Evidence base behind foot trimming in UK dairy cattle

The Dutch Five Step trimming method (Toussaint Raven, 1985) has been an internationally recognised standard for cattle foot trimming for over 30 years. However, with the increasing size and productivity of UK dairy cattle, modifications have been proposed. Research evidence suggests that some modifications may be beneficial, particularly a deeper concavity of the sole of the lateral hind claw to reduce peak force and compression of the corium which can lead to injury during standing and locomotion. There remains considerable debate over optimal toe length and lack of clarity about from where the initial measurement is made. Furthermore, there is limited evidence on what is the optimal frequency of routine trimming. Current research supports the view that routine trimming using best practice standards is beneficial in terms of reducing lameness and promoting welfare, but this may not always be cost beneficial in herds with a low lameness incidence. It should also not be prioritised over lameness treatment.

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Preventative and corrective foot trimming can form an important part of dairy herd lameness control plans alongside routine foot disinfection (Bell et al, 2014) and management of the environment (e.g. cubicle comfort and stocking rates). This article summarises and appraises current literature on trimming technique and frequency. Papers were identified by searching databases including Pubmed, Science Direct, Mendeley, Google Scholar and Scout.

Foot trimming technique: critical appraisal of the evidence

A search of the scientific literature revealed five peer review papers and one notable conference paper investigating claw trimming technique (*Table 1*).

The most widely taught method of foot-trimming is the Dutch Five Step method (DFSM) (Toussaint Raven, 1985). The steps are listed in *Box 1* for hind feet, where pathology is more common (Murray et al, 1996). The medial hind claw is the most normally shaped, perhaps because it endures lower peak forces in locomotion (Tsuka et al, 2012). For this reason the medial claw is inspected first and overgrowth corrected if necessary and then used as the template for correcting overgrowth in the more commonly diseased lateral hind claw. In front feet the converse is true with the medial claw experiencing more disease, so the lateral claw is inspected first. Normal dorsal wall length was described as 'a good 75 mm for a Friesian' and normal sole thickness 5–7 mm.

The aims of the first three steps are to redistribute ground reaction forces and standing forces so they are borne more through the toes and walls and less on the central sole (sole ulcer site) and more evenly between the claws. Van der Tol et al (2004) found that the DFSM reduced the proportion of weight on the lateral claw from 80 to 70% in the live animal. The DFSM also increased the floor contact area by 45%, by removing proud areas, and decreased average pressure at the sole. Maximum pressure was unaltered but shifted towards the stronger white line. Weights were measured one leg at a time and it is possible that this created artificial weight bearing differences. Related to this, Philips et al (2000) found that cows had more grip following trimming, although the feet used in the study were unrepresentative of the UK average dairy cow.

Since the DFSM was developed, the UK dairy cow phenotype has changed significantly, increasing in size, weight and milk yield (representing the metabolic demand). It is therefore logical that adaptations to the DFSM are necessary. Proposed adaptations relate to dorsal wall length, medio-lateral claw balance and modelling.

One of the most common mistakes made by novice trimmers is to trim toes shorter than 7.5 cm from the top of the firm claw capsule. This can lead to over trimming of the sole, and has been reported to cause osteitis of the third phalanx (Thompson, 1998). It has also been implicated as a major cause in toe necrosis (Kofler, 1999). Archer et al (2015) advised increasing the generic minimum dorsal wall measurement stated within training materials to 85 mm (or 90 mm if trimmed to a point) to reduce the risk of over trimming

Table 1. Summary of the five peer-reviewed papers and one conference abstract describing aspects of claw trimming technique in cattle

Author, date and country	Study population	Study design	Outcomes	Key results	Study weaknesses
Phillips et al (2000), UK	36 distal limbs from nine heifers of mixed breeds at approximately 9 mo.	Cross-over intervention study comparing frictional characteristic of hooves before and after trimming.	Mean coefficient of static friction.	DFSM trimming increased claw grip: • Prior to trimming — 0.361µ • After trimming — 0.395µ *p*<0.001.	Heifers selected were unrepresentative of the national dairy herd: • 6 different breeds • 9 months old • 78 kg of load on each leg.
Van der Tol et al (2004), the Netherlands	Hindlimbs from five Holstein-Friesian cows from the experimental farm at Utrecht University.	Clinical trial comparing claw balance before and after trimming intervention. Each cow used as its own control.	Weight balance between medial and lateral claws.	Corrective trimming using the Dutch Five Step Method (DFSM) improved balance across the medial and lateral claws: Before trimming — lateral:medial (80:20) After trimming — lateral:medial (70:30). Trimming increased claw floor contact area by 45%, reducing average pressure, but not maximum pressure.	Small sample size. No follow up. Weight bearing from each leg measured at different times and added up to 110% of the animal's weight. All trims performed by a single trimmer, harder to extrapolate to the general population of trimmers.
Nuss and Paulus (2006), UK	Hindfeet from 40 Simmental cows at an abattoir.	Cross-over intervention study before and after a DFSM trim.	Toe and sole depth	In step 2 of the Dutch Five Step, Nuss et al found that when both claws are trimmed to the same depth, the lateral claw horn is significantly thinner (2.71 mm) than the medial (5 mm). Strict adherence to step 2 could lead to over trimming the lateral sole.	Beef cows are likely to have different trimming requirements to Holstein-Friesians. Lack of detail on how heel balance was judged.
Burgi and Cook (2008), USA	Personal experience.	Opinion based on field comparisons.	Proposed three adaptations to the Dutch Five Step.	1. Increasing the dorsal wall angle from 48° to 52° 2. Trimming the flat sole surface of the medial claw to the sum of the dorsal wall length and sole thickness (around 80 mm) 3. A deeper model of the lateral claw sole in step 3.	Lack of evidence. Impractical to measure dorsal wall angle.
Ouweltjes et al (2009), the Netherlands	400 Holstein herd	Randomised positive control trial with 5 groups, 4 free stall automatic milking: 1. Tx slatted concrete 2. Tx slatted rubber 3. Cx slatted concrete 4. Cx slatted rubber 5. Conventional milking Tx Concave (Norwegian) trimming with '3–5 mm of sole dug out over the claw bone'. Cx Dutch 5 step.	Lesion prevalence Claw dimensions Activity.	No significant difference between trimming methods and lesions. Cows on rubber had significantly fewer sole haemorrhages at the 3 month inspection (22 vs 48% prevalence).	Cows from one farm, with a low incidence of lameness.

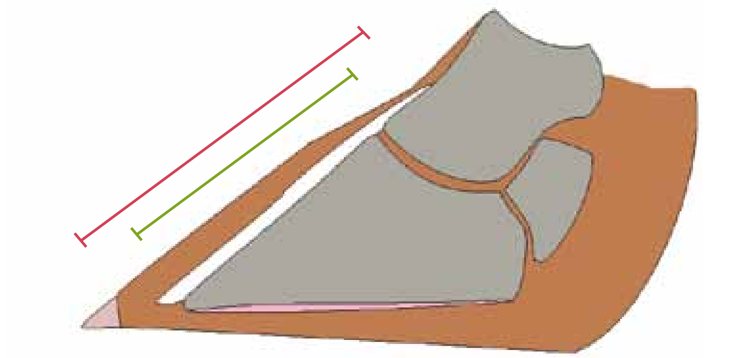
Archer et al (2015), UK	68 Holstein-Friesian dairy cows collected post mortem, 219 claws. From Scotland's Rural College Dairy Research Centre, Dumfries	Prospective cohort study. Medial and lateral claws of hindfeet were examined under computed tomography (CT).	CT images of hindfeet used to measure dorsal wall length and sole thickness	Strict application of steps one and two of the Dutch Five Step would cut 55% of claws too short. The authors propose that the minimum recommended claw length stated in training materials for all Holstein-Friesian cows should be increased to 90 mm. Minimum dorsal wall length increases by 1 mm per year of age.	When measuring the dorsal wall in step one, there is ambiguity over where the primary measurement should take place. This study measured from toe to the junction of perioplic horn and skin. Uncertainty about identifying landmarks taken from CT images for use in the live animal. All animals from the same farm. In vitro study, no evidence in the live animal. Lateral claws were included in the study which may be more variable in shape: 104 medial claws, 115 lateral. No account of dorsal wall curvature or disease which alters normal anatomical landmarks. Minimum dimensions might not relate to optimal (Blowey, 2015a)
Key: Tx = treatment Cx = control Heifers = primiparous cows					

by novices. The authors based this measure on the avoidance of thin soles (<5 mm) when toe length was measured from the most proximal aspect of the claw capsule at the junction between the periople (the shiny layer of claw capsule which extends most proximally) and skin. While this is different to the landmark used by DFSM trainers, this is undoubtedly safer than allowing for misinterpretation of anatomical landmarks. Dutch instructors typically measure from where the claw capsule becomes firm to pressure rather than the most proximal aspect of the horn capsule as illustrated in *Figure 1*. It is not advisable to trim the lateral hind claw to a measured length as it is frequently distorted by disease, deformity and trauma. Therefore dimensions and levels for trimming of the lateral hind claw can be better judged by skilled trimmers using the healthy medial hind claw (Van Amstel et al, 2006). For example the dorsal wall curvature seen in many lateral hind claws mean the healthy medial claw gives the best indication of appropriate sole depth (*Figure 2*). This assumption requires further investigation, but appears to hold true in Holstein Friesians except in severely diseased feet.

Box 1. Dutch five step method for trimming hindfeet

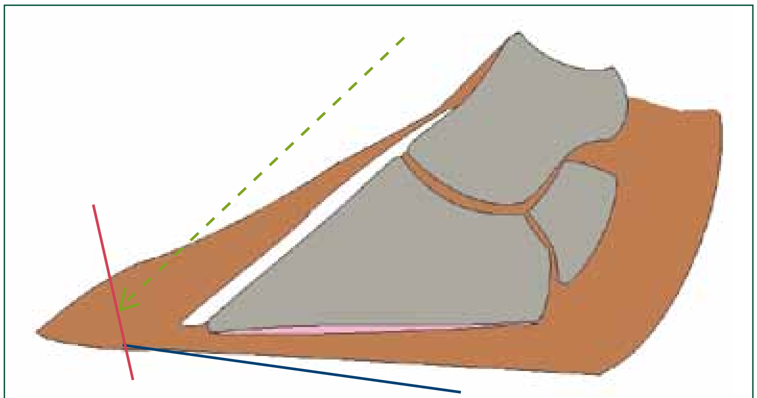
1. Measuring from where the claw capsule is firm at the coronary band, trim medial toe length to 75 mm. Pare the bearing surface down to 5–7 mm at the toe, sparing the heel.
2. Match the untrimmed claw to this length and balance levels with the medial claw across the toe and the heel. Judge levels from a stable toe triangle.
3. Model out the middle third of the sole, allowing a flow of muck and relieve weight off the sole ulcer site on the lateral claw.
4. Identify any lesions and alleviate weight off a painful claw
5. Remove loose or under-run horn and hard ridges.

(adapted from Mahendran et al, 2015)



Key:
Green — 75–80 mm measured from where the dorsal wall becomes palpably hard, cutting the toe to a step.
Red — 90 mm measured from the junction of perioplic horn and skin, and cutting the toe to a point.

Figure 1. The author's interpretation of where to measure on the medial claw.



Key:
Green — Use proximal dorsal wall to assess orientation of PIII for cut 1.
Red — Cut at correct length (75–80 mm)
Blue — Cut 2 until estimated correct thickness (balance across toes)

Figure 2. Correct estimation of toe length and sole depth with dorsal wall curvature in the lateral hind claw. Many professional trimmers remove the dorsal wall curvature before correcting length.

Nuss and Paulus (2006) demonstrated the risk of over trimming in step two when perfect medio-lateral claw balance was created in Simmental post-mortem limbs. However, this study highlights the importance of establishing breed and animal specific guidance on judging correct toe length and balance as continental beef breeds are likely to have larger claws and different conformation to Holstein-Friesian dairy cows. Furthermore, it is unclear if the stable toe triangle of medial claws was used to judge balance (more conservative) or if heels were balanced across the most plantar aspect of both heels.

Burgi and Cook (2008) recommend a deeper and wider model of the lateral claw in step three to reduce maximum pressure over the typical sole ulcer site. They report reduced incidence of interdigital skin lesions and sole ulcers, however there was no published evidence found in a literature search. Ouweltjes et al (2009) tested a similar concave sole and found no difference in prevalence of sole haemorrhage (SH) or sole ulcers (SU) between the trimming techniques. There is still a logical argument for this approach considering the anatomy of the claw, new bone formation at this site in older animals, and proposed pathogenesis of sole ulcers (Blowey, 2008; Weaver et al, 2013).

There are other methods described, which are not included in *Table 1* due to a lack of evidence, but worth noting. Blowey (2015b) describes 'The White-Line Method': a similar technique to the DFSM, where the toe length correction starts with the lateral hind claw, with the sole trimmed until there is restoration of the white line continuity at the toe. The dorsal wall is therefore cut longer (80–85 mm) than if the toe was cut to a step. Siebert and Eureka (2005) argue trimming soles flat to the distal phalanx (as in the DFSM) puts more pressure on the lateral claw sole. They propose 'The Kansas Adaptation' that soles should be trimmed to an angle of three to four degrees abaxial to axial wall to preserve weight bearing to the abaxial white line.

With respect to foot trimming timing there were six peer review papers found on the timing of foot trimming in relation to lameness prevention (*Table 2*).

For optimal foot health, Toussaint Raven (1985) has recommended twice yearly trimming, and Hulsen (2006) up to three times a year. Furthermore, Hulsen (2006) recommended trimming heifers prior to their first lactation. These views are supported by some published evidence.

A study by Manske et al (2002) found that twice yearly trimming was associated with significantly lower odds of lameness caused by sole haemorrhages (OR=0.86), white line disease (OR=0.71) or sole ulcers (OR=0.59) than one trim only. They also report significantly increased odds of a case of clinical lameness in the single trim group. No interaction was found between trimming success and stage of lactation suggesting that trimming can be beneficial at any time of the year. Due to the study design more cows with lesions are likely to have been presented at the autumn trim, leading to an underestimation of the positive effects the following spring.

Manson and Leaver (1988) reported a significant decrease in locomotion score and the number of reported cases of lameness, but no effect on milk production following foot trimming. Similarly Maxwell et al (2015) assessed a blanket heifer trim at 80 days in milk and found no significant improvement in milk yield. However, the study did report a benefit in heifers showing signs of lameness. Hence, they concluded it was sensible to target lame heifers for trimming both financially and in terms of improved welfare. Hernandez et al (2007) found a reduction in lameness incidence in late lactation following routine trims of non-lame cattle at mid lactation. This reduction is interesting but was not statistically significant (perhaps due to an insufficient sample size).

In the case of corrective trims, Leach et al (2012) found that early intervention reduced lameness prevalence at 4 weeks post

Table 2. Summary of the six peer-reviewed papers describing aspects of timing and frequency of foot trimming

Author, date and country	Study population	Study design	Outcomes	Key results	Study weaknesses
Manson and Leaver (1988), UK	48 early to mid-lactation British Friesian cows.	Randomised matched control trial with four groups: 1. No trim, low protein diet 2. No trim, high protein diet 3. Pre-trial Dutch 5 step trimming method (DFSM) trim, low protein diet 4. Pre-trial DFSM trim, high protein diet Weekly locomotion scores (with prompt treatment), hoof measurements and production values were recorded.	Prevalence and incidence of lameness. Lesion incidence. Heel bulb hardness. Production values.	High protein level significantly increased (p<0.001) and trimming significantly reduced (p<0.001) the prevalence of lameness. Untrimmed cows had significantly higher locomotion scores, lameness incidence and sole ulcer incidence. Net hoof growth was significantly increased by trimming (p<0.01). Trimming significantly reduced the hardness of the heel bulb centre (p<0.05) but no other part of the foot. There were no significant differences in production values between groups.	Smaller cows than the current UK average, mean live weight was 550 kg. Small sample size including 12 heifers.
Manske et al (2002), Sweden	A 2-year experiment on the effect of claw trimming on hoof health was performed in 77 Swedish dairy herds (3444 dairy cattle). Swedish red or Swedish Holstein.	Randomised positive-control trial: Tx = autumn and spring trim Cx = spring trim only.	Claw shape, presence of lameness and lesion type evaluated at the following spring trim. Lameness treatments between visits recorded.	At the spring trim, the treatment group had reduced chance of: • Lameness (OR=0.66) • Sole haemorrhage (OR=0.86) • Sole ulcer (OR=0.59) • White line disease (OR=0.71) No significant difference in incidence of heel horn erosion and digital dermatitis. Between trims the control group had an increased chance of an acute episode of lameness (OR=2.02). No significant reduction in digital dermatitis incidence (OR=0.96). No significant difference between trimming success and stage of lactation.	Different trimmers being used, potential for inconsistent technique. Different management systems to the UK. Not random, alternating allocation. More lame cows presented in the Tx group.
Hernandez et al (2007), USA	333 mid lactation (mean 204 days) Holstein cows from one farm in Florida.	Randomised negative control trial. Cows without apparent lameness were randomly allocated into: Tx = Foot inspection +/- trimming Cx = No examination All cows underwent routine foot trimming at drying off. Weekly locomotion scores to monitor lameness. Cows classified as lame in the first 200 days were excluded.	Incidence of lameness in late lactation. Cost benefit analysis.	No significant change in incidence of lameness in late lactation: Tx = 18% Cx = 24% p = 0.09 Costs based on 120 high yielding cows: Tx = \$41,000 Cx = \$48,000	Lame cows <200 days in milk were excluded from the study. Only one herd, too small a sample size to show a significant improvement. In the treatment group, only 11 cows (7%) had hoof lesions at intervention.

Table 2 (continued). Summary of the six peer-reviewed papers describing aspects of timing and frequency of foot trimming

Leach et al (2012), UK	4 commercial farms in the UK. 1152 cows, 575 Cx, 577 Tx.	Randomised treatment vs negative control trial: Tx = Treating cows within 48 hours of being detected at fortnightly locomotion scorings. Cx = Conventional approach was farm specific (e.g. regular foot trimmer)	Median time to trim in control group. Lameness prevalence. Milk yield.	In the control group the median time to trim after a case of lameness was 65 days. Early intervention significantly reduced prevalence of lameness 4 weeks after treatment. At 2 and 6–10 weeks this difference was not significant. No effect of early treatment on milk yield.	Only hindlimb lameness assessed.
Groenevelt et al (2014), UK	23 691 locomotion scores from 1195 cows on 4 UK dairy farms	Randomised matched treatment control trial. At the start of the study animals were matched by parity and stage of lactation and randomly allocated to control or treatment. Cows were enrolled when fortnightly locomotion score showed they went lame from being sound. Tx = Trimming at 3–48 hours after lameness Cx = No intervention Farmers blinded to the study, but allowed to treat Cx and Tx groups as they saw fit.	Locomotion score.	Trimming is linked to improved locomotion score within 2 weeks. 2 weeks after lameness: 78% of the trimmed group were sound compared with 66% of the control. 18 weeks after lameness: 41% of the trimmed group were sound compared with 13% of the control. This suggests follow-up trimming interventions may be beneficial.	Control group allowed for farmer treatment, which is inherently variable. Only hindlimb lameness assessed.
Maxwell et al (2015), UK	282 heifers from 8 farms in the UK 305 days yield >8500 litres	Randomised treatment vs negative control trial. Tx = A single foot-trim in early lactation (50–80d). Cx = no intervention.	Milk yield Cost benefit analysis.	No significant difference in 305 days milk yield between treatment (7727 litres) and control (7646 litres). 81 litres difference (£10.53 — based on margin of 13ppl) compared with the cost of the intervention (£15). Although not cost effective in the whole group, a targeted trim of lame heifers may be beneficial. This is also encouraged in terms of improved welfare.	Single intervention only, no follow up trims. Only production values recorded, no data collected on lameness. Trimming at peak lactation is an unusual timing. Not random, alternating allocation. Different trimmers were used, potential for inconsistency.

Key: Tx = treatment Cx = control OR = odds ratio ppl = pence per litre Heifers = primiparous cows

trim although at 6, 8 and 10 weeks the difference disappeared. Similarly, in a single intervention randomised control trial, Groenevelt et al (2014) showed that improvement in mobility following a lame cow trim was short lived. Reader et al (2011) showed that cows with a history of lameness were more likely to go lame compared with non-lame cows. All of these articles would support the idea of follow-up checks and repeated mobility scoring to identify cows most likely to benefit from treatment and ongoing monitoring.

So, while the literature is in agreement that all cows should be inspected routinely, there is surprisingly little evidence to determine an optimal frequency with which this should be done. An approach tailored to the individual cow (parity, season of calving and history) and on-farm conditions (season, bedding, housed or grazing) would seem most prudent. Regular foot inspection does not mean that all feet have to be trimmed; if the toe length is correct, claws well-balanced without sole overgrowth, there is even weight bearing and the cow is sound, then the foot should be left untrimmed. Over-trimming has been associated with sole ulcers (Divers and Peek, 2008), thin soles (Shearer, 2005) and toe necrosis (Kofler, 1999). If a cow is showing early signs of lameness then the feet should be inspected straight away, particularly as persistently lame cows (mobility scores 2 + 3) can lose 500–1000 litres of milk per 305 day lactation (Archer et al, 2010). Finally it may be prudent to schedule regular re-checks for cows with previous (historic) problems.

Cost benefit

Lameness has an estimated prevalence of 36.8% in the UK national herd (Barker et al, 2010), and is the third most expensive disease after mastitis and fertility disorders (Enting, 1997; Kossaibati and Esslemont 1997). Costs can be broken down into direct and indirect and are summarised in *Box 2*. All of these costs are affected by duration of lameness, with early intervention leading to quickest resolution. The biggest indirect costs are reduced yield and impaired fertility (although this is hard to

Box 2. Direct and indirect costs of lameness

Direct costs	Indirect costs
• Treatment	• Reduced yield
• Time/labour	• Effect on fertility
• Waste milk	• Increased risk of culling
	• Metabolic problems associated with decreased feed intake

quantify). *Table 3* summarises the literature for estimated indirect and total costs in the three most common causes of lameness, and a mean cost per lame cow.

Table 4 shows a brief cost–benefit analysis of two trimming approaches based on the above costs, per 100 cows per year. Cost of disease without proactive trimming interventions is estimated at £5839–24 042. The cost–benefit is hugely dependent on the lameness incidence, which varies widely across different studies (Barker, 2007). Assuming a whole herd 6 monthly trim reduces the lameness incidence (Manske et al, 2002), then the cost of lameness is £3847–15 868. Cost of claw trimming is estimated at £3000 per annum using £15 per trim (Maxwell et al, 2015) giving an overall cost of £6837–18 686. Based on the odds ratios (OR) reported, this approach would break even at roughly 25 cases per 100 cows per year.

The protocol used by Groenevelt et al (2014) of annual herd inspection, with follow-up trims for cows scoring 2 or 3 on fortnightly mobility scores, reports a greater reduction in lameness (OR 0.44). This reduces the cost of lameness to £2576–10 579. Three of the four herds had routine annual inspections, and one herd had none so the total cost of intervention includes 75 routine trims (£1125), plus interventions for 100 cows lame on mobility score (£1500), plus an estimated £300 per year for mobility scoring. With the cost of intervention at £2925 per year, the total cost of disease is £5501–13 504. This protocol breaks even at 15 cases per 100 cows per year.

Looking at the total cost of disease it is therefore more cost effective to target lame cows than routine herd inspection for herds with average levels of lameness (15–50 cases per 100 cows per year). However, chronically lame animals non-responsive to corrective trims should be culled. Many herds will have greater than 50 cases, which would improve the return on investment with routine claw inspection.

Conclusions

There is a lot of evidence to support the DFSM as a trimming technique although small modifications remain an area for further investigation. There are fewer papers that investigate regular routine foot trimming, none that show a detrimental effect and one showing a beneficial effect. Routine claw trimming is likely to be cost beneficial, but targeted intervention with mobility scoring could have more benefit, particularly in low prevalence and low incidence herds. Therefore trimming protocols should be decided locally, and should be worked out in conjunction with trimmers and veterinarians. Early intervention in cases of lame-

Table 3. Indirect costs of lameness

Lesion	Milk yield loss per 305 day lactation	Increased calving interval	Increased culling	Total cost per case
Digital dermatitis	0–57 kg[1]	+20 days (Argaez Rodriguez et al, 1997)	Low	£75.57[3]*
White line	370 kg[1]	+30 days (calving to conception interval) (Lucey et al, 1986)	-354 days less in herd (RVC student project — unpublished data)	£300.05[3]*
Sole ulcer	570 kg[1]	+40 days (Collick et al, 1989)	-457days less in herd (RVC student project — unpublished data)	£518.73[3]*
'Lame cow'	360 kg[2]	+60 days (Willshire 2012)	8.4x (Sprecher et al, 1997)	£323.47[3]*

*Costs will vary based on milk price, margin of purchased feed, cull and replacement costs. [1]Amory et al, 2006; [2]Green et al, 2002; [3]Willshire and Bell, 2009.

Table 4. Cost benefit analysis of two herd intervention protocols, per 100 cows per year

	Farmer only treatments	Whole herd twice per year[1]	Routine herd inspection + if lame or over-grown based on fortnightly mobility score (2 or 3)[2]
Reduction in Lameness (OR)		0.66[1]	0.44[2]
Lameness Incidence	17–70%[3]	11.2–46.2%	7.5–30.8%
Cost of lameness	£5839–24 0424	£3847–15 8684	£2576–10 579[4]
Prevention		200 routine trims	Routine trims (75) + treatments (100)[2] + time mobility scoring (£300)+
Cost of prevention	£0	£3000	£2925
Total cost of disease	£5839–24 042	£6837–18 868	£5501–13 504

[1] Manske et al, 2002
[2] Groenevelt et al, 2014
[3] Barker, 2007
[4] Willshire and Bell, 2009 — cost of a case of lameness at £343.47
*Based on the cost of a routine herd trim of £15 per cow (Maxwell, 2015)
+ Based on 90 minutes per 100 cows per fortnight, roughly 40 hours per year (£300)

KEY POINTS

- The majority of trimmers and studies are using a method based on the Dutch Five Step trimming method.
- When judging toe length, clarity is needed on where to measure from in step one and when to deviate (show caution) due to disease.
- Lame cows (mobility score 2 and 3) should be inspected immediately (within 48 hours) with follow up after 2–5 weeks.
- Lame cows should be targeted and prioritised over routine foot checks of sound cows. Chronically lame animals non-responsive to corrective trims should be culled.
- All cows in the herd should be inspected at a frequency determined by herd conditions, season and individual cow factors, ideally using mobility scores.
- Routine foot checks are cost beneficial for the herd with average levels of lameness (15–50 cases per 100 cows per year). Targeted intervention is likely to be more cost beneficial for low incidence herds, and high incidence herds may benefit from more routine interventions.

ness has been shown to produce good results, however follow-up trims are recommended by many professionals. There are no published reports on efficacy of follow-up inspections, and this recommendation is largely based on opinion. LS

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