Blank panels in sheep yards encourage sheep to jump

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Abstract

The lateral sides of two adjacent forcing pens and the sides of the races were clad with plywood to improve sheep flow in yards at AgResearch Lincoln farm. Following this, two flocks of yearling sheep were run through the yards every two weeks for drafting. One flock was exclusively male (n = 223), while the other was all female (n = 248). On the first occasion, a number of yearlings jumped out of the forcing pen. This had not been observed in previous years, so the number jumping was recorded. A non-parametric time-to-event analysis method, the Kaplan-Meier estimator, was used to obtain cumulative incidence functions of sheep jumping. If they were to jump out of the pen, the sheep had two choices, a pipe rail fence (or gate) or a blank plywood wall. During 14 handling events, 1% of yearlings jumped the pipe rails whereas 7% jumped the plywood wall ($P < 0.001$). These yearlings chose to jump a fence they could not see through. Clearly there are many variables that could be tested in this model.

Keywords: sheep behaviour; yard materials

Introduction

Sheep-yard designs are described in some textbooks (Barber & Freeman 1986; Casey & Hamilton 1990) and several published papers (Franklin & Hutson 1982; Hargreaves & Hutson, 1997). This information is generally about the layout of sheep yards. The internet carries a wealth of information about sheep-yard design with varying degrees of veracity and there is also literature on sheep behaviour in yards (Dove et al. 1974; Hutson 2007). However, there is scant literature on the form sheep yard panels should take.

There are some reports that aid decisions on where to use blank panels or more open forms for yard fences. Riddolls (1958) noted that sheep should not be able to see through the fence leading into the drafting race because they may baulk. Hutson & Hitchcock (1978) reported that sheep ran through a race way faster when the sides of the race were blank than when the sides of the race were open. For cattle yards, Grandin (1980) also advised the use of blank fences rather than rails, so that the cattle were not distracted or frightened by anything outside the yard or race. Franklin & Hutson (1982) reported that sheep moved faster towards an open wire mesh, a mirror, decoy or model sheep, or photographs or films of sheep, than towards a blank race end. Barber & Freeman (1986) suggested that the drafting gates in particular should be made of pipe rails, because sheep are less likely to baulk than with blank gates, the open gates make the drafting race appear shorter and the previous sheep moving away from the draft remains visible to the following sheep. The caption of one figure in a report by Hamilton (1990) noted that rail fences allow better access for dogs on the outer curve of a "bugle" shaped yard, while the inner curve should be solid to obscure the handler. Hutson (1980) suggested that if the outer curve is blank, the sheep will perceive they are moving towards a dead end, while Hutson (2007) noted only that judicious use of blank and open panels can direct vision and movement. Finally, if sheep or working dogs jump a fence made of either pipe or wooden rails and get their leg caught, there is a good chance of injury and often a broken leg. There are thus good reasons to use blank panels.

This report presents data from chance observations of a behavioural pattern the authors have previously seen but not experimented on. Although this report tests the hypothesis that sheep will jump one type of fence panel in preference to another, the most important reason for publishing this information is to begin the conversation.

Materials and methods

Working on the advice of Ridolls (1958) and experience of the phenomenon reported by Hutson & Hitchcock (1978), the farm manager at AgResearch Lincoln enclosed the sides of the forcing pens of a set of pipe-rail yards with plywood panels (Figure 1). This was a retro-fit aimed to improve sheep flow in the covered yards. Immediately thereafter, the yearlings of two long-term breeding trials were brought into the yards and a group jumped out over the newly clad fence. These particular sheep were naïve to these yards, but this was unprecedented behaviour for these two genotypes in these forcing pens. The number of sheep that jumped the fences on this and subsequent occasions was recorded every two weeks from the middle of August to late December 2013.

The sheep were run as one mob of yearling ewes and one mob of yearling rams from two breeding experiments. The ewes were candidates for replacement in a flock of composite sheep selected for easy-care traits reported elsewhere (Scobie et al. 2007) or for two selection lines of New Zealand Wiltshire sheep also described elsewhere (O'Connell et al. 2012). The flock of males consisted of Wiltshires (n = 74) and composites (n =149). The female flock consisted of Wiltshires (n = 97) and composites (n = 151). The rams were candidates for sires in the breeding experiments, and though smaller numbers of sires were required than ewes, almost all males weaned in the Wiltshire flock were retained as candidates until shearing on the

11th of September. Wiltshire ram numbers were reduced dramatically by culling on Monday the 7th of October and only a small number remained (n = 10). A small number of surplus Wiltshire ewes were also culled at this time but most remained (n = 88). Both sexes of composite were shorn on the 26th of November and numbers remained constant following shearing.

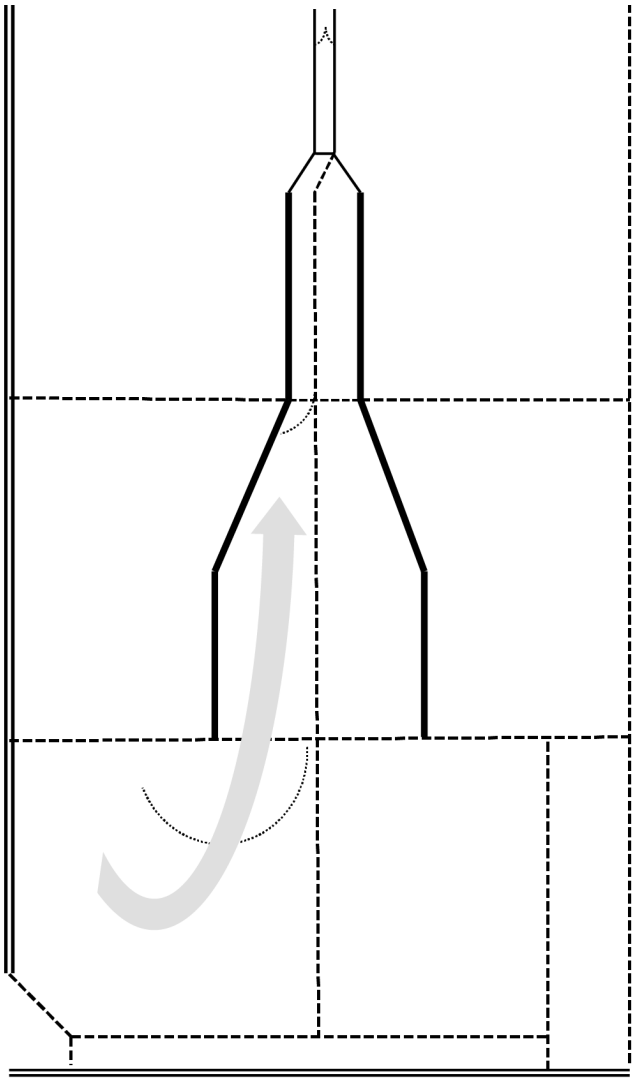

Figure 1 Layout of the covered sheep yards at AgResearch Lincoln farm. Heavy solid lines on the sides of the forcing pen and working race indicates the panels that were clad with plywood. Dashed lines identify the pipe rail fences, while the light solid lines along the drafting race and entrance indicate the panels that were originally blank with flat sheet steel. Double lines at the perimeter of the yard indicate corrugated-iron walls of the covered yard. The grey arrow indicates the direction of sheep flow during all handling events.

Sheep were always handled through the same pathway from the holding pen and into the forcing pen (Figure 1). The forcing pen on the left side was used exclusively and no sheep were present in the right side forcing pen or race. Sheep dogs were not used during any handling event when records were kept, but the distance, route, time of day, shepherd, vehicle and presence of dogs varied on the journey into the yards.

Analysis

The analysis used a non-parametric time-to-event analysis method, the Kaplan-Meier estimator, to obtain cumulative incidence functions of sheep jumping across the observed period for the two fence-panel types. A log-rank test was then used to compare the two cumulative incidence functions. The analysis was carried out using statistical software Minitab version 16 (Minitab Inc, www.minitab.com). The analysis used the sum of male and female Wiltshire and composite sheep groups across the period from the 15th of August to the 18th of December 2013) i.e., each sum was calculated on each date as:

Number that jumped = (Wiltshire male + female) + (composite male + female).

The Kaplan-Meier estimator remained unaffected by the change in number of sheep that occurred on the 7th of October.

Results

Date and numbers of sheep jumping are shown in Table 1. Not all mobs of sheep were handled on all dates, and black sections in the table indicate when a particular group was not brought into the yards. On almost every occasion that they were handled, at least one sheep jumped. Figure 2 shows the cumulative incidence functions for the pipe rail and blank plywood panel designs obtained from the Kaplan-Meier estimator. These two functions were statistically significantly different (P<0.001 from the log-rank test).

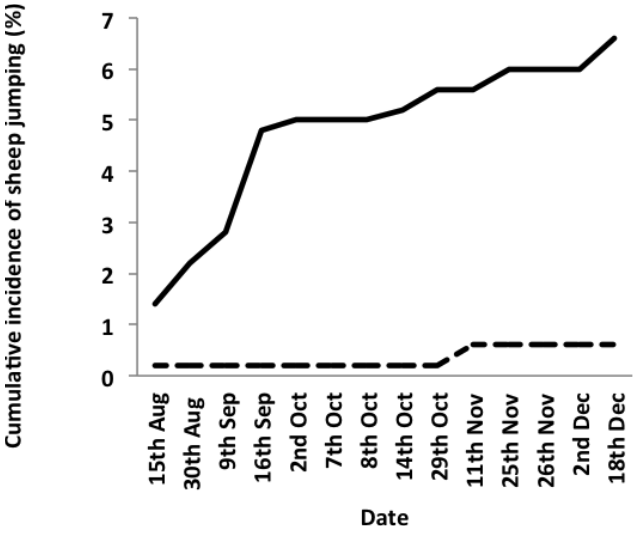

Figure 2 Cumulative incidence functions of sheep jumping by yard-panel design. The solid line indicates the proportion of sheep jumping blank panels while the dashed line indicates those jumping pipe rail panels.

During 3001 handling events involving females, 24 of them jumped while only 12 males jumped during 2238 handling events. This difference was not significant (P = 0.311) according to the Fisher's exact test. However, there was weak evidence (P = 0.058) that composite sheep were more likely to jump (28 jumped during 3300 handling events) than the Wiltshires (eight jumped during 2004 handling events).

Table 1 Yearling sheep that jumped blank plywood or pipe-rail yard panels at various dates in 2013. Empty cells occur where no sheep jumped, while black cells indicate where a particular group was not yarded.

Date	Blank plywood				Pipe rail			
	Wiltshire		Composite		Wiltshire		Composite	
	Male	Female	Male	Female	Male	Female	Male	Female
15 Aug				7				1
30 Aug	1		3					
9 Sep	3							
16 Sep			1	9				
2 Oct				1				
7 Oct								
8 Oct								
14 Oct			1					
29 Oct				2				
11 Nov					1*		1*	
25 Nov			1	1				
26 Nov								
2 Dec								
18 Dec		3						

* rear gate of forcing yard

Discussion

Blank plywood panels were used in an attempt to improve the rate of flow of sheep through yards. However, it appears that blank panels encourage sheep to jump, perhaps with less chance of injury from the rails. Our unpublished observations in yards on AgResearch and private farms support this conclusion. Whether the rate of flow was improved was not recorded, but progress was slowed by the need to return jumping sheep to the forcing pen and then into the race to evaluate them for the breeding experiments.

An Australian sheep farmer (Dwyer, 1990) observed that larger sheep tended to jump out of his race because the blank panels were too low (800 mm). This is one of the few references in the literature on jumping, and although only anecdotal evidence, jumping must have been sufficiently frequent to be noted. Australian industry advice suggests that yard fences should be 800 to 900 mm high so that operators and their dogs can get over the fence easily (Australian Wool Corporation 1980). The fences in the AgResearch Lincoln yards were 860 mm high both before and after cladding with plywood.

The ways in which this experiment could be improved are numerous. The sheep observed here were run in sex-based mobs and there were relatively few sheep jumping, so the results for both breeds and both sexes were combined for the Kaplan-Meier test. The frequency of jumping events might be increased with a lower panel height, or trained sheep might yield greater numbers of events. Individuals did seem more likely to jump than their flock mates, but identities were not recorded. The sheep were naive to the yards on the first occasion, but not on subsequent occasions. It would be better to work with naïve young sheep, record identity and structure repeat observations to test a variety of fence-panel types.

Vandenheede & Bouissou (1993) found that rams were less fearful than ewes. Although there was no significant difference between the sexes used here, the females tended to jump slightly more frequently. Assuming fear was the stimulus to jump the fence, these sheep may behave like those of Vandenheede & Bouissou (1993) if the genders were combined. In the practical New Zealand context, it may be useful to know how different genders act, but large flocks of yearling rams used here are not common on commercial farms. The predominant sheep type in New Zealand is the adult crossbred ewe, and their smaller, naïve, more active and possibly fearful lambs, and most sheep-yard panels should be designed with these in mind. Replacement females are an important stock class though, and they are frequently traded, and therefore, naïve to the handling facilities of the purchaser, which should be designed with sheep behaviour in mind.

Whateley et al. (1974) reported differences in the speed of movement through yards depending on breed, though none of the breeds they used were observed here. In the current experiment, an outbred composite was slightly more likely to jump than the relatively inbred strain of Wiltshire used. We do not suggest that all composites will be more likely to jump, nor that all Wiltshires are less likely to, but it would be interesting to understand the response of other breeds. It may very well be possible to phenotypically or genetically select against sheep that jump.

After jumping the blank panel, the sheep were in a pen that had one shed wall clad with corrugated iron and some transparent material to let in light. The plywood was permanently located on one fence of the forcing pen and the choice of fence to jump was therefore, not randomised with respect to the surroundings. Other authors suggest sheep like to move towards light or into a lighted area (Hitchcock & Hutson 1979; Kilgour & Dalton 1984; Lynch et al. 1992), however, these sheep were most frequently jumping away from the brighter, unclad side of the covered yards and perhaps not considering an ultimate escape but only immediate escape. The adjoining yard was also blank on the far side and all but one sheep may have perceived that there would be no benefit jumping the pipe rail fence into that pen. Two sheep jumped the pipe rail gate back into the holding pen from which they had come. This holding pen was also brighter due to a doorway. More rigorously designed experiments should be undertaken to confirm these findings, and expand them to test other materials and perhaps more effective panel designs. Indeed, Hargreaves & Hutson (1997) proposed that blank panels might lead to better distribution of sheep in storage areas and open sides might cause faster transit through handling pens, quite the opposite of current dogma.

One case-study farm had made what they called “blind panels” which were tarpaulins made to fit pipe-rail panels of portable yards to turn them blank (Muller et al. 2011), in essence the same as the transition from pipe rails to plywood panels. This Australian farmer placed the portable yards according to the terrain and the location of the sun and

kept notes about what did and did not work with respect to sheep flow and referred back to them. Compared with our covered yards, these portable yards were set up in the open, so shadows were important, and the sheep could potentially be naïve to the yards each time they were set up. If sheep flow was not efficient, this farmer removed the blinds and moved them to another panel. There was no mention of whether the blinds caused the sheep to jump more often so this farmer was contacted (Bruce McCallum pers. comm.). The fences were 1100 mm high and he had no problem with Merino sheep jumping the blank panels.

The initial cost and depreciation are important considerations when building or repairing sheep yards Lollback (1990). Grandin (1980) suggested that mistakes are difficult to rectify once facilities are built, but we would disagree. The plywood panels were cheap and quick to add and could be easily removed, and the tarpaulins discussed above would make this even easier. If existing yards are causing frustration or time could be saved, retrospective changes may very well pay off.

There are a number of permanent and portable sheep yard manufacturers, and designs have undergone revolutions with time. One designer was concerned with injuries from pipe rail yards and produces panels with vertical steel slats which are claimed to "… stop the sheep from wanting to jump or smash themselves at the fences" (https://agrihq.co.nz/article/combi-clamp-for-stock-handling). Considering behaviour has the potential to improve throughput, improve welfare and ultimately reduce handling costs.

The farm manager at AgResearch Lincoln is happy that the flow of sheep has improved and the small number of jumping sheep is a minor annoyance. Provided there is no increase in injuries of sheep, man or dogs then this improvement is worthwhile. In an article entitled "Improving sheep flow in races" (Hamilton 1990), no comment was made about blank panels or jumping in the text, though some useful tips about light, noise, temperature and time of day were made. Most importantly Hamilton (1990) suggested; "If the sheep will not flow, get on your hands and knees and get a sheep's view!" We could not agree more, but we should first experiment to find what it is that the sheep are looking for.

Acknowledgements

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References

Australian Wool Corporation 1980. Working races. Wool harvesting note No. 1.131.

Barber AA, Freeman RB 1986. Design of shearing sheds and sheep yards. Inkata Press. Melbourne. 212 pp.

Casey MF, Hamilton GR 1990. Yards 'n' Yakka. Kondinin group. Perth. 382 pp.

Dove H, Beilharz RG, Black JL 1974. Dominance patterns and positions of sheep in yards. Animal Production 19: 157-168.

Dwyer 1990. Bugle yards with many problems. In: Casey MF, Hamilton GR ed. Yards 'n' Yakka. Kondinin group. Perth. p 54.

Franklin JR, Hutson GD 1982. Experiments on attracting sheep to move along a laneway. III Visual stimuli. Applied Animal Ethology 8: 457-478.

Grandin T 1980. Observations of cattle behavior applied to the design of cattle handling facilities. Applied Animal Ethology 6: 19-31.

Hargreaves AL, Hutson GD 1997. Handling systems for sheep. Livestock Production Science 49: 121-138.

Hamilton HM 1990. Improving sheep flow in races. In: Casey MF, Hamilton GR ed. Yards 'n' Yakka. Kondinin group. Perth. pp 202 -206.

Hitchcock DK, Hutson GD 1979. Effect of variation in light intensity on sheep movement through narrow and wide races. Australian Journal of Experimental Agriculture and Animal Husbandry 19: 170-175.

Hutson GD 2007. Behavioural principles of sheep-handling. Chapter 10 In: Grandin T. ed Livestock Handling and Transport CABI publishing Wallingford UK. pp. 155-174.

Hutson GD, Hitchcock DK 1978. The movement of sheep around corners. Applied Animal Ethology 4: 349-355.

Hutson GD 1980. Sheep behaviour and the design of sheep yards and shearing sheds. In: Wodzicka-Tomazweska M, Edey TN Lynch JJ ed. Behaviour in relation to reproduction, management and welfare of farm animals. University of New England Publishing Unit, Armidale, NSW Australia. pp. 137-141.

Kilgour R and Dalton C 1984. Livestock behaviour: A practical guide. Methuen Publications. Auckland.

Lynch JJ, Hinch GN and Adams DB 1992. The behaviour of sheep: Biological Principles and implications for production. CSIRO Publications, East Melbourne. pp 85 – 91.

Lollback MW 1990. Selecting sheep yard material. In: Casey MF, Hamilton GR ed. Yards 'n' Yakka. Kondinin group. Perth. pp. 338 - 340.

Muller F, Lawson P, Nugent T 2011. Blind panels make for easy work. Farming Ahead No 230. p. 59.

O'Connell D, Scobie DR, Hickey SM, Sumner RMW, Pearson AJ 2012. Selection for yearling fleece weight and its effect on fleece shedding in New Zealand Wiltshire sheep. Animal Production Science 52: 456-462.

Riddolls AW 1958. Chapter 7 Farm structures. In: Farm Engineering. Government Printer, Wellington. pp. 331 – 346.

Scobie DR, O'Connell D, Morris CA, Hickey SM 2007. A preliminary genetic analysis of breech and tail traits with the aim of improving the welfare of sheep. Australian Journal of Agricultural Research 58: 161-167.

Vandenheede M, Bouissou M F 1993. Sex differences in fear reactions in sheep. Applied Animal Behaviour Science 37: 39-55.

Whateley J, Kilgour R, Dalton DC 1974. Behaviour of hill country sheep breeds during farming routines. Proceedings of the New Zealand Society of Animal Production 34: 28-36.