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ANIMAL BEHAVIOR AND PRODUCTION EFFICIENCY

Clarence V. Hulet

INTRODUCTION

Animal performance is greatly affected by stress that can result from physical, social, mental, psychological, and emotional factors, individually or in combinations. It has been documented that cattle gain better when cared for by a kindly gentle person than by one who dislikes cattle. Emotional stress can cause duodenal ulcer and death in dogs. There is no reason to believe that sheep are not subjected to emotional and psychological stress. The stress of weaning, shipping, and even a change of feed can lead to poor performance and even illness and death. The objective of this discussion is to make us more aware of social, emotional, and psychological factors that may limit or enhance productivity in sheep.

BREEDING

The sudden introduction of the ram with ewes during late anestrus (Schinckel, 1954; Radford and Watson, 1957; Watson and Radford, 1960; Chesworth and Tait, 1974) induces an early and relatively synchronous start to the breeding season (figure 1). When rams are placed with and removed from ewes at monthly intervals, a consistently higher breeding response is observed in ewes (figure 2).

September, October, and November are spring months in Australia, which is south of the equator. If one wanted to breed and produce lambs throughout the year without hormone or light therapy, it would be important to 1) have the right breed, and 2) to remove and reintroduce the rams at intervals, rather than maintain the rams with the ewes on a continuous basis.

It has been recommended that sterilized rams (vasectomized, epididymectomized or aproned) be put with ewes about 17 days before the planned start of breeding. The sterile rams are then replaced with fertile rams. Work by Knight (1980) suggests that the use of sterile rams could be maxi-

mized by exposing the rams to the ewes for only 48 hr rather than 17 days as advocated by others. This needs further confirmation.

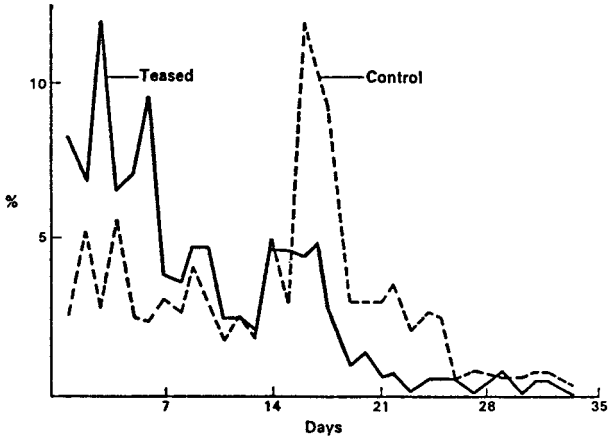

Figure 1. The daily incidence of estrus (%/day) in teased and control ewes in Australia during November-December (Schinckel, 1954).

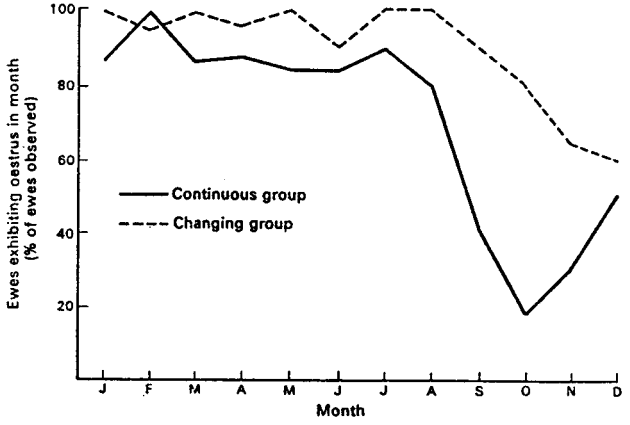

Figure 2. The incidence of estrus in ewes kept continuously with rams and changed at monthly intervals. Two years' data are combined (Riches and Watson, 1954).

Knight and Lynch (1980) suggest, on the basis of a preliminary trial, that simply placing the wool and wax from rams in a bag over the ewe's nose will cause the same response as does the introduction of the ram. This will require further testing for validation. Testosterone-treated wethers and ewes also have proved effective in inducing the ram effect for early-season breeding.

The ram effect on estrus in ewe lambs in late summer has not been documented. An observation at the Sheep Station in Dubois suggests that ewe lambs will respond. Traditionally we have not put Polypay ewe lambs into breeding before September 1 because our earliest recorded conceptions have occurred about September 10. However, in 1981, because of a shortage of pastures, the decision was made to combine the ewe lambs with the ram lambs in early August. About two-thirds of these lambs conceived and lambed to matings occurring before September 1. This phenomenon needs to be studied further.

Illius et al. (1976) found that ram testes were larger and presumably more fertile when they were in the presence of females than when kept separate from them. This suggests management practices that might increase the libido and fertility of rams, especially during the seasons that are not normally considered as the breeding season in sheep, and when ram libido and fertility are normally at low ebb.

Ewe lambs are relatively shy breeders (table 1). Studies in New Zealand by Inkster (1957) have shown that mature ewes will seek out and aggressively compete for the attention of the rams, whereas maiden ewes will not. Because of the short duration of estrus and lack of initiative and sexual aggressiveness in ewe lambs, the breeding response of lambs should be materially improved by breeding them separately from older ewes--on small, open fields where visibility is good.

TABLE 1. SEXUAL BEHAVIOR OF ADULT EWES AND EWE LAMBS

	Separately[a]		Mixed[a]	
	Lambs	Adults	Lambs	Adults
No. observed	18	17	9	9
Total mounts	245	166	38	166
Total matings	22	60	2	17
No. mated (%)	11 (61.1)	17 (100.0)	2 (22.2)	8 (88.9)

Source: M. G. Keane, 1976.
[a]Observation period: Separately--duration of estrus.
Mixed--12 hr.

SOCIAL DOMINANCE

It is very common to use multisire matings in sheep. The flock owner and manager should be aware of the competition and interaction among rams and how it can affect breeding efficiency. When rams are put together, a dominance rating or "peck order" is quickly established. Certain rams establish themselves as "boss" rams. Mature rams almost always are dominant over yearling rams and yearling rams are dominant over ram lambs (Hulet, 1966). This "peck order" can be a serious problem in a closely confined breeding area because the "boss" ram can prevent or greatly reduce the breeding activity of subordinate rams. This is especially serious if only two mature rams are used and the degree of dominance is not complete. The dominant or "boss" ram may spend much of his time preventing the second ram from breeding, resulting in a failure to breed many of the ewes in heat. Three rams or five rams in a multisire situation are always better than a two or four ram combination.

The problem of dominance can be greatly reduced by increasing the number of rams above two or four and by increasing the size of the breeding pen or pasture.

INTENSITY OF SEXUAL BEHAVIOR

Some rams appear to be sexually inhibited. Other rams exhibit a very low libido or breeding intensity. This can be an especially serious problem in a single sire flock because it can either delay breeding or result in a complete lambing failure. Some inhibited rams will start normal breeding after several hours to several days with ewes that are in heat. Some fail to recover. This indicates the importance of careful observation on the part of the flock owner when the ram or rams are first put into breeding. Make certain that the rams have good sex drive as well as large, firm testes and that the rams are aggressively seeking out and breeding ewes in heat. Highest levels of breeding activity should occur during the first 8 hr after the rams are put with the ewes (figure 3). The amount of mating activity is also affected by the number of ewes in heat (Hulet et al., 1962). Each new ewe in heat acts as a stimulus to the ram's mating activity.

Fortunately, rams appear to prefer ewes newly in estrus and recently unmated (Pepelko and Clegg, 1964). Our studies have shown that the most active rams can copulate as many as 48 times during the first 24 hr in breeding. This rate, however, will not be sustained. In Australia, selected valuable stud rams have given satisfactory breeding performance when put with flocks of 200 ewes each. Normally we would not recommend more than 120 ewes/ram. The percentage of ewes lambing and the uniform early birth of the lambs tend to be better when rams are placed with fewer ewes. The age and condition of the ram, the quality and quantity

of semen produced, the sex drive of the ram, the ambient temperature during breeding, the size and topography of the breeding area, all influence the number of ewes a ram can breed efficiently.

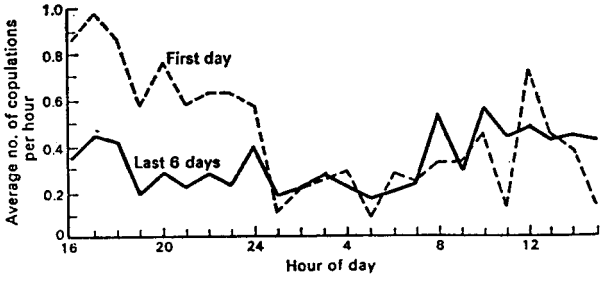

Figure 3. Average number of copulations/ram for Day 1 compared with Days 2 to 7.

We suggest that, under optimum conditions, a ram should be able to efficiently breed 120 ewes. Especially valuable sires with good management could be bred to 200 ewes with satisfactory results. However, when conditions such as size and topography of the breeding area, temperature, and condition of the ram become less than optimal, higher lambing percentage would be obtained by reducing the number of ewes assigned to each ram. Under average farm flock conditions, one yearling ram/60 ewes would be considered a good ram-to-ewe ratio. Under average herded range conditions or fenced range, two to three rams/100 ewes has proved to be satisfactory in most cases. Ram lambs should not be expected to breed as many ewes as do yearling or mature rams. Rams purchased at public ram sales, where the rams have been "fitted" as for a show, often give a very disappointing breeding performance. Most of them are completely out of breeding condition; they are too fat, their muscles are soft and flabby, and they cannot keep up with the ewes on the range--much less give adequate breeding performance. If you buy this kind of ram, buy far in advance of the breeding season and get the ram in good, trim, athletic condition before he is put with the ewes.

MATERNAL BEHAVIOR

Following a successful breeding and gestation, parturition or lambing ensues. Ewe behavior has an important impact on this event and the early neonatal development of the lamb. Some mothers are very attentive to their lambs

and provide adequate milk. Even when twins are born, they recognize that there are two lambs and are careful to keep them together and care for both of them. Unfortunately, some ewes are very poor mothers or completely void of maternal instinct. As soon as the lamb is born, a poor mother may walk away and leave the lamb completely unattended, or even butt it down and injure it, or simply prevent it from nursing. This behavior appears to be more frequent in ewes lambing for the first time. Without human intervention or a "ganny" ewe, this unfortunate lamb would soon die of starvation. There are intermediates between these extremes.

Obviously it would be desirable to have all "good" mothers. However, this seldom happens. Good management and selection can improve maternal behavior and reduce losses. This becomes especially important as the incidence of twinning and multiple births increases in our flocks. For example, it is quite common for the first lamb in a set of twins to wander off, or for the ewe to move away while the second lamb is being born. The first lamb can contribute to the problem if it is too weak to follow its mother.

Other sheep in the vicinity can be a problem because newborn lambs cannot recognize their mothers and tend to follow any moving object. Some ewes, shortly before lambing, will claim or adopt newborn lambs. These ewes, called "gannies," not only complicate management but can confuse pedigrees and frustrate genetic selection. When a number of ewes lamb together, it is easy for lambs and ewes to get mixed up. If pedigree is not important, just see that each ewe has the best number of lambs and that the lambs are well matched.

Confusion of pedigree, because of mix-ups, can be reduced by ample space at lambing, frequent observations, confinement in lambing jugs as soon after birth as possible, or (where numbers are small) separating ewes into individual pens shortly before lambing. Ewes can become semiwild under some very extensive range conditions with no herding. If disturbed soon after lambing, they may run away, never to be reunited with their lambs. To optimize lamb survival, it is important to avoid disturbing these wild sheep during lambing.

The tendency for ewes to accept alien lambs shortly after birth also can be used to advantage under shed lambing or another intensive lambing management system. Lambs that have lost their mothers or are getting inadequate nourishment can be fostered (grafted) onto ewes that have lost their own lambs or that can easily support additional lambs. Fostering presents few problems if attempted during the first 4 hr postpartum; the earlier the better. This sensitive period varies greatly among ewes; thus fostering can be quite successful with some ewes up to 8 hr postpartum, whereas other ewes will reject alien lambs within an hour after birth. The sensitive period can be extended with use of tranquilizers, or when high doses of estrogen (Poindron et al., 1980) are used to induce parturition.

Keverne et al. (1980) reported that 5 min of vaginal-cervical stimulation given to recently parturient ewes, after the development of selective bonding to their own lambs, reversed their rejection behavior of alien lambs so that they would accept and adopt alien lambs.

It is much more difficult to add an alien lamb to a ewe with one lamb than to simply foster one or two alien lambs onto a ewe that has lost her lambs. Tranquilizers appear to work well for up to 12 hr when the ewe has lost her own lamb but seldom lead to a successful addition of an alien lamb to a ewe with her own lamb (Tomlinson et al., 1982). The most successful procedure for adding a lamb to a ewe with a single lamb is to make the graft immediately after that ewe has given birth to her own lamb. Smearing the ewe's placental fluids on the foster lamb and rubbing the two lambs together appear to be very helpful techniques. Some grafts of add-on lambs are made successfully after the ewe's own lamb is dry, by immersing both lambs in a salt solution and then rubbing the two lambs together. As the lambs get older, these techniques are not possible. The English fostering stanchion can be effective for older add-on lambs (figure 4). The ewe's head is confined in the stanchion, then the alien lamb is added. The ewe is restricted in her ability to distinguish between the two lambs when she cannot turn her head back. After about 5 days she will usually accept both lambs. Given the common environment of the two lambs, with little or no opportunity for the ewe to investigate them, it is soon impossible for most ewes to differentiate between the lambs. Usually, both lambs are accepted equally (Hulet et al., 1979).

Many methods of grafting have been used (with varying degrees of success) including putting dead lamb pelts on alien lambs, tying the ewe to the fence, tying a dog next to the pen, etc. With good management, planned lamb fostering can be a valuable tool for putting the lambs with the best milk sources for more efficient production.

Sheep have been observed to be very social creatures. Social bonds formed early in life have a profound influence on an animal's subsequent behavior. Strong bonds are formed not only with other sheep but even with animals of other species kept with them during early stages of development. Disruption of these social or companionship groups, whether relationship groups, peer groups or multispecies groups, is psychologically disturbing and could reduce performance for some time. If disruption of social groups occurs at breeding time, ovulation and fertility could be adversely affected, as has been observed in the human menstrual cycle. This could explain why some small-farm flocks with one owner-operator may have superior lamb production performance compared to that of large flocks. In large flocks at the U.S. Sheep Experiment Station, many close associations are disrupted when the sheep are sorted by various criteria into many small, single-sire breeding pens. The Station

sheep also are constantly subjected to observation by strangers (some of whom, not knowing how to handle sheep, severely maltreat them).

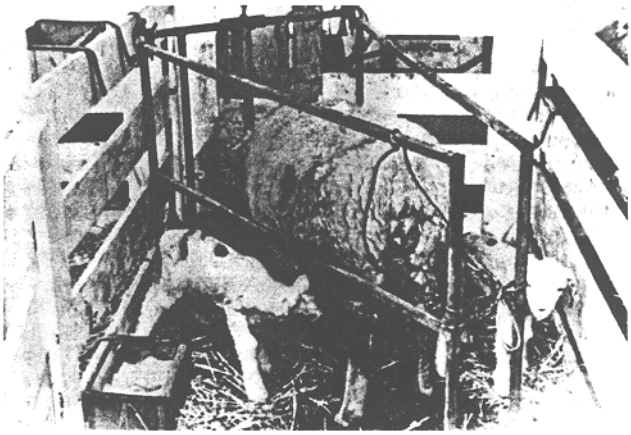

Figure 4. This metal restraining stanchion used at the U.S. Sheep Experiment Station in Dubois, Idaho, sets in the lambing jug. The Targhee ewe has adequate milk for her own lamb and for the second lamb being grafted.

Weaning is an extreme example of the disruption of close social relationships. When lambs are early weaned from their dams, they characteristically exhibit a slowing of growth. Nutritionists have tried in vain to formulate diets that would eliminate this cessation or reduction in rate of growth. It is probable that the stress associated with removing the lamb from its mother, a strange new environment, and frequently a new type of feed, accounts for the marked reduction in gain for some time following weaning. It is recommended that, starting at least 10 days before weaning, lambs be adapted to the feed they will be given at weaning and that the ewes be moved away from the lambs--and not the lambs away from the ewes. This permits the lambs to remain in familiar surroundings on a familiar feed, which should reduce stress and improve postweaning performance.

I learned how strong animal social bonds can be when I was a schoolboy. We bought a Hampshire ram at the local auction. We hauled the ram down into the west field, across the canal from the ranch house and yards, and put him in to breed with our ewes. The next morning we found the ram near the house with the horses. Concerned about getting the ewes bred, we immediately returned the ram to the ewe flock. The next morning he was back with the horses. I have since

learned about early socialization and imprinting in animals, thus it is easy to recognize that this ram probably was raised as an orphan and kept with the horses.

The key to developing a good guard dog also can be illustrated by the Hampshire ram episode. From a very early age, raise the dog with sheep. Not only will the dog want to stay with the sheep but also the sheep raised with the dog will likewise have a social bond to the dog.

A knowledge of sheep psychology and behavior can facilitate handling sheep quickly and easily with a minimum of stress and also could have some impact on performance.

Working chutes, loading chutes, and management facilities should be designed for the easy free movement of sheep. Grandin (1983) has studied this important management area. The design should take advantage of the very strong tendency for sheep to follow other sheep. Sheep do not like to look directly into the sun. They are also fearful of sharp contrasts of light and dark. A single shadow across a working area can create handling problems. Use solid chutes that avoid broken patches of light and dark in runways. Make certain that cutting chutes are at least 20 ft long and not too wide (to prevent turning) or too narrow (to prevent blocking). About 18 in. wide is about right for average-sized sheep. An adjustable width is good for accommodating smaller or larger sheep. One-direction flow valves (figure 5) to prevent backup can greatly facilitate working of the sheep, especially if help is scarce. Gates in the chutes should permit the animals to see through to the sheep ahead so that they will not balk. Make sure that loading chutes are not too steep, especially for unloading. Have plenty of good cross-cleats (1 in. by 1 in.) about 8 in. apart to prevent slipping. Avoid gaps where feet can slip through and get caught. If you are shipping large volumes of sheep, a chute that allows for two or more sheep abreast works best for loading or unloading. However, if your volume is low, the narrow loading chute is your best choice.

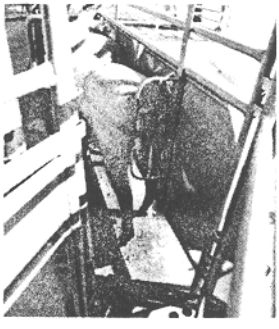

Figure 5. One-direction flow valve to prevent sheep backup in chute. (Photo courtesy Gibson Manufacturing Co., Inc., Brook, IN).

DEPRAVED APPETITE

Completely pelleted diets can be a problem if fed for extended periods of time. A short feeding time for finishing lambs for market, especially when they are on full feed, is usually not a problem. However, adult sheep or replacement lambs, when limit-fed completely pelleted diets, will develop depraved appetite, the symptoms of which include chewing and damaging of wooden structures with protruding edges and eating the wool from other sheep. Phosphorus supplementation appears to reduce the problem slightly but will not prevent it. The cause has been attributed to the fine grind and rapid consumption of the pellet and boredom. The feeding of a coarse roughage, such as straw or coarse hay, along with the pellet will effectively prevent the problem. However, after the problem or habit has developed, it is difficult to stop.

GENERAL CONCLUSIONS

Many important facts that are pertinent to more efficient lamb production have been discussed. It is very clear that sheep are social animals. Stress and psychological and social influences not only affect the ease of handling and working sheep but also can have profound effects on lamb-production efficiency.

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