen and host responses (Green, 2005) or where many pathogens can cause one disease presentation e.g. mastitis in cattle, pneumonia in calves, we need to ensure that there is industry-wide understanding and adoption of the benefits of treatment of affected individuals to control transmission of infection in the flock or herd.

Farmers highlighted that they like to attend meetings on farms to gain new information. In the current study, farmers who attended day meetings or read 'The Sheep Farmer' reported a higher prevalence of lameness in their flock, either indicating that that they were less aware of current best managements or that they were tolerant to the level of lameness. Attendance at

meetings might indicate that they were seeking knowledge to reduce levels of lameness. There was an increase in rank score for both EBLEX and DEFRA as ideal sources of information, suggesting that a higher input from these bodies would be accepted. The internet was not widely used by the sheep farming community and is thus not a useful route of communication currently. Batte (2005) reported that significantly fewer livestock farmers adopted computer technology compared with other groups of farmers in his survey of computer use in Ohio, United States. The slight increase in score in an ideal context suggests that the potential for this medium was recognised by farmers but was not accessible or not used at the time of the survey.

Results from the current study might indicate that research on flock control measures for lameness would be well received. Given that farmers prefer not to routinely trim feet, and considered it a poor use of their time, and given that the evidence to date suggests that trimming feet is not associated with lower prevalence (Wassink *et al.*, 2003, 2005; Green *et al.*, 2007; Kaler and Green, 2008a) foot trimming would be a useful area for further research that, should routine foot trimming be ineffective or detrimental, would be readily accepted by the end-user.

The flocks in this study had a farmer-estimated mean prevalence of lameness of 7%, less than the national average of 10% (Kaler and Green, 2008a), probably because they were a compliant group of farmers interested in lameness in sheep, but similar to the prevalence of lameness that these farmers reported when they participated in Kaler and Green (2008a). We can be reasonably confident of farmers' estimates of the prevalence of lameness in sheep. Sheep farmers are able to recognise even mildly lame sheep in video clips and estimates of prevalence of lameness in their own flock correlate logically with their reported rate of treatment (Kaler and Green, 2008b). More recently, 35 sheep farmers were visited and their estimate of the prevalence of lameness in their flock was compared with that of a trained researcher who observed the sheep

on the same day; the estimates, which ranged from 2 – 25% were >80% correlated between the famer and researcher, (King, personal communication). This is contrary to cattle farmers who appear unable to estimate lameness in their herds (Leach *et al.,* 2010) but it does mean that we can be fairly confident that sheep farmers who participated in the current study reported the prevalence of lameness in their flock with some accuracy.

5. Conclusions

We conclude that sheep farmers who are satisfied with their management of FR and ID have a mean prevalence of lameness of <5% and consider that they have a good use of time and money with treatment of lame sheep within 3 days of observing them lame. Sheep farmers who are dissatisfied are using flock control measures such as foot trimming, foot bathing and vaccination instead. Counter intuitively, in an ideal situation, some farmers would prefer to use whole flock control measures, this might be an example of cognitive dissonance. The evidence to date is that FR and ID, along with many other transmissible diseases, are best managed through prompt treatment of individuals. There is a challenge to explain the relationship between individual and population management of disease when transferring knowledge to farmers. Farmers look to their veterinary surgeons and day meetings to gather new information on management of lameness. Consequently these two routes might be the optimal for transfer of evidence-based medicine. Improved vaccines or other rapid flock management tools are likely to be well received by farmers.

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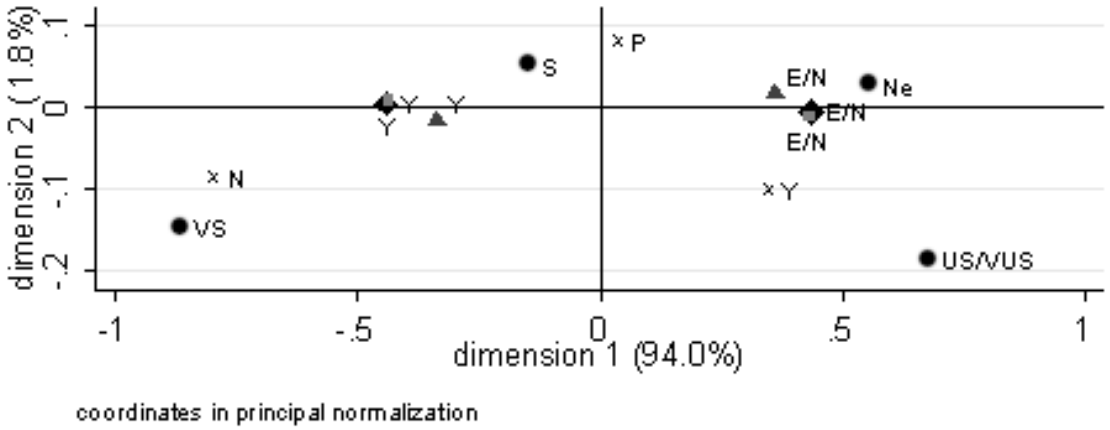
Fig. 1. Multiple correspondence analysis (MCA) of satisfaction with lameness management, willingness to change methods, whether methods worked, and whether it made best use of money and ti **Fig. 1.** Multiple correspondence analysis (MCA) of satisfaction with lameness management, willingness to change methods, whether methods worked, and whether it made best use of money and time



● satisfaction: VS – very satisfied, S – satisfied, Ne – neither satisfied nor unsatisfied, US/VUS – unsatisfied/very unsatisfied

υ time: Y – yes, E/N – to some extent/no

■ money: Y – yes, E/N – to some extent/no

▲ methods worked: Y – yes, E/N – to some extent/no

x change: Y – yes, P – possibly, N – no

Table 1

Example of question collecting data on managements to prevent footrot

C1.1 Please list in the centre column of the table below the **top 5 managements that you used to prevent footrot in ewes** in 2006, number the options from 1 (most important) down to 5

Prevention of footrot	**Management in 2006**	**Ideal management**
Cull lame sheep immediately		
Cull lame sheep at weaning		
Footbath group with footrot		
Footbath whole flock		
Foot trim sheep with footrot		
Foot trim all sheep in flock		
Purchase **ewes** from farms with low levels of lameness		
Purchase **rams** from farms with low levels of lameness		
Quarantine ewes with footrot		
Quarantine new sheep		
Reduce stocking density		
Replace ewes with ewe lambs born to non-lame ewes		

Rotational grazing		
Treat ewes with footrot with injectable antibiotics		
Treat ewes with footrot with topical spray		
Use set stocking		
Vaccinate flock with Footvax once per year		
Vaccinate flock with Footvax twice per year		
Vaccinate rams prior to tupping		
Other *(please state)*_____		
Other *(please state)*_____		

460

461 **C1.2** Now, please repeat this in the right hand column of the table above for your **ideal**

462 **management to prevent footrot in ewes**

463

464

Table 2

Top five managements used to prevent FR and ID in 2006 and top five ideal managements.

Prevention	FR No.	Cumulative rank score[a]		ID No.	Cumulative rank score[a]	
		Current	Ideal		Current	Ideal
Foot trim lame[!] sheep	106	429	193**	75	280	160**
Footbath whole flock	87	356	303*	100	379	397
Treat lame[!] ewes with topical spray	103	309	129**	108	371	261**
Treat lame[!] ewes with parenteral antibiotics	79	236	153**	66	182	147**
Foot trim flock	63	213	151*	44	144	134
Footbath group with lame [!]sheep	48	148	91**	69	286	230*
Cull lame[!] sheep at weaning	41	111	113	27	64	87
Rotational grazing	40	97	80*	43	121	143
Quarantine lame[!] ewes	26	80	130*	30	79	132
Quarantine new sheep	25	76	90	26	69	111**
Vaccinate flock against FR once / year	18	69	147**	-	-	-
Reduce stocking density	19	42	56	18	54	79*
Purchase rams from farms with low levels of lameness	18	36	91**	12	20	54*
Replacements from non-lame ewes	12	33	81**	11	25	52*
Purchase ewes from farms with low levels of lameness	12	25	113**	10	26	82*
Use set stocking	11	23	17	-	-	-
Vaccinate rams before mating	9	21	33	-	-	-
Cull lame[!] sheep immediately	7	15	182**	6	11	57**
Vaccinate flock against FR twice/ year	1	5	63**	-	-	-

The ranked responses were weighted and summed for each management to give a total score

a: Wilcoxon matched-pairs signed-ranks test: * $P<0.05$, ** $P<0.01$

No.: Number of farmers ranking a method in the top 5 from a total of 161

!Lame with FR or ID respectively

Table 3

Top three managements used to treat FR and ID in 2006 and three ideal managements.

Condition	FR			ID		
	No.	Cumulative rank score[a]		No.	Cumulative rank score[a]	
Treatment		2006	Ideal		2006	Ideal
Foot trim	125	574	509**	99	421	394
Topical antibacterial spray	112	492	405**	123	560	510**
Footbath	102	485	484	115	535	583**
Parenteral antibacterials	70	383	335**	58	314	308
Vaccination	18	115	270**	-	-	-
Painkiller	2	27	35	4	40	59*

The top three ranked responses weighted and summed for each management to give a total score

a: Wilcoxon matched-pairs signed-ranks test: * $P<0.05$, ** $P<0.01$

No.: Number of farmers ranking a method in the top 3 from a total of 161

Table 4

Multivariable logistic regression model identifying managements associated with a reported prevalence of lameness in the ewe flock of ≥5%, 5% was the median value for lameness reported by farmers

Variable	No.	%	OR[a]	95 per cent CI	LR χ^2	*P* value
No. times whole flock footbath						
≤ 2/year	73	6.6	1.00			
> 2/year	65	7.0	2.38	1.09- 5.23	8.80	<0.01
Inspect feet of all ewes						
≤ 1/year	68	5.9	1.00			
> 1/year	70	7.7	4.71	2.02-10.95	14.94	<0.01
Rotational grazing						
Not in top 5	90	6.6	1.00			
In top 5	48	7.1	2.82	1.21-6.60	20.87	<0.01
Purchase rams from farms with low prevalence of lameness						
Not in top 5	119	6.6	1.00			
In top 5	19	8.0	5.14	1.59-16.62	24.84	<0.01
Time between observing lame sheep and catching						
≤ 3 days	86	5.3	1.00			
> 3 days	52	9.2	4.11	1.75-9.69	30.94	<0.01
Replace ewes with ewe lambs born to non-lame ewes						
Not in top 5	121	7.0	1.00			
In top 5	17	5.8	0.19	0.05-0.80	36.93	<0.01

No.: Number of farmers, %: prevalence, OR: odds ratio, 95 per cent CI: 95 percent confidence interval, LR χ^2: likelihood ratio chi-square, df: degrees of freedom, $\div^2$ *P* value: probability of chi-square

a: Number of ewes in the flock forced into model as binomial data of <400 and ≥400

Table 5

Farmer satisfaction with and interest in change in lameness management by prevalence of lameness in the flock in 2006

Response	No. (%)	Ewe lameness prevalence (%)	Lamb lameness prevalence (%)
Satisfaction with management			
very satisfied	17 (11)	4.1	2.7
satisfied	93 (58)	6.5	6.5
neither satisfied nor unsatisfied	34 (21)	8.0	9.2
unsatisfied/very unsatisfied	17 (11)	9.8	9.3
Test for trend[*]		*z=4.16 P<0.01*	*z=3.93 P<0.01*
Interest in change			
yes	53 (34)	8.5	8.0
possibly	81 (51)	6.8	7.4
no	24 (15)	3.9	3.3
Test for trend[*]		*z=-2.85 P<0.01*	*z=-3.66 P<0.01*

* test is an extension of the Wilcoxon rank-sum test

Table 6

Number of farmers and cumulative rank score of source of new information on the management of lameness in 2006, ideal source and in their most influential source.

Source of Information	No.	Cumulative score[a]		
		2006	Ideal	Most influential
My Vet	108	475	464	553**
"Farmers Weekly" !	70	238	169**	125**
Another sheep farmer	72	232	163**	208
EBLEX fact sheets	65	201	247*	190
DEFRA publications	59	163	206*	158
An evening meeting of sheep farmers	42	148	114	104*
"The Sheep Farmer" !	41	145	113	105*
Day meeting of sheep farmers	22	75	65	84
Visit to sheep farm	19	53	78	82**
My advisor	18	55	62	48
Own knowledge	17	84	34**	43*
The internet	12	33	79**	34
"Farmers Guardian" !	2	9	9	13
SAC letter	1	5	5	0
NSA	2	9	8	10

a: Wilcoxon matched-pairs signed-ranks test between preferred and 2006 and between most influential and 2006:

* $P<0.05$, ** $P<0.01$

No.: Number of farmers ranking a method in the top 5 from a total of 161

! magazines read by farmers