

Field versus Pen Bonding Lambs to Cattle¹

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Summary

Field bonding (FB) lambs to cattle was compared to a proven pen bonding (PB) method. Lambs born to bonded dams in a flerd (bonded small ruminants and cattle) are vulnerable to coyote predation because bonded ewes tend to isolate themselves from the flerd at lambing time, and, as a result, minimize the protection cattle provide during the neonatal period. Therefore, ewes and their lambs were gathered within 3 d after birth and maintained in drylot, safe from predation until lambs were about 60 d of age. Ewe-lamb pairs were then returned to the mixed-species flerd. These lambs stayed with their dams in association with cattle. Dams were removed, for weaning, from the flerd for 5 d when lambs averaged about 150 d of age. The lambs remained with the flerd. The affinity of the weaned FB lambs for the flerd was compared to a peer group of 10 similar lambs bonded to cattle by PB of the 2 species for 34 d. Group behavior of lambs and their affinity towards cattle from the two bonding methods, each replicated once, were tested independently of other sheep or goats following 217 d with the flerd. Affinity for cattle varied ($P = .003$) among the four groups. One group of FB lambs demonstrated less affinity for cattle than the other FB group probably due to individual animal differences within replicates. Replicates within bonding method were combined and randomly assigned to two separate pastures and

observed over three consecutive days. The FB and PB lambs reacted similarly ($P = .900$) and consistently demonstrated affinity for cattle. Once test groups were reunited with the flerd, all lambs consistently stayed near cattle.

Key words: behavior, bonding, predator, sheep, mixed-species stocking.

Introduction

Complementary grazing of cattle and sheep promotes more uniform and efficient utilization of forages, because of differences in dietary preferences (Stoddard and Smith, 1943; Baker, 1985). Therefore, it is possible to co-graze 2 or 3 sheep for each cow on many ranches without reducing cow numbers. However, coyote predation and locating sheep in shrub infested pastures conducive to coyote predation are two challenges that confront mixed-species management systems (Etchepare, 1985; Merrill, 1985).

Sheep do not consistently graze with cattle unless their behavior has been modified. If an enduring association between sheep and cattle can be efficiently obtained, the results may have both economic and management benefits. Sheep can be bonded to cattle (Anderson et al., 1987) to produce a flerd (flock/herd), Anderson et al., (1988). In this manuscript, "flerd" refers to sheep and goats that were bonded to cattle to form a mixed-species unit in which

the small ruminants consistently stayed with cattle under free-ranging conditions. Hulet et al. (1987) have shown that coyote predation losses are less in a flerd compared to a mixed-species group of sheep and cattle in which the sheep are not bonded to cattle. Yet, close confinement of lambs with cattle in pens to initiate bonding can be costly unless incorporated into ongoing management, such as winter-feeding or a feedlot program. Since bonded sheep stay with cattle, we hypothesized lambs raised by their dams in close proximity to free-ranging cattle might develop a similar affinity to cattle, yet this was not found in lambs less than 12 mo old (unpublished data). The tendency for parturient ewes to leave the flerd for a short time (≥ 2 d) could make the lambs and ewes vulnerable to predation. This study was initiated to explore the possibility of bonding lambs to cattle under free-ranging conditions.

Materials and Methods

On Jan. 17, 1990, the free-ranging

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flerd consisted of 183 animals; composed of 41 cows, 42 sheep, 35 lambs, 12 mature Spanish goats, 45 Spanish kids and 8 mature Angora goats. Sheep and goats had previously been bonded, independently, to cattle as a result of pen confinement. Through socialization in the flerd the small ruminants remained together with the cattle under free-ranging conditions. Between Oct. 31 and Dec. 5, ten female lambs (≤ 3 d of age) were hauled with their dams from the range flerd to ranch headquarters and put into a single drylot pen about 474 m² in size for about 60 d (field bonding, FB). The pen provided line of sight to the surrounding area in which one or more cows would have been visible to the ewes and lambs. The ewes and lambs were returned to the flerd on Jan. 17, 1990, and observed daily for lamb survival and closeness of association of the dams and lambs with cattle for 96 consecutive days. When lambs were about 5 mo of age (April 16), the flerd dams were removed from the FB lambs for 5 d to wean the lambs. The newly weaned lambs were observed daily during this time. Association or non-association was judged on whether sheep could see the cattle. Line of sight varied due to topography and density of the standing crop. Therefore, all observations were made while the observer knelt in order to more closely approximate the view seen by sheep.

Another group of ten lambs about 50 d of age, born in a flock of non-bonded ewes of similar age and breeding to those from the flerd, were weaned on March 20. These lambs were randomized into 2 groups and confined in pens about 70 m² in size with 2 heifers per pen for 34 d until April 23 (pen bonding, PB). Pen confinement had been used previously to successfully produce bonds between sheep and cattle (Anderson et al., 1987).

The PB lambs were confined with the flerd containing the weaned FB lambs in an area about 810 m² in size to socialize overnight on April 23. The following morning the flerd containing both FB and PB lambs was returned to pasture. The FB and PB

lambs were observed for closeness of association (line of sight) to cattle along with lamb survival during the following 216 d.

On Nov. 26, 1990, the bonded lambs, now 12 mo old, were randomized into four groups in which each bonding method (FB and PB) was replicated once (five lambs plus five heifers and four lambs plus five heifers) and kept in a separate 405 m² pen overnight (two PB lambs were pregnant and not used). The following morning, the four pens of animals and four observers were assigned at random to one of four pastures. Detailed data on the affinity of sheep to cattle were recorded at 15-min intervals over five consecutive hours of observation. During the afternoon of Nov. 27, replicates of lambs within bonding method were combined and the FB and PB groups were randomly assigned to two pastures. During the following 3 d, detailed data on affinity were recorded. A total of eight evaluations were made on each treatment group (4 evaluations from each of the 2 pastures). Affinity was based on the estimated minimum diameter in meters of intra-specific and inter-specific groups and the minimum distance between the lamb and cow groups.

Measurements were made by holding a measuring tape at arm's length and recording the length or width of a sheep and/or cow, the minimum diameter of two circles, one encircling all small ruminants and one encircling all cows, and the minimum distance between the perimeters of these two circles. Sheep and cows were measured for length and width before field observations in order that ratios between actual animal measurements and lengths read from the measuring tape in the field could be used to calculate accurate distances in the field. The shorter the distance between the perimeter of the circle enclosing cattle and the circle enclosing the small ruminants, the more cohesive to the cattle the sheep were assumed to be. When the cattle and sheep separated such that line of sight was judged to be broken, they were brought together by the

observer.

The data taken at 15-min intervals on Nov. 27 to compare groups of FB and PB lambs were analyzed as a completely randomized design with time within treatment group as the error term. Data from combined replicates within treatments over the 3-d period were analyzed as a randomized complete block design. The day-by-treatment interaction was used as the error term for testing day and treatment, while time within day and treatment was used to test the day-by-treatment interaction (SAS Institute, 1985). The General Linear Models (GLM) procedure of the Statistical Analysis System (SAS) statistical software package was used to generate least-square means for each of the variables.

Results and Discussion

Regardless of bonding method, the lambs appeared to behave similarly to ewes in the flerd, however, it is possible that the FB lambs were following their mothers and/or other sheep, rather than having an individual affinity for cattle (Anderson et al., 1988). The FB lambs and ewes, when returned to the flerd following 60 d of separation, demonstrated the general character of bonded sheep to stay close to the cattle (Anderson et al., 1987). Lambs stayed near their dams and the dams and lambs were always near the cattle when observed over 96 consecutive observations between January and April. Lamb survival was 100%. The FB lambs were always within line of sight of cattle in the flerd during weaning. No lambs were lost over this 5-d period.

Following return of the FB lambs' dams and introduction of the PB lambs, both lamb groups stayed within line of sight of cattle in the flerd for 100% of the observations over the next 7-mo period. One consideration in interpreting these data is the influence lambs from one bonding method had in maintaining cohesiveness of the entire group with cattle under field conditions. The experimental design of combining FB and PB lambs into the same flerd is a factor in this influence.

For this reason, it was decided to test the bond of the FB lambs, independent of their dams or other small ruminants, and directly to PB contemporaries. The results of these observations are summarized in Tables 1 and 2. Both replicates of FB and PB

lambs resulted in the development of an affinity of lambs for cattle. However, FB Group 1 lambs exhibited less affinity to cattle compared to Group 2 of the FB lambs and PB Groups 3 and 4 (Table 1). One can only speculate as to why the two FB

groups were different. It has been very clear to the authors that bond strength of sheep to cattle is highly variable among individual lambs. Some sheep demonstrate their preference for cattle when attempts are made to temporarily separate

Table 1. Minimum least-square means (lsmeans) of intra- and inter-specific group diameters (m) and minimum inter-specific distances (m) of cattle and 12-mo-old lamb groups

Treatment groups	Group diameter ^a			Minimum distance between lamb and cattle groups	Number of times irreconcilably separated
	Lamb	Cattle	Lamb + Cattle		
Field-bonded					
1	9.3 ^b	89.8 ^b	131.5 ^b	36.8 ^b	3
2	14.2 ^c	70.2 ^b	74.8 ^{b,c}	2.8 ^c	0
Pen-bonded					
3	10.4 ^{b,c}	45.1 ^b	56.2 ^c	7.5 ^c	0
4	8.8 ^b	47.1 ^b	53.3 ^c	6.2 ^c	0
Overall P Value	0.0613	0.1676	0.0264	0.0033	

^a Four observations per hour for 5 hours for each experimental group.

^{b,c} Lsmeans in the same column with the same superscript are not different ($P > .05$) according to the GLM Procedure (SAS Institute, 1985).

Table 2. Minimum distances (m) with least-square means (lsmeans) of field-bonded and pen-bonded free-ranging 12-mo-old lamb and cattle groups each observed 8 times in 2 pastures for inter-specific affinity over 3 consecutive d beginning Nov. 28, 1990

Treatment groups ^a	Pasture	Date	Time	Group diameter			Minimum distance between lamb and cattle groups
				Lamb	Cattle	Lamb+Cattle	
Field-bonded							
1 + 2	A	Nov. 28	0843	24	101	101	0
1 + 2	A	Nov. 28	1139	22	122	122	0
1 + 2	A	Nov. 28	1506	16	52	52	0
1 + 2	A	Nov. 29	0841	18	40	61	10
1 + 2	B	Nov. 29	1222	18	72	88	4
1 + 2	B	Nov. 29	1530	18	40	56	8
1 + 2	B	Nov. 30	0840	24	88	88	0
1 + 2	B	Nov. 30	1150	22	114	168	48
Lsmean				20	81	96	10
Pen-bonded							
3 + 4	B	Nov. 28	0851	18	171	175	0
3 + 4	B	Nov. 28	1129	12	94	94	0
3 + 4	B	Nov. 28	1517	12	58	76	12
3 + 4	B	Nov. 29	0902	18	64	64	0
3 + 4	A	Nov. 29	1233	12	15	24	0
3 + 4	A	Nov. 29	1556	16	30	55	16
3 + 4	A	Nov. 30	0827	28	122	122	0
3 + 4	A	Nov. 30	1204	18	110	116	0
Lsmean				17	87	94	3
Overall P Value				0.2419	0.6344	0.9002	0.4580 ^b

^a Groups (1-4) each consisted of 4 or 5 lambs and 5 cows.

^b Statistic probably not valid due to low number of observations and high number of zeros.

bonded sheep from the cattle for management purposes (unpublished data). Because of individual variation among animals in forming interspecific bonds and the small numbers used in this study it appears reasonable to expect that small groups might vary in affinity to cattle. This reasoning was further strengthened by observations over the 3-d evaluation period, in which replicate Groups 1 + 2 (FB) and 3 + 4 (PB) were combined (Table 2). Both FB and PB combined Groups demonstrated high affinity for cattle. This suggests that lambs strongly bonded to cattle in Group 2 provided a "bridge" that strengthened the affinity of the entire FB Group for cattle, thus masking differences in Group 1's affinity to cattle. Earlier research (Anderson et al., 1988) has demonstrated that bonded sheep can influence movement of non-bonded sheep under free-ranging conditions when bonded and non-bonded sheep are in a 1:1 ratio.

Our results though informative and promising are not conclusive. Therefore, further research is needed to determine how individual animal differences influence group behavior, especially those related to establishing and perpetuating enduring bonds.

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