WOOL
HARVESTING
NOTE

NO: 1.01

DECEMBER 1980

SHEEP BEHAVIOUR AND THE DESIGN OF SHEEP YARDS AND SHEARING SHEDS

Acknowledgement: The material for this Wool Harvesting Note is adapted from a paper of the same title written by G.D. Hutson of the School of Agriculture and Forestry, University of Melbourne. The paper appeared in "Behaviour in Relation to Reproduction, Management and Welfare of Farm Animals" edited by M. Wodzicka - Tomaszewska, T.N. Edey and J.J. Lynch, published by the University of New England Publishing Unit, 1980. It is reproduced by kind permission of the author and publisher.

In recent years farmers have shown increasing interest in reducing the labour and costs associated with all aspects of sheep and wool handling. Sheep movement has been regarded as one area where greater efficiency could be easily achieved since sheep can move themselves without human assistance. However, despite this potential for improvement there have been few innovations in modern sheep yard or shearing shed design which have produced significant labour savings in sheep movement. Many traditional and contemporary views on sheep behaviour are often cited in support of a particular design, but a recent evaluation has shown than some of these views are inaccurate (Hutson, 1980a). Nevertheless, careful consideration of sheep behaviour can lead to improvements in conventional yard and shearing shed design.

SHEEP YARDS

Sheep yards have four main functions - to store, move, draft and handle sheep (Elliott and Ransom, 1975; Hall, 1976). The traditional design for sheep yards is based on a rectangular plan whereas modern yard designs tend to be circular (Anon., 1977; Barber, 1977a; Barber, 1977b; Jelbart, 1977). Three types are common - bugle, semi-circular and circular. The main design changes incorporated into modern yards are the transfer of the storage function of yards to small holding paddocks, and improvements to the handling race, which is often raised above ground level, adjustable in width, and covered for operator comfort and equipment storage. Sheep behaviour is important in relation to five aspects of yard design.

Site

The location of yards is usually predetermined by the position of the shearing shed, and it is generally recommended that yards be sited on slightly sloping ground to allow good drainage (Anon., 1974). However, sheep movement is better on the flat than up or down inclines (Hitchcock and Hutson, 1979b) and so the direction of movement should be across the slope rather than uphill or downhill. To avoid dead ends, the direction of movement should also be away from any buildings (Kilgour, 1977), and from south to north, so that during drafting the operator has the sun behind him (Anon., 1974).

Layout

Modern circular and bugle-shaped yard designs are based on the assumption that sheep move more readily around corners (Ballantyne, 1975; Hall, 1976; Ransom, 1976; Barber, 1977a). However, Hutson and Hitchcock (1978) have shown that in 1.5 m wide races sheep move better straight ahead than around corners and only when sheep move in single file do corners appear to be superior to straight races. This suggests that the reason these designs may work is not related to movement around corners, but to other factors. There appears to be two possibilities. Firstly, the operator has easy access to the sheep should they baulk or stop, without having to climb over gates or fences as in some traditional designs. Secondly,

This Wool Harvesting Note was financed from Wool Research Trust Funds as recommended by the Australian Wool Corporation.

Agdex 430/722

although the sheep may see the operator they do not move directly towards him until they enter the draft, whereas in traditional designs they are always moving directly towards him. Improvements to traditional designs could be made by screening the operator and allowing him better access to jammed or baulked sheep via a laneway.

Another important design problem is the relative position of the drafting race and the handling race. As a rule of thumb, I suggest that the most important design criterion for yards is that sheep should have a clear, unobstructed view of the exit, or towards where they are meant to move. This means that in general the draft should not precede the handling race as this obstructs the sheep's vision towards the exit. A better alternative is where the draft and handling races have a separate entrance. However, this raises another problem related to learning. The advantages of handling sheep in the same set of yards is that they learn where they are meant to go. Sheep familiar with a particular route and direction through yards move better than sheep unfamiliar with the yards or sheep familiar with a different route or direction (Hutson, 1980b). Therefore, ideally sheep should travel the same path through yards for all handling operations, and not go along a different route to the draft and handling race. This could be achieved by drafting off the end of the handling race. If rigorously applied this view also indicates that sheep handling in yards should not be separated from the shearing or crutching operation and that all sheep handling should be done in the shed (e.g. Vernon, 1974). The dip should also be placed along the route sheep usually travel through yards rather than relegated to a separated area.

Forcing pen and race entrance

An advantage of modern circular yard designs is that the forcing pens are long and narrow. This allows greater control over sheep than in traditional designs, where pens are often wide and square to allow for sheep storage. The advantage of a narrow pen shape is that when a forcing stimulus is applied, e.g. a man appears or a dog barks, sheep can only run in one direction.

A disadvantage of all yard designs is that sheep are funnelled into the drafting race entrance and if two sheep enter at once they become jammed. An alternative is for the race entrance to be off the side of the forcing pen, and some distance (about 1 m) from the end. Sheep are then not forced into the entrance and if a particular sheep is hesitant to enter there is room for it to step aside (Hutson and Butler, 1978).

Shadows

It is often noted that sheep tend to baulk or remain stationary if they can see shadows on the ground ahead of them (Jones and Bottomley, 1976; Jelbart, 1977). I have confirmed this observation in a small experiment where sheep in a Y-maze were given a choice between moving down a normal 1.5 m wide race or a race with a 5 cm wide shadow across it. The shadow was simply a piece of flat sheet metal painted black and placed on the race floor 15 cm from the start. Eight out of nine groups of sheep moved down the normal race, clearly indicating an aversion to the shadow (Hutson, unpublished data). Kilgour (1976) has noted that the situation in which a sheep casts its own shadow ahead also should be avoided.

Shadows are difficult to control unless yards are completely covered. A north-south alignment may reduce the occurrence of shadows, but apart from doing all handling in the shed, there seems to be no easy solution to this problem. If shadows present a serious problem in the draft or handling race movable curtains or screens may be useful.

Open and covered panels

The position of open and covered panels in yards is crucial. In general, sheep run faster through races with covered rather than open sides (Hutson and Hitchcock, 1978). This seems to be because the covered sides restrict peripheral vision and channel the sheep's sight towards the exit, whereas with open sides distractions may be visible in various directions. Covered sides can also be used to obscure the sight of other sheep and of the operator. Thus, the sight of stationary sheep will slow down the movement of sheep through an adjacent race (Hutson, 1980a) and covered sides should be used in key areas where sheep are required to move past other standing sheep e.g., the forcing pen, drafting race and handling race. However, in curved races, covered sides should be used with care as sheep will have the impression of moving towards a dead end. The material which should be used for covered panels is open to debate, but steel sheeting is probably unsuitable because of the loud drumming noise it makes when sheep run into it.

SHEARING SHED

The traditional design of a shearing shed is known as "across-the-board". Sheep enter the shed and reach the shearing board via a series of pens (sweating, forcing and catching) and after shearing leave via an exit in the shed wall adjacent to the shearer. Modern shed designs are "centre-board", where shorn sheep leave via a return race or chute underneath the shed. Most recent innovations in shed design have related to wool handling and preparation, e.g. raised board, Fawcett mat, round wool tables (Freeman, 1977), and apart from front-fill catching pens, there have been few changes in relation to sheep movement. There is a general feeling that conventional shearing is developed as far as possible (e.g. Murphy, 1977) and that new wool harvesting innovations will involve different shearing methods (e.g. chemical shearing) and therefore different sheep delivery systems. However, until that eventuates, improvements in design must be directed towards the conventional system where sheep are penned-up and shearers catch from a pen. There are four areas where the behaviour of sheep is important in shed design.

Entrance

Shearing sheds are raised off the ground primarily to allow faeces to fall through the grating floor. As a consequence the entrance into the shed must be an incline. However, sheep movement is better on the flat than up an incline, and sheep move more slowly as the angle of the incline increases (Hitchcock and Hutson, 1979b). The solution to this problem is probably to use a long ramp with a shallow rise rather than a short ramp with a steep rise. Sheep also have well developed stereoscopic vision (Clarke and Whitteridge, 1973) and good perception of depth, as shown by the instinctive fear response of lambs to a visual cliff (Walk and Gibson, 1961). It is therefore advisable to cover the ramp sides to prevent sheep from looking out. The type of ramp floor seems unimportant so long as sheep can get a good grip with their feet (Hitchcock and Hutson, 1979b).

The visual response of sheep to the shed entrance is also important, as they must move from the brightly lit area outside the shed into the generally dark interior, as well as towards what appears to be a dead end. Hitchcock and Hutson (1979a) demonstrated that sheep move more readily into brightly lit areas which suggests that sheds should be well lit to encourage movement both into and within the shed. Sheep movement is also better where they have a clear and unimpeded view of an escape route or exit. This suggests that the ideal shed entrance is where the ramp leads directly into the shed, but there is a clear view through the shed to an exit on the opposite side (e.g. Hamilton, 1977). If this is not feasible, an alternative design is for the ramp to run parallel to the shed wall so that sheep turn a 90^0 corner into the shed when they reach the top. In this way sheep avoid approaching a deadend until they are almost in the shed.

Grating

A shearing shed floor is usually made of 50 x 38 mm wooden battens spaced 16 mm apart. One edge is often bevelled to ensure self-cleaning. Sheep movement on slatted floors is affected by both the light intensity below the floor and the alignment of the battens. Sheep are hesitant to step onto floors brightly illuminated from below, especially if they are moving along the direction of the battens. In addition, sheep prefer to move across the direction of the battens, as they can obtain a better grip with their feet (Hutson, unpublished data). Thus care should be taken in shed design to ensure that battens are at right-angles to the direction of sheep flow, and that light is excluded from underneath the grating floor.

Pens

Pens should, in general, have a rectangular shape, which in conjunction with slide-swing gates gives excellent control over movement. The rectangular shape forces sheep to move in only one direction when a stimulus to move, such as a shed hand or dog, appears. Slide-swing gates also allow the shed hand to move into the full pen of sheep, move the gate around, and sweep the sheep into the empty pen (Barber, 1979).

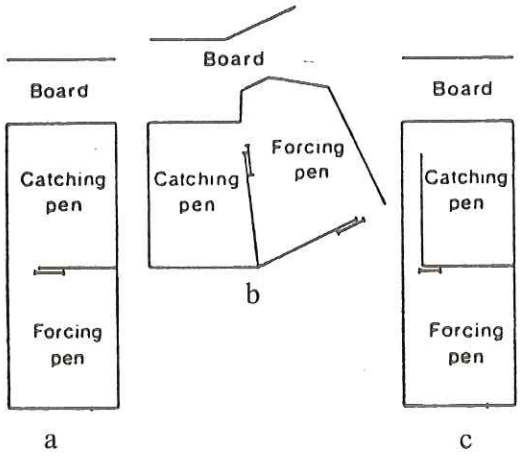

Diagram 1. Catching-pen design. a) Rear fill; b) Front fill; c) Race fill.

The design of the catching pen is very important, and a recent design, the front-fill catching pen, is becoming popular. In traditional designs the catching pen is filled from the rear (Diagram 1a), which is often extremely difficult as sheep are required to move towards the noise and activity on the board. In front-fill pens, the forcing pen is adjacent to the catching pen (Diagram 1b). Both pens are filled with sheep before the start of a run, and then half-way through, when the catching pen is almost empty, the shed man opens the gate and directs sheep into the pen. Sheep usually move quite readily as movement tends to be away from the board. The pens are refilled at the end of a run when the shearers are resting (Freeman, 1977). Front-fill pens appear to work extremely well (Mackenzie, 1974; Hall, 1976) and are probably the most successful innovation utilizing knowledge of sheep behaviour (movement away from fearful stimuli) which works. A disadvantage is that they are best used in conjunction with a curved shearing board and are difficult to install in existing sheds. In an attempt to overcome this difficulty race-fill pens have been tried (Hamilton, 1977), but suffer from the problem that sheep must still be forced to move towards, rather than away from the board (Diagram 1c). Furthermore, sheep must move towards a dead end, and also past any remaining stationary sheep in the catching pen. Covering the race sides and using an attractive visual stimulus at the end of the race (e.g. a life-size photograph of a sheep) could overcome these problems (Franklin and Hutson, unpublished data).

Exit

In centre-board sheds there are two alternative types of exit for shorn sheep, either via a "return race" on the shearing shed floor, or via a chute to underneath the shed. Each type has advantages and disadvantages, which are discussed by Brien (1978) and Barber (1979). Sheep readily enter a return race, but have to cross paths with unshorn sheep before leaving the shed. Sheep do not readily enter a chute and usually must be pushed down by the shearer. This confirms observations that sheep are hesitant to step onto and descend steep inclines (Hitchcock and Hutson, 1979b). However, chutes allow greater flexibility in forcing and catching pen design, which cannot be achieved with return races, and this advantage probably outweighs the disadvantage of having to push sheep down. Also, a one-way flow of sheep through the shed is preferable as sheep will learn where they are meant to go (Hutson, 1980b).

CONCLUSIONS

Consideration of sheep behaviour can lead to cost and labour savings in sheep handling and improvements in shed and yard design. In shearing sheds, the most significant savings can be made with front-fill catching pens. In yard design various layouts appear to be efficient, especially where sheep have a clear view towards the exit and follow the same path for all handling procedures. Circular designs appear to have no intrinsic advantage over traditional rectangular designs so long as the operator is screened from the view of approaching sheep and has easy access to sheep in the forcing pen.

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