Preventive Hoof Trimming in Dairy Cattle: Determining current practices and identifying future research areas.

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KEYWORDS

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ABSTRACT

Background: The extent to which preventive hoof trimming is implemented on Great Britain's (GB) dairy farms is unknown. The aims of this study were to determine common practices and capture producers' input on key areas that require further research.

Methods: An online survey was conducted over a four-week period from March to April 2017.

Results: A total of 338 valid survey responses were received. The majority of farmers undertook preventive hoof trimming (82.4%), and this was significantly positively associated with increased herd yield ($p<0.001$). Drying off was the most common time trimming was undertaken, with 72.2% of farmers who implemented preventive trimming doing so at this point in the management cycle. Of those undertaking preventive trimming, 46.4% solely used an external hoof trimmer, 31.7% solely used farm staff and the remainder (21.9%) used a combination of operators. Four over-arching themes were identified within the key research questions; when to trim, why we should trim, how to trim and who to trim. The most frequent questions related to optimal trimming timing, frequency and method.

Conclusion: This study highlighted that preventive hoof trimming is a widespread practice on GB dairy farms, undertaken by both external hoof trimmers and farm staff. Despite this, farmers still

want to know when they should undertake preventive hoof trimming and which technique they should use.

INTRODUCTION

Whilst preventive cattle hoof trimming is considered an important component of lameness prevention[1], the extent to which it is undertaken by Great Britain's (GB) dairy farmers is currently unknown. Despite its perceived widespread practice, evidence supporting trimming technique and optimal frequency of trimming are limited for the modern dairy cow[2].

A recent study surveyed 61 dairy farms to determine risk factors associated with lameness[3]. It was reported that 63.6% of farms undertook preventive hoof trimming, with 23% of respondents implementing a preventive trim between 60-100 days of lactation, which was significantly associated with a decreased lameness prevalence. However, this relatively small-scale study was based on a convenience sample, and it is not clear if these results are representative of herds across GB. Therefore, a study is required which captures data from a larger, more geographically widespread population of farmers and includes more detailed information about trimming practices.

Qualitative research methods have previously been used to explore the opinions and behaviours of farmers in relation to lameness with the results then being used to drive future research. For example, studies have sought to identify farmers' key motivators when tackling lameness using online and face to face surveys[4] and in depth interviews[5] to determine how 'incorporating the voice of the farmer' could impact on the uptake and implementation of research outputs on lameness treatment. However, they have not sought to specifically ask farmers where future lameness research should be focused. By gaining a greater understanding of farmers' main areas of interest and their key questions for research it has the potential to achieve farmer support at an early stage, prior to involvement of expert opinion.

The aim of this study was to identify future research areas in the subject area of preventive hoof trimming. The objectives were to determine common preventive hoof trimming practices and to capture producers' thoughts on the key areas of preventive hoof trimming that require further research.

MATERIALS AND METHODS

Study Design

A sample survey was designed and distributed to GB dairy farmers in March to April 2017 to determine common preventive hoof trimming practices and to capture thoughts on the key areas of preventive hoof trimming that require further research. For the purposes of the survey preventive hoof trimming was defined as 'trimming which takes place as a preventive measure to correct overgrowth of the hoof in the non-lame cow' and the focus was on routine interventions at the herd level rather than the individual cow.

The survey was an open, voluntary survey with a target population of GB dairy farmers that were farming commercially at the time of the survey, regardless of the type of management system they operated. At the time of the study there were 10,324 dairy farmers in GB (AHDB Dairy, 2017). To estimate the proportion of GB dairy farmers undertaking routine preventive hoof trimming and therefore identify common practices, the sample size required was determined to be 370 based on a confidence level of 95% and margin of error of 5%[6].

Ethical Approval and Consent

The study received ethical approval from the School of Veterinary Medicine and Science Ethics Committee, The University of Nottingham. In accordance with the ethical guidelines produced by the British Educational Research Association (2011), participating in the questionnaire was on a voluntary basis and participants were also offered a summary of the study's results. Consent was collected from each participant as part of the survey.

Survey Development and Dissemination

The survey consisted of a mixture of multiple choice, open and closed questions and is provided in full in Supplementary Materials. In brief, it was composed of three sections; background information regarding the participant's farm, the future of the farm and how the participant reacted to new practices; preventive cattle hoof trimming protocols and participant questions regarding preventive cattle hoof trimming and which areas they would like to see researched. The questionnaire was developed using SurveyMonkey (SurveyMonkey Inc.).

Once complete, the questionnaire was piloted on four dairy farmers for detailed one-to-one feedback and, following editing, piloted further within the Ruminant Population Health research group at the University of Nottingham.

The survey link was distributed electronically via 5 different methods to reach as many of the target population as possible: (1) through the Agriculture and Horticulture Development Board (AHDB) Dairy database to approximately 5,000 dairy farmers, (2) via AHDB Knowledge Exchange Managers to the top 20% of AHDB contributors (based on levy payments), (3) farmers registered on the AHDB Healthy Feet Programme, (4) approximately 1,000 farmers on aligned contracts supplying three different supermarkets and (5) to the clients of a national consultancy company. A paper version was also circulated at two farmer meetings involving a total of 30 farmers from across GB, and the 12 responses received were entered manually into the SurveyMonkey database. Additionally, promotion of the survey was carried out via social media, specifically Twitter, throughout the 4-week survey window.

Participants who completed the questionnaire were given the opportunity to supply their email address in order to enter a prize draw. The prize consisted of a set of hoof pincers and pair of hoof trimming knives, with a combined value of approximately £100.

Data management and analysis

All data were collected via SurveyMonkey and the responses downloaded into a spreadsheet file (Microsoft Excel 14, 2010 Microsoft Corporation) and transferred into *R*[7]. Both of these software programmes were also used to manage the dataset, create graphs and tables and undertake statistical analysis. Data was analysed using descriptive, quantitative and qualitative methods.

Data was cleaned within the spreadsheet to ensure all answers were in the expected format, for example postcode and milk sold per year. Responses involving free text were examined individually by one researcher (SP) and excluded if they were considered ambiguous or incomprehensible. The total number of responses after removal of missing and/or excluded answers was used as the denominator for that individual question during analysis.

Strict criteria were used to determine whether an answer should be excluded or not. Assumptions regarding the respondents intended answer were not made, however, reasonable deductions were made where grammatical errors existed. If there was strong evidence that the respondent had misinterpreted the definition of preventive hoof trimming or misinterpreted a specific question, then the answers were excluded. An example of this was Question 6 when respondents were asked

'Is your herd routinely hoof trimmed?'. If they answered 'yes' but then failed to provide information that confirmed this in the subsequent questions, then answers to all questions related to the preventive hoof trimming on their farm were excluded.

Milk yield was calculated as milk per cow per year using the data provided on cow numbers and total milk sold per year (litres). Data was excluded from the analysis if milk/cow/year was <4,000 litres or >13,500 litres. Associations between farm system, herd size and milk sold/cow/year and if and when a herd was preventive trimmed were assessed using logistic regression. Statistical significance was set at $p<0.05$.

The questionnaire contained one open question which asked the participants to list questions they had regarding preventive cattle hoof trimming or the research areas they would like focused on in the future. The participants were able to list as many questions and topics as they liked. The responses were analysed following thematic analysis[8] using an inductive approach within Microsoft Excel. Initially the questions were grouped according to their specific theme e.g., frequency or timing of preventive hoof trimming, based on visual inspection. These individual themes were then amalgamated into overarching themes within a thematic map.

RESULTS

A total of 358 responses to the questionnaire were received over a four-week time frame, of which 20 were excluded due to incomprehensible answers, duplications, no responses provided to questions regarding foot trimming practices or completion from outside GB (see Supplementary Material for geographical spread of responses). Therefore, 338 valid responses were analysed. Not all respondents provided an answer to every question, with 326 answering all sections of the questionnaire.

Overview of Respondents

The median number of dairy cows on each farm was 215 (range 10 to 3050; n=338). The median milk sold/cow/year was 8,618 litres (range 4,333 to 13,077 litres; n=325). Respondents from all 5 AHDB management systems which are categorised based on calving pattern, length of the grazing period, and feeding system[9] were represented in the questionnaire (Figure 1). Proportionally, 6.2% of respondents implemented system 1 (spring calving, >274 days grazing and limited supplementary

feed), 13.6% system 2 (block calving, 183-274 days grazing with increased use of supplementary feeding), 39.1% system 3 (block/all year round calving, 91-182 days grazing and use of partial mixed ration and supplementary concentrates), 21.1% system 4 (all year-round calving, 0-90 days grazing and limited use of grazed grass for feeding) and 20.1% system 5 (all year-round calving, housed and no use of grazed grass).

Preventive trimming practices

Out of 324 responses, 82.4% said they carried out preventive hoof trimming on their farm at the time of surveying, and the remainder did not. Of those that did undertake preventive trimming (n=267), 46.4% answered that this was carried out solely by a professional hoof trimmer, 31.7% solely by farm staff and 21.9% by a combination of both. Figure 2 shows the combined responses to both questions.

The proportion of respondents, both overall and by management system, that routinely undertook preventive hoof trimming on their farm and at which time points/intervals it was undertaken is shown in Table 1. Overall, 72.2% of respondents carried out preventive trimming at dry off and 44.1% during lactation, 5.9% preventively trimmed heifers pre-calving and 5.2% trimmed the entire herd at regular intervals regardless of stage in the management cycle. The timing of the preventive trim during lactation varied widely with some respondents providing exact intervals and others specifying much wider ranges, however, all repones fell between 40 and 180 days in milk. For those undertaking trimming of the entire herd at regular intervals there was also a wide variation in the intervals provided, from 17 weeks to annually. The most common combination of timings was at/around dry off and during lactation with 38.6% of respondents undertaking preventive trimming at both of these time points.

Table 2 shows the results of a multiple logistic regression model with implementation of preventive hoof trimming as the binary outcome. Herd size, milk sold/cow/year and system were included in the original model and eliminated through a stepwise backward approach, with explanatory variables retained in the model where they reduced the Akaike Information Criterion (AIC). Systems 1, 2 and 3 had similar associations to each other, as did systems 4 and 5. Recoding the systems variable to reflect these combined categories reduced AIC. Milk yield had a statistically significant association with trimming ($p<0.001$), with every 1,000 litres sold per cow per year associated with just over doubled odds of routine trimming being implemented. Increased herd size was associated

with reduced odds of trimming (p=0.07), and systems 4 and 5 were associated with increased odds of trimming (p=0.06).

Table 1: Proportion of respondents within each AHDB management system that undertook preventive cattle hoof trimming (i.e., hoof trimming in the absence of clinical lameness) and when this was undertaken, based on results from a survey of GB dairy farmers on current hoof trimming practices (n=324). See Figure 1 for definitions of system groups.

		Median herd size (range)	Median milk sold/cow / year (L)	Is preventive trimming undertaken?		When is preventive hoof trimming undertaken?			
System	n			No	Yes	Heifers pre-calving	At/around dry off	During lactation	Entire herd trimmed at regular intervals
				n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
1	20	240 (20 – 1,500)	5,240	11 (55.0%)	9 (45.0%)	0 (0.0%)	7 (35.0%)	3 (15.0%)	0 (0.0%)
2	43	250 (10-1,500)	7,120	18 (41.9%)	25 (58.1%)	2 (4.7%)	20 (46.5%)	10 (23.3%)	1 (2.3%)
3	126	158 (41-700)	8,351	21 (16.7%)	105 (83.3%)	5 (4.0%)	93 (73.8%)	52 (41.3%)	6 (4.8%)
4	67	235 (80 – 1,500)	8,966	5 (7.5%)	62 (92.5%)	7 (10.4%)	54 (80.6%)	36 (53.7%)	5 (7.5%)
5	68	350 (85-3,050)	10,300	2 (2.9%)	66 (97.1%)	5 (7.4%)	60 (88.2%)	42 (61.8%)	5 (7.4%)
ALL	**324**	**270 (10 – 3050)**	**9,272**	**57 (17.6%)**	**267 (82.4%)**	**19 (5.9%)**	**234 (72.2%)**	**143 (44.1%)**	**17 (5.2%)**

Table 2: Outputs from multiple logistic regression model investigating the relationship between preventive hoof trimming (yes/no outcome) and systems group (grazing more or less than 90 days per year), herd size and milk sold/cow/year, based on responses to a survey on preventive hoof trimming practice (n=312). See Figure 1 for definitions of system groups.

Model term	Coefficient	Standard Error	Odds ratio (95% confidence interval)	P value
Intercept	-3.963	0.896	-	-
Herd size (x100 cows)	-0.122	0.067	0.89 (0.77 – 1.01)	0.069
Milk sold/cow/year ('000 litres/cow/year)	0.724	0.121	2.06 (1.62 – 2.63)	<0.001
Systems group: System 1/2/3	Reference category			
Systems group: System 4/5	0.9309	0.4800	2.54 (0.97 – 6.62)	0.052

Questions regarding preventive cattle hoof trimming and future research areas

A total of 289 respondents provided 483 questions that they would like to see answered through research, however, not all were directly related to preventive cattle hoof trimming. Seven overarching themes emerged from the responses provided; four were related to preventive cattle hoof trimming and three were not related but concerned lameness, for example, treatment of claw horn lesions and housing. The four themes relating to preventative hoof trimming were: (1) When should we trim?, (2) How should we trim?. (3) Why should we trim? and (4) Who (i.e., which animals) should we trim? Table 3 outlines the themes and subthemes relating to the questions surrounding preventive hoof trimming and Figure 3 shows the top five most frequent question subthemes overall.

Table 3: The themes and subthemes relating to preventive hoof trimming with example questions derived from thematic analysis of answers provided during a survey of GB dairy farmers regarding the areas they would like to see researched in the future (n=289).

Theme	Subtheme	Example question(s)
When should we trim?	Frequency	*"How often should they be done?"* *"Is twice a year trimming enough?"*
	Timing in Management Cycle	*"Is pre-drying off trimming necessary?"* *"Would we benefit from a routine trim at 100 days calved?"*
	Concerns	*"What effect does routine trimming during the service period have on conception rates?"* *"What stress is caused by trimming and can it reduce fertility?"*
	Management System	*"We have robots, when is the best time to trim?"* *"Should the protocol differ between robot, housed and extensive systems?"*
How should we trim?	Method	*"Are some methods better than others?"* *"Is the Dutch Method best?"*
	Toe Length	*"What toe length is best to use when trimming?"* *"What is the optimum length of toe on larger cows?"*
	Equipment	*"Can grinders cause damage?"* *"Knife or grinder?"*
	Over-trimming	*"Is over-trimming as bad as never trimming?"* *"Is grinding the foot into shape a good idea?"*
Why should we trim?	Outcome	*"Is routine trimming of benefit?"* *"Will it reduce lameness?"*
	Economics	*"How much is not routinely trimming costing me?"* *"Cost analysis of frequency of foot trimming"*
	Trimming sound animals	*"Should cows be trimmed if they appear OK?"* *"Is mobility scoring better than routine trimming?"*
Who (i.e., which animals) should we trim?	Pre- vs post-calving	*"Do heifers benefit from trimming pre-calving, post-calving or not at all?"*
	Trimming pre-calving	*"Would trimming heifers at 20 months of age prevent lameness in 1st lactation?"* *"Is trimming heifers pre-calving economically viable?"*

When should we trim?

The most frequently asked questions with regard to preventive hoof trimming fell under this theme. There were four common subthemes related to the optimal timing and frequency of hoof trimming, which is reflective of the wide range of days in milk or trimming intervals that were evident in the responses to earlier questions in the survey. Questions within the subtheme relating to timing in the management cycle were the most frequently asked questions overall and were mostly concerned with when/if an early lactation and/or a dry off trim should be undertaken. Trimming around 100 days in milk featured in a number of the questions and how this compared to trimming at an earlier time point e.g., 60-70 days in milk.

Within the subtheme of 'frequency' the questions were mostly centred around the optimal number of trims a cow should have per lactation or whether trimming the whole herd at the same time (regardless of stage of lactation) was more or less effective at preventing lameness than trimming at set time points in her management cycle.

How should we trim?

The second most commonly asked questions related to 'How should we trim?' which incorporated subthemes on method, toe length, equipment and over-trimming. There were a number of questions regarding hoof trimming equipment in relation to overtrimming, specifically the use of 'grinders' (handheld rotating circular cutting discs). The general theme emerging was the concern that this was leading to too much horn being removed and/or overzealous shaping of the hoof wall. It was interesting to note that questions within this theme related to the power tool themselves and seemed disconnected from the operator i.e., the hoof trimmer.

Why should we trim?

Questions falling under this theme were as frequent as those on method. The majority were related to the benefit of preventive trimming as opposed to therapeutic trimming only e.g., 'Is there any benefit to trimming a cow's feet even if she isn't showing any signs of lameness' and 'Is mobility scoring regularly as effective in reducing lameness as implementing a 90-day routine trim?'.

Who (i.e., which cows) should we trim?

All of the questions in this theme related to the trimming of pre-calved heifers. Across all of the survey responses, the single most repeated question was 'Should I be trimming heifers pre-calving?'. This is perhaps reflective of the large proportion of respondents already preventively trimming at dry off and in early lactation and so logically the pre-calved heifers would be the only group excluded from protocols.

DISCUSSION

The objectives of the survey were firstly to determine the current preventive foot trimming practices of dairy farmers in GB and secondly to gather their opinions as to the key areas that should be focused on in future research on preventive cattle foot trimming.

Current Preventive Hoof Trimming Practices

The results of this study are the most comprehensive to date regarding the preventive hoof trimming practices of GB dairy farmers. The results confirm that preventive hoof trimming is a widespread practice amongst producers; the 82.4% reported is this study is higher than that indicated previously from a survey of 61 farmers which reported that 63.6% undertook preventive hoof trimming (73.6% if non-responses are excluded from their dataset)[3].

Timing of Preventive Hoof Trimming

Whilst a large proportion of the survey's respondents undertook preventive hoof trimming, there was a large variation in both its frequency and timing. This perhaps reflects the limited evidence-base in this area leading to uncertainty regarding best practice and the differences between farms and their management practices.

The large proportion of respondents undertaking preventive hoof trimming at/around dry off is perhaps not unexpected as this is widely recommended as the most beneficial timepoint to undertake a preventive hoof trim and in many regards is one of the more convenient times to implement this significant management intervention. However, despite our understanding of the aetiopathogenesis of claw horn disruption lesions and the significance of calving, the evidence-base to support this recommendation is limited. Whilst it has been reported that a preventive hoof trim

285 at dry off reduces the subsequent risk of sole ulcers[10], it has also been suggested that hoof trimming
286 may only be beneficial in primiparous animals with no history of chronic lameness[11].

287 Nearly half of respondents were undertaking a hoof trim in early lactation, although there was a
288 large range in days as to when this was undertaken. As with trimming at/around dry off, suggestions
289 for early lactation trims are based largely on our understanding of the aetiopathogenesis of claw
290 horn lesions and the significance of calving as a risk event. Routine intervention prior to expected
291 peak prevalence is hypothesised to reduce the risk of lameness developing. However, whilst this has
292 been reported to be associated with reduced herd lameness prevalence[3], there are no firm
293 conclusions to be drawn from the evidence-base. Two studies have incorporated an early lactation
294 trim into their study designs which focused on first lactation heifers. The first reported an increased
295 milk yield in heifers when they were trimmed at 50-80 days in milk and lame at the point of
296 trimming, when compared to non-lame heifers that didn't receive a trim[12]. The authors suggested
297 that targeted trimming of lame heifers may be a more cost-effective approach than trimming all
298 heifers regardless of lameness status. Similarly, the results of a later study also did not support a
299 preventive trim at 100 days in milk based on lameness prevalence[13]. However, 100 days in milk is
300 beyond the point of peak lameness prevalence[13] and therefore an earlier intervention may have
301 been more beneficial. The results of both studies do raise consideration as to whether greater
302 benefit may be achieved from attention to early detection and treatment of lameness in early first
303 lactation rather than routine preventive trimming per se.

304 A very low proportion of respondents were routinely trimming heifers pre-calving (5.9%) which is
305 similar to the 4.9% reported previously[3]. This may be a reflection of the results of the previous
306 studies questioning the value of trimming heifers at this time[12,13], which may have deterred farmers
307 from implementing it, or possibly logistical challenges when handling heifers pre-calving, however,
308 as discussed earlier it was a theme in the responses surrounding future research areas.

309 Only 5.2% of respondents were routinely trimming the entire herd at the same time at regular
310 intervals and the intervals reported varied from 16 to 24 weeks. Whilst trimming the whole herd at
311 once regardless of stage of lactation does not fit with the concept of trimming to the individual
312 cow's management cycle, there is an absence of evidence comparing the two different approaches.
313 It has been reported that there is a benefit to trimming the whole herd in spring and autumn as
314 opposed to just spring[1], however as discussed previously, this study did not differentiate between
315 preventive and therapeutic trimming therefore the true findings in relation to preventive trimming
316 only cannot be determined. Furthermore, it is difficult to extrapolate the findings to the UK due to
317 differences in management systems. Whilst the whole herd trimming approach has been adopted on

some farms, primarily due to convenience and management factors, further studies are required to determine how it compares to the more conventional approach of trimming at set points in the cow's management cycle e.g., dry off.

Who undertakes the hoof trimming

Whilst it may be expected that professional hoof trimmers would be undertaking a large proportion of preventive hoof trimming on farms, the results indicate that there are also a large proportion of farms where only farm staff are undertaking this task, or they are doing so in conjunction with a professional trimmer. Whilst almost half of the herds in management systems 1 and 2 only used farm staff for preventive trimming, this was observed to be lower in the other management systems where cows were housed for longer periods of time. There are a number of different factors that may influence why a herd may undertake their own hoof trimming or employ a contractor. Some of these factors may include biosecurity concerns, herd size, calving pattern, economic factors, staff skillset, on-farm facilities, hoof trimming protocols and lameness prevalence. It was beyond the scope of this survey to identify why these trends were observed, however, this is an important area to explore in future work.

There are few reports in the literature about who undertakes hoof trimming on farms in GB, however, it is interesting to note that a study undertaken in the 1990s reported that in some geographical regions the majority of preventive hoof trimming was undertaken by veterinarians[14]. Overall, the study reported that more hoof trimming was undertaken by veterinarians and farm staff in comparison to professional hoof trimmers. This is in contrast to both the results reported in this current study and previously[3] where veterinarians were not mentioned in response to who undertook the preventive hoof trimming and a higher proportion was undertaken by professional hoof trimmers. This observed change is most likely reflective of the changes seen in both the veterinary and cattle hoof trimming professions over the last twenty-five years. As a result of this profound shift, the implementation of preventive hoof trimming has almost completely become decoupled from routine veterinary management. This has consequences both in terms of oversight and legislation of this important intervention and should be considered by pertinent regulatory authorities.

Associations between Hoof Trimming and Farm Management

This study identified that herds with higher milk yields were significantly more likely to undertake preventive hoof trimming, although causality for this association could not be explored in this study. There was also a trend towards herds being more likely to implement preventive hoof trimming if they were housed for longer periods. It could be hypothesised that this association is related to the approach taken to overall management practices in these herds and attitude towards preventive strategies. Equally, it could be that those operating under more grazing based systems could see less hoof overgrowth due to the effect of extended grazing periods and thus the potential for more wear on the hoof due to longer walking distances. Since one of the aims of preventive hoof trimming is to correct overgrowth, it may be felt that there is less of a need to undertake preventive trimming.

Future Research Themes

Encouraging farmers to change behaviours or adopt new practices can be challenging[15] and therefore the rationale behind the participatory approach undertaken was that by involving farmers in steering research that applies directly to them, it firstly targets limited applied research resources to those areas considered important by end users and secondly it may then assist in driving engagement and implementation of any new practices that emerge as a result of that research[16].

Within the questions received on the research areas respondents would like to see addressed, there were many questions which have already been addressed through previous research including 'What is the best way to treat a sole ulcer?'[17] and 'Do lame cows become thin or thin cows become lame?'[18]. Whilst this was not useful for the purposes of setting future research questions on preventive hoof trimming, it does indicate that there is potential for improvement within knowledge exchange programmes involving the dissemination of research findings or perhaps an opportunity to engage farmers through a range of different methods to improve the uptake of new findings.

Whilst a third of the questions submitted were not related to preventive hoof trimming and therefore not relevant to this survey, they in themselves provide additional steer for future focus outside of the subject of preventive hoof trimming, for example, the questions put forward on digital dermatitis and footbathing highlight that this is still an area that farmers find challenging.

Given the high proportion of farmers already following preventive trimming protocols with defined timings it was interesting to observe that questions regarding timing and frequency were the most commonly asked (accounting for over a third of all questions relating to preventive hoof trimming). This perhaps reflects uncertainty over the benefit of currently recommended protocols and the need

to add to the current literature in this area in order to provide further evidence as to the benefit of interventions at specific times.

Some respondents raised concerns regarding trimming at specific time points, particularly in relation to fertility and the potential for the stress of trimming to influence service outcomes. Interestingly this has subsequently been addressed within the research[19] which may assist in increasing the uptake of any future research that indicates a benefit of trimming at an early point in lactation. One respondent was concerned regarding the impact of hoof trimming on abortion risk and this again has since been reported in the literature, with a Danish study including data from more than 1 million hoof trims demonstrating a small but statistically significant increase in risk when cows were trimmed in the last 4 weeks of gestation[20].

With regard to toe length, recent research indicated that a toe length of 9cm (when measured from the top of the perioplic horn to a sharp point at the toe) should be used to avoid overtrimming of the sole[21], however, the results from this survey could reflect either a lack of uptake of this research or confusion surrounding its interpretation with regard to the measurement landmarks[22]. The number of questions within the theme of overtrimming are perhaps reflective of wider concerns within the industry regarding the standard of hoof trimming and the adherence to best practice guidelines[23].

Whilst research has shown that regular mobility scoring with early, effective treatment can have a positive impact on mobility scores[24,25], recognition of early cases on farm remains a challenge[24,26]. Therefore, whilst questions surrounding the benefit of preventive trimming versus early intervention are important to address, it is perhaps more important to consider these as separate interventions and identify their effect as stand-alone practices. In addition, the survey results suggest that the cost-benefit of different protocols should be assessed within future research so that informed decisions can be made by individual farmers.

Limitations

Although the 358 responses received did not reach the target of 370 responses based on the sample size calculations, it was considered an adequate response rate for the purposes of the study. Whilst responses were received across all the different systems as described by AHDB, the proportion of farms in systems 3 to 5 were substantially higher than expected based on comparisons with data obtained from a random sample of 600 GB dairy farms (Garnsworthy, personal communication). This is not surprising given the subject of the survey and the data collection

methods were likely to attract more interest from farmers already engaged in preventive trimming. However, it does have the potential to introduce bias into the results which should be taken into account when considering the results.

A further limitation was the misinterpretation of the questions. Whilst this was a survey on routine preventive hoof trimming and this was repeatedly defined throughout the survey to mean the trimming of non-lame as opposed to lame cows, 166 questions of the 455 questions provided for future research areas on this subject were not related to preventive trimming. This is perhaps a reflection that respondents felt this was an opportunity to demonstrate all of the areas they would like further input/research on but could also reflect a need for an alternative description of preventive trim to highlight that this is more a of 'check' rather than an absolute requirement to trim the foot.

Whilst the survey has drawn useful conclusions regarding current preventive hoof trimming practices and associations with herd yield and potentially length of the grazing period, it is beyond the scope of this study to identify the casual links between these.

CONCLUSION

This study concludes that preventive hoof trimming is a widespread practice on GB dairy farms and is undertaken by both external professional hoof trimmers and internal farm staff. It has indicated that the key questions farmers have on this topic are based on whether trimming heifers pre-calving is beneficial, the optimal time in the management cycle to hoof trim and the optimal technique to use. It is therefore concluded that for maximum impact and uptake amongst farmers that these are the focus of future research.

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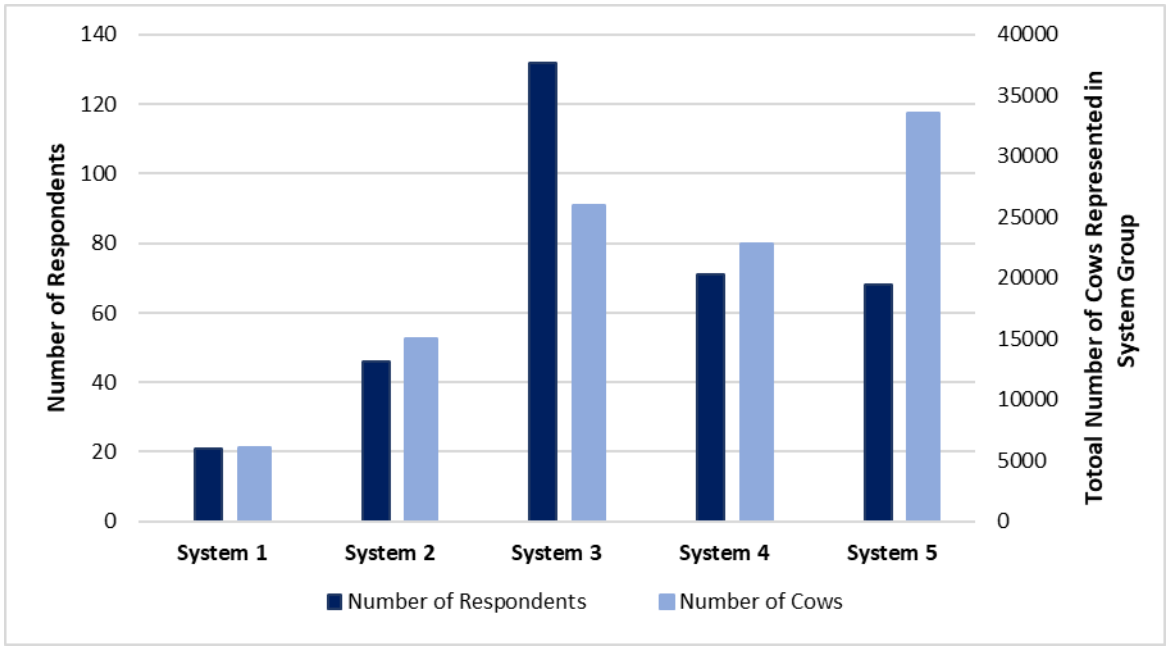

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511 Figure 1: Number of respondents from a survey on preventive cattle hoof trimming that adopted
512 each of the AHDB management systems (n=338) and the number of cows represented in each
513 system in the responses received. System 1: Spring calving, >274 days grazing. Limited
514 supplementary concentrates and conserved forage only fed during shortfall in grazed forage; System
515 2: Block calving. 183-274 days grazing. More use of conserved forage/supplementary concentrates;
516 System 3: Block/All year-round calving. 91-182 days grazing. Use of partial mixed ration and
517 supplementary concentrates; System 4: All year-round calving. 0-90 days grazing. Limited use of
518 grazed grass. Total mixed ration or partial mixed ration with supplementary concentrates; System 5:
519 All year-round calving. Housed. No use of grazed grass. Total mixed ration or partial mixed ration
520 with relatively high use of supplementary concentrates.

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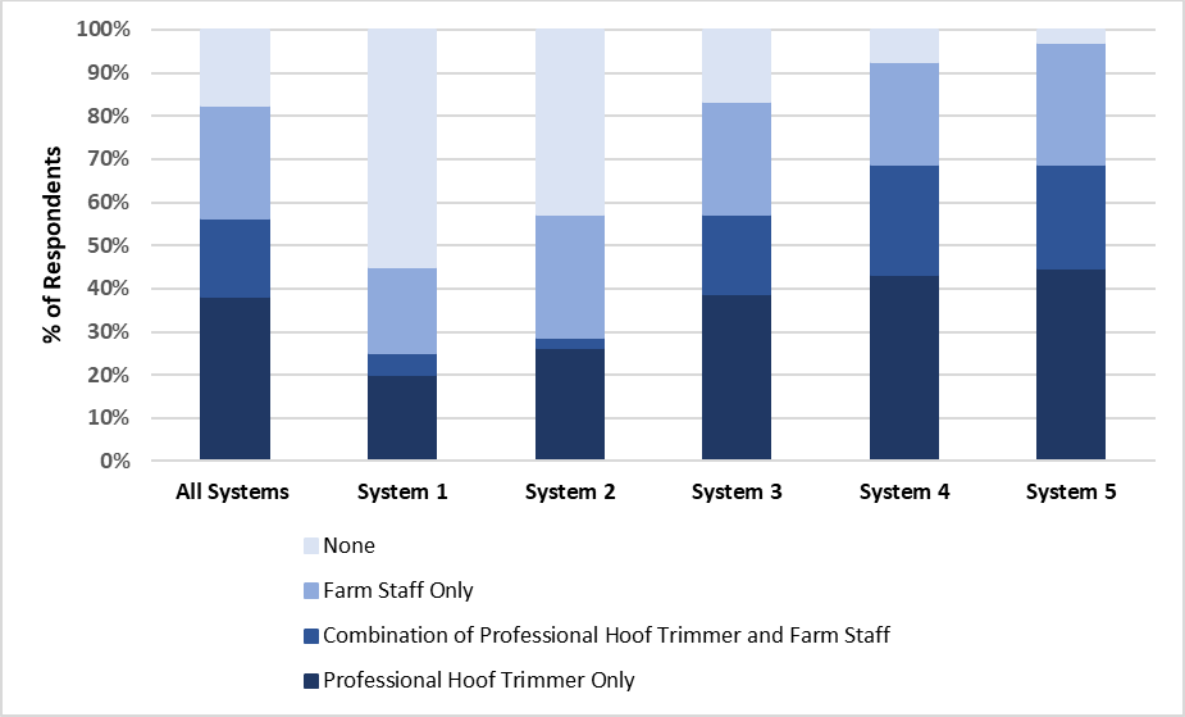

Figure 2: The proportion of respondents from a survey on preventive cattle hoof trimming that either did not undertake preventive hoof trimming or did, and used an external profession hoof trimmer, internal farm staff or a combination of both, to undertake this procedure on their farms (n=322). Results for all systems and by each individual AHDB management system are shown. See Figure 1 for definitions of system groups.

Figure 3: A bar chart showing the top five most frequent question subthemes on future research topics for preventive hoof trimming, which were provided as part of a survey of dairy farmers on preventive hoof trimming practices and research areas (n=289).