

## Short Communication

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# An attempt to bond weaned 3-month-old beef heifers to yearling ewes\*

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### ABSTRACT

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This study was conducted to determine if recently weaned heifers, averaging 3 months of age, would bond to sheep. Heifers with a mean age of 90 days were penned for 80 days, singly or in groups of three, with two or five yearling ewes, respectively. The cattle and sheep were observed together, while on pasture following 40 and 80 days of pen confinement for cohesiveness by estimating interspecific distances at 15 min intervals over several consecutive hours. Single heifers consistently stayed close to sheep while on pasture. However, if two or more heifers were together at pasture, the heifers would not consistently stay with the sheep. Therefore, attachment of single heifers to sheep is believed to result from social dependence. During observations when two or more heifers were together at pasture, yearling ewes that had been penned together with the heifers usually followed the heifers. This phenomenon was not anticipated in the design of this study, however, preliminary observations suggest yearling ewes will form an attraction and follow cattle when at pasture after having been penned with them for 80 days.

### INTRODUCTION

Semi-desert rangeland supports a heterogeneous standing crop of grasses, forbs and woody plants, predominately shrubs. Because different species of free-ranging animals prefer different dietary components, stocking rangeland

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with more than one species of animal should efficiently increase the spatial use of land and the standing crop compared with single-species stocking (Baker, 1985). However, predation of small ruminants, especially by coyotes, often makes multispecies grazing uneconomical under range conditions (Hulet et al., 1987b).

Anderson et al. (1987) demonstrated that young lambs 45–90 days old can be bonded to 6- to 8-month-old heifers. This bond endures under free-ranging conditions, and substantially reduces lamb predation by coyotes (Hulet et al., 1987a). This is apparently because cattle intimidate coyotes as they approach. Individual cattle have been observed to be aggressive towards threatening canines: we documented cattle bunting and kicking at a barking, threatening dog (Anderson et al., 1988). In addition, we witnessed a cow chase a coyote, which was approaching a group of sheep, completely out of a pasture. In either instance, protection from coyote predation apparently occurs when lambs stay close to cattle (Anderson et al., 1988). The bond between sheep and cattle appears to be unidirectional. Sheep are bonded to cattle, but cattle show only a tolerance for sheep under free-ranging conditions.

If reciprocal bonding of cattle to sheep could be accomplished, periodic separation of the two species under free-ranging conditions would be minimized. This should help protect sheep from predation because cattle are present. The objective of this study was to determine if weaned 90-day old heifers would bond to sheep when penned in close confinement with yearling ewes for 40 or 80 days.

#### ANIMALS, MATERIALS AND METHODS

The study was conducted on the Jornada Experimental Range in southcentral New Mexico between 7 July and 25 September 1987. Five adjacent rectangular pens, each approximately 5 m × 14 m in size, were constructed at ranch headquarters to facilitate the bonding process. Solid panels blocked the line of sight between adjacent pens. Water and feed were provided at opposite ends of each pen. Alfalfa hay was fed in a common feeder each evening while water, a salt block and a loose mineral mix were provided ad libitum.

Eleven range-reared Hereford × Brahman heifer calves averaging 90 days old (weighing  $100 \pm 8$  kg) were weaned 4 h before they were placed in the pens. Heifers were not tame when first confined to pens and kept a maximum distance between themselves and technicians. Fourteen Polypay × Rambouillet yearling range ewes, which had not been previously exposed to cattle, were used in this study. The ewes and heifers were sequentially allotted to each of the five pens, among which two of three livestock combinations had been randomly allocated. The control pen, containing three heifers only, was the only treatment not replicated because of facility limitations. Two pens

(replicates) contained one heifer and two ewes (individual bonding; 1:2 ratio) and two pens (replicates) contained three heifers and five ewes (group bonding; 3:5 ratio). After 27 days of confinement, heifers still showed a fear of humans by moving away from the technicians during feeding. During the following 13 days, the heifers' fear of humans was reduced to facilitate field observations by feeding 41% crude protein cottonseed cubes twice daily while technicians were in the pen.

Field evaluations lasted between 1.25 and 5.5 h. A priori we intended to test each group for 5 consecutive h, however, when animal groups would not stay together after two attempts to bring them together we considered them to be irreconcilably separated and terminated the field trial. Two consecutive days were required to evaluate all livestock combinations. The day before each field test, livestock to be evaluated the following day were transported by trailer 7.2 km to a corral adjacent to the test areas. The three livestock combinations (five experimental treatment groups) were evaluated in separate pastures of similar size (approximately 120 ha) and vegetative cover, which were physically separated from each other to avoid interaction among experimental animal groups. The initial field test of the replicated individual and group-penned heifers along with the pen of control heifers, was conducted on 17 and 18 August after 40 days of uninterrupted confinement. Ewes from group-penned replicates were used to evaluate the response of the control heifers.

Collection of data began after all livestock had left the corral. Animal behavior data were recorded every 15 min by one trained observer per group (Table 1). The distance between groups of cattle and sheep was regarded as a measure of cohesiveness. Separation of cattle and sheep was estimated as the minimum distance between the perimeters of two circles, each with minimum diameters, that enclosed an intraspecific group. To accurately test the reciprocal nature of the bond, a continuous count was made of the number of times conspecifics were observed moving towards the other species group, i.e. a leader–follower relationship, when the two species groups were separated. The leader–follower relationship, when observed, was distinguished as different from the interspecific group moving as a contiguous unit.

Following an additional 40 days of pen confinement, each replicated pen group and the control heifers were again evaluated for cohesiveness in the field. In addition to the initial animals tested, 19–30 non-confined mature ewes, not previously conditioned to cattle, were used to test all heifer combinations. This evaluation was not originally designed into the study, but was added because the small livestock groups that had been penned together persistently stayed close to the corrals. In addition, these non-confined sheep were deemed necessary because of the unexpected confounding effects of the apparent social attraction of the yearling ewes to the heifers during the August field trial. One of the combinations tested was a ratio of heifers to ewes of 2:4, which was accomplished by combining replicate Groups 1 and 2. Addi-

TABLE 1

Relative affinity of young (130–170 day), weaned, heifer calves and yearling ewes following 40 days (Trial 1) and 80 days (Trial 2) confinement in small pens

Replicate pen groups	Confinement period (days)	Confined animals		Observations (No.)	Closeness of association (% within range)		Following direction <sup>3</sup> (Times observed)	
		Heifers (No.)	Ewes <sup>1,2</sup> (No.)		(0–45 m)	(> 45 m)	Ewes following heifers	Heifers following ewes
1	40	1	2	7	100	0	0	1
2	40	1	2	13	100	0	1	0
1	80	1	2	16	100	0	0	3
2	80	1	2	13	100	0	6	3
				Mean %	100	0		
3	40	3	5(A)	11	73	27	4	3
4	40	3	5(B)	15	80 <sup>4</sup>	20	5 <sup>4</sup>	3
3	80	3	5(A)	15	67	33	5	1
4	80	3	5(B)	15	86 <sup>4</sup>	14	16 <sup>4</sup>	0
				Mean %	77	23		
5	40	3 Control	5(A)	6	50	50	5	0
5	80	3 Control	5(A)	5	20	80	1	0
				Mean %	35	65		
6	80	3	5(A)+21	23	41	59	0	2
7	80	3	5(A)+19	9	11	89	0	0
8	80	3 Control	5(B)+30	7	86 <sup>4,5</sup>	14	0 <sup>4</sup>	0

<sup>1</sup>(A), ewes initially confined with heifers in Group 3; (B), ewes initially confined with heifers in Group 4.

<sup>2</sup>Numbers added indicate additional mature ewes not previously exposed to heifers.

<sup>3</sup>May be up to three observations per 15-min period in following direction only. None of the cattle in Groups 3–7 appeared to deliberately follow the ewes.

<sup>4</sup>Some of the confined ewes in Group 5(B) appeared to follow the heifers which resulted in keeping the two species in close proximity.

<sup>5</sup>Two or three ewes stayed with cattle most of the time.

tional ratios of 5:24, 5:26 and 5:35 were tested by adding 19, 21 and 30 mature ewes, not previously conditioned to cattle, to groups previously tested (Table 1).

The raw data of interspecific separation and the leader–follower relationships were tested as a completely randomized design within the Catmod procedure in Statistical Analysis Systems Institute (SAS Institute, 1985). In addition, we calculated an approximate 95% confidence interval on percentages of observations in which separations were either  $\leq 45$  m or  $> 45$  m.

## RESULTS

Length of confinement (40–80 days) had no distinguishable ( $P=0.7410$ ) effect on separation distances ( $\leq 45$  m vs.  $> 45$  m) between heifers and sheep. Therefore, confinement periods were pooled to test for the effect of treatment on the cohesiveness (frequency of association between 0 and 45 m or distance of separation being  $> 45$  m) between species (Table 1). Cohesiveness among treatment groups varied among groups ( $P=0.0027$ ; Table 1). Both species in Groups 1 and 2 (1:2 ratio) remained within 45 m of each other during the observation period, while the ewes and heifers in Groups 3 and 4 (3:5 ratio) were within 45 m of each other for only 77% of the observations. When the control heifers grazed in common with ewes unfamiliar with cattle, the heifers and ewes were only within 45 m of each other for 35% of the observations.

Data recording the direction of movement (Table 1) indicate the heifers were following the ewes, appear to have been partially the consequence of the location of the different species in the field. When, at infrequent times, ewes and heifers were grazing/walking in a line in which ewes were in front of the heifers, the leader–follower relationship was recorded as heifers following ewes. However, observations over time indicated the cattle would often bypass the ewes and pursue an independent and irregular course. Once this occurred, the ewes usually maintained visual contact with the heifers and eventually changed their direction of grazing/walking to orient themselves in the general direction in which the heifers were moving. They would usually rejoin the heifers as they followed their irregular pattern of grazing. This behavior further supports our supposition that sheep are largely responsible for maintaining the close spatial relationship between the two species.

We devised additional tests when we suspected the lone heifers were socially dependent on sheep because of isolation from their own species, and the yearling ewes had truly developed some affinity for the cattle and were primarily responsible for the closeness of association with groups of cattle. We increased the number of animals to be tested in an attempt to make the groups more independent of the corral area so true separations could be more easily observed. This was done by combining groups and adding ewes that had not been previously exposed to cattle to our original test groups.

Combining the two heifers and four ewes from replicate Groups 1 and 2 produced startling results in the field. The heifers immediately dissociated themselves from the ewes when the group was released from the corral. The heifers ran together to the opposite end of the pasture while the ewes stayed near the corral. Line of sight between the observer and the ewes and heifers was broken, thus negating data collection. The trial clearly demonstrated that although single heifers may stay with ewes when isolated from conspecifics, when in the presence of other heifers their intraspecific attachment for each

other is greater than any interspecific associations that may have formed through close confinement.

Larger ratios of heifers to ewes gave similar results. Ewes with no previous experience with heifers (non-confined ewes) were added to the original 3:5 bonding treatment (replicate Groups 3 and 4) and to the three control heifers and the ewes from treatment Group 4. These combinations resulted in new treatment Groups 6, 7 and 8 (Table 1). Adding non-confined ewes to Groups 3, 4 and 5 to make larger groups (6, 7 and 8) resulted in most of the confined ewes following the non-confined ewes, demonstrating essentially complete independence from the heifers in all but one possible instance. Uniquely, Group 8 containing control heifers with original treatment Group 4 ewes plus non-confined ewes showed more affinity ( $P=0.017$ ) than did the confined heifers with Group 3 ewes plus non-confined ewes (Groups 6 and 7).

## DISCUSSION

The fact that yearling ewes associated with the heifers, though not anticipated, may have resulted from the formation of intraspecific attachments as a result of pen confinement. The development of social attachment behavior demonstrated in young sheep (Anderson et al., 1987) apparently is not entirely eliminated as an animal matures (Cairns, 1966), even though Boissy and Bouissou (1988) conclude that cattle apparently do not have a critical or sensitive pre-pubertal period during which interspecific associations form with man. Scott (1962) indicates that the capacity of highly social animals to form social attachments through contact and emotional arousal is a process that is almost impossible to inhibit and may take place throughout life, however, these attachments may occur more slowly outside certain critical periods.

Isolation of animals from conspecifics may have complex effects on physiology and behavior (Wood-Gush et al., 1975). Isolated animals of different species may willingly associate with one another. This socializing is recognized and has been interpreted by Fraser (1988) as a conscious want of company. Our observations support previous research that indicates cattle (Ewbank, 1961) and sheep (Kilgour, 1971) are motivated to maintain visual contact with each other under pasture conditions. Cattle show visible signs of distress by swishing their tails, running and jumping fences when isolated (Grandin, 1987). Sheep too show great upset when isolated (Lynch and Alexander, 1975).

Isolation behavior from conspecifics may be used in livestock management. Single donkeys can provide protection for sheep from threatening canines, because when isolated from other donkeys, they will stay with the sheep. However, it is important to select donkeys for aggressiveness to canines because only about 50% will demonstrate this type of aggressive behavior. If

more than one donkey per pasture is used in guarding, the donkeys will stay together, but not necessarily near the sheep (Green, 1989; Walton and Field, 1989).

Broom and Leaver (1978) reported that group-reared calves, during their first month under free-ranging conditions, were observed to be alone 5% less often than isolation-reared calves ( $P < 0.002$ , 2-tailed Mann-Whitney U-test). Therefore, it was not surprising that our lone heifers under free-ranging conditions were dedicated to staying close to the sheep. We also observed this isolated-heifer, social-attachment behavior in earlier, unpublished, observations. These data suggest isolation of heifers from their own species can result in an association, or perhaps a social dependency on sheep until reunited with their own species. Associations which apparently change as the situation and motivation change have been described by Gubernick (1981) as attachment behaviour. The observation that in replicate Groups 3 and 4 the heifers appeared more cohesive to the sheep than heifers in Group 5 (control), suggests that even a small group of heifers that has been raised in confinement with sheep for 40 or 80 days might have some attraction to them. However, this could have been more a matter of heifer independence on the part of ewes in Group 5 than affinity of heifers for the sheep in Groups 3 and 4. Observations of animal movements suggest the ewes in replicate Groups 3 and 4 were almost totally responsible for any closeness of the two species and not random movements. The August observations of the control heifers strongly suggests the yearling ewes were socially attracted to the heifers, and a possible affinity had developed between the yearling ewes and heifers during pen confinement. Yearling ewes were deliberately selected for this study because it was thought these ewes were too old to form social attachments to cattle.

Ewes were not identified for individual recognition in the field. Therefore we can only speculate as to why two or three ewes in Group 8 stayed within 20 m of the heifers. Possibly the ewes that appeared to associate with the heifers were from original Group 4. The remainder of the ewes in this test group tended to stay aloof from the heifers. The attraction behavior seen in treatment Group 8 did not happen in Groups 6 and 7. The closeness of association and the direction of ewes following heifers (Table 1) over the entire study indicates at least certain ewes in treatment Group 6 originally confined with treatment Group 4 were consistently more dedicated to close association with the heifers than ewes of the other groups. Further research in which individual sheep are identified will be required to evaluate attachment behavior in yearling ewes under free-ranging conditions.

We conclude the young heifers demonstrated a strong social dependence on sheep under free-ranging conditions when they were isolated from their own species. Individual heifers that have been kept with sheep strongly resist management efforts to separate them (W.L. Shupe, personal communication, 1988). However, when two or more heifers that had been penned with sheep

were brought together in the presence of ewes, they immediately acted more independent of the ewes than when isolated from peers. On the other hand, yearling ewes developed what appeared to be a social attachment to the heifers when small groups were maintained in close confinement with heifers. If coyotes can be successfully repelled by cattle, it appears small groups of sheep maintained with a single cow might receive some protection from canine predation, based on the findings of this study.

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