Applied Animal Behaviour Science, 19 (1987) 31-40 31
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

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Bonding of Young Sheep to Heifers

D.M. ANDERSON[1], C.V. HULET[1], J.N. SMITH[1], W.L. SHUPE[1] and L.W. MURRAY[2]

[1]*Jornada Experimental Range, Agricultural Research Service, U.S. Department of Agriculture, Box 30003-NMSU,Las Cruces, NM 88003-0003 (U.S.A.)*
[2]*New Mexico State University, Las Cruces, NM 88003-0003 (U.S.A.)*

Cooperative investigations of the Agricultural Research Service, U.S. Department of Agriculture and the New Mexico Agricultural Experiment Station. Journal Article 1312, Agricultural Experiment Station, New Mexico State University, Las Cruces, NM

(Accepted for publication 17 August 1987)

ABSTRACT

Anderson, D.M., Hulet, C.V., Smith, J.N., Shupe, W.L. and Murray, L.W., 1987. Bonding of young sheep to heifers. *Appl. Anim. Behav. Sci.*, 19: 31-40.

Rambouillet × Polypay lambs, averaging 45, 62 and 90 days of age, were penned with 8-9-month-old heifers for 60 days. Following 30 and 60 days of pen confinement, the treated and control lamb-heifer groups were observed in a 120-ha paddock for interspecific and intraspecific aggregation or dispersion; i.e. cross-species bonding. Interspecies distances averaged $\leqslant 20$ m in the treated groups vs. 600-1000 m in controls. Interspecific distance was not different between 45 and 90-day-old lambs. Treated lambs followed any heifer(s) which tolerated sheep. Bonding was poorly developed (lambs and heifers were widely separated) within the 62-day-old lamb-heifer group, possibly because two heifers periodically physically abused the lambs by butting and kicking them. It was concluded that 45-90-day-old lambs can be successfully bonded to cattle by penning the two animal species together for a period as short as 30 days.

INTRODUCTION

Grazing of more than one animal species in the same pasture has been advocated as a biologically sound range management tool (Stoddart and Smith, 1943). Studies indicate that if a paddock is stocked simultaneously with mature cattle and sheep, they seldom graze together in the same area (Squires, 1981; Anderson et al., 1985). Research indicates that grazing of more than one animal species contributes to a more uniform and complete use of the standing crop (Cook, 1954; Bennett et al., 1970; Kautz and Van Dyne, 1978; Parker and Pope, 1983) while providing higher economic returns to producers (Hamilton and Bath, 1970; Terrill, 1975; Ospina, 1985). Today, predation of sheep and goats often makes grazing impractical in many areas (Etchepare, 1985; Merrill, 1985).

Cohesive tendencies between animal species were reported as early as 1775 (White 1976). Lambs form cross-specific attachments with a wide range of animate and inanimate objects (Cairns, 1966b; Hulet et al., 1975). Six-month-old lambs and yearling steers were observed to form cohesive pairs when grazed together in 4-ha pastures (Bond et al., 1967). However, social affinities might be changed later in life by forced changes in the composition of social groups (Cairns, 1966a; Price and Tomlinson, 1979).

The object of this study was to determine if lambs approximately 45, 62 and 90 days old would form a cross-specific attachment or bond to growing heifers.

METHODS

The study took place on the Jornada Experimental Range in southcentral New Mexico between 16 December 1985 and 28 March 1986. Forty-two crossbred Rambouillet×Polypay lambs and 26 yearling heifers (13 Hereford×Angus and 13 Brangus genotypes) were evaluated in three treatments. The three average lamb ages, 45, 62 and 90 days, (treatments) were each replicated once.

A random selection of male and female lambs was obtained from two flocks of ewes mated at the same time. The ewes and lambs had no contact with cattl before the study. Treatments began on 16 December (Treatment 1), 3 January (Treatment 2) and 31 January (Treatment 3). The lambs used in Treatment 1 and Treatment 2 averaged 45 and 62 days old, at which stage they were weaned and placed in the study. Lambs in Treatment 3 averaged 90 days old, but were weaned at 62 days of age and were maintained with other lambs before being introduced into the study.

Heifers selected for the study had no previous contact with sheep and were chosen for uniform size. They were assigned to each pen containing lambs at random. They averaged 8, 8.5 and 9.5 months old at the beginning of Trials 1, 2 and 3, respectively.

To promote cross-species attachment, hereafter referred to as bonding, 7 lambs, all of the same age, were penned with 6 heifers equally represented by the two genotypes. The lamb–heifer groups were randomly assigned to one of three adjacent pens, each averaging 139 m^2. The pens were constructed to prevent visual contact with heifers and lambs in adjacent pens. However, no attempt was made to shield any pen from the view of cattle in the surrounding area. Seven additional lambs within each age-class served as controls and were randomly assigned to one of three adjacent pens, 10 m from the pens containing the test groups. These combined pens averaged 25 m^2 in size and had no visual barrier between them, but were screened from the view of cattle in the surrounding area. Six heifers were kept in a pen away from ovines. These heifers served as control heifers to test the control lambs for interspecific attraction or repulsion.

In addition to the animal groups, one Brangus and one Hereford×Angus heifer were each placed with a single 45-day-old lamb at the beginning of Treatment 1 to maximize the possibility of producing an interspecific bond. The two pens used for each pair averaged 35 m^2 in size and were adjacent to, but secluded from, the pens containing lambs only. A visual barrier was constructed between the two pens containing the lamb–heifer pairs. Water and alfalfa hay were provided ad libitum to each pen. In addition, a 20% protein supplement was provided to the lambs in each pen in a creep not accessible to the heifers.

The distance between lambs and heifers during grazing, walking and resting was used to evaluate bonding. This evaluation was done in a 122-ha (300-acre) triangular paddock following 30 and 60 days of pen confinement. The treated and control lamb(s) and heifer(s) were randomly assigned to consecutive days for evaluation. Following the testing of both the treated and control groups all treated and control lambs, within a given age, were released together as a group and their spatial distribution was evaluated.

Each of the 20 field tests began between 07.30 and 08.45 h, Mountain Standard Time and continued uninterrupted for 8 h. Animals were hauled to a corral that opened into the paddock and given a few minutes to become accustomed to their new surroundings and to each other before being released into he test paddock. The animals were allowed to leave the corral at will. Collection of data began when all animals had left the corral.

For each date, at 15-min intervals, a circle with the smallest diameter that would enclose all animals of the same species was estimated. The diameters of each circle and the shortest distance between the perimeter of each of these two circles was recorded. Wet- and dry-bulb ambient air temperature, wind speed and direction were recorded at the beginning, middle and end of each field trial.

Animal location was determined by one or more observers. Observers used radios to communicate with each other. Marked poles, along the perimeter fence and within the paddock, provided a grid for estimating distances. During field evaluations one observer recorded the diameters and interdiameter distances on scale maps of the test paddock.

The data were summarized by classifying the estimated diameters of each species group into one of three categories: diameter $\leqslant 15$ m; 15 m $<$ diameter $\leqslant 30$ m; diameter > 30 m. Likewise, the estimated shortest distance between perimeters was classified into one of three categories: diameter $\leqslant 161$ m; 161 m $<$ diameter $\leqslant 322$ m; diameter > 322 m. We arbitrarily defined bonding as having occurred if interspecific distances were $\leqslant 322$ m, and the degree of bonding was considered to be strong if the distance was $\leqslant 161$ m. The maximum distance animals could be separated in the pasture was approximattely 1.6 km. The six frequency classes were statistically analyzed using χ^2 procedures with age of lamb and length of penning as independent variables. In addition, mean diameters and distances between perimeters along with standard deviations were calculated where distances were judged to have been estimated precisely.

RESULTS

Weather during the 20 days of field testing was typical for the January–March period. Rain was recorded on 4 February between 09.45 and 12.45 h and again on 3 March between 13.00 and 15.30 h. In general, mornings were calm and ambient air temperatures ranged between 0.5 and 16 °C. Intermittent light winds and rising temperatures occurred throughout the remainder of most days. Throughout the three treatments, heifer genotype did not have any apparent influence on bonding even though the control heifer eliminated from the field tests was Brangus. Physical abusiveness of heifers towards lambs was observed only with the 62-day-old lamb treated group during field testing.

Treatment 1: 45-day-old lambs

Lamb–heifer pairs

Results of the initial (21 January) and final (20 February) field tests of the Hereford×Angus heifer–lamb pair and the Brangus heifer–lamb pair were similar. Lambs stayed within 0–9 m of the heifers during the first test and within 5±3 m during 5.5 h of the final test. In February the diameter never exceeded 9 m. Observations during the initial and final field tests were within 250 and 1300 m south of the corral, respectively.

During grazing the lambs were most frequently seen between the two heifers. However, during travel the lambs usually followed closely behind the heifers. The lambs vocalized several times during the day and once a heifer was heard to vocalize as if in response to the lambs. This interspecific vocalization took place when the two species were about 46 m apart.

Lamb–heifer groups

The 7 control lambs and 6 control heifers were initially tested together in the field on 22 January. The lambs and heifers maintained distinct intraspecific groups, each having mean minimum diameters of ⩽15 m. These groups were separated in line of sight by ⩾700 m (Table I). The lambs never traveled more than 400 m from the corral, and often returned to the corral after short grazing forays. On 19 February the lambs spent most of the day between 800 and 1000 m from the starting point. However, there was still no association between the cattle and sheep (Table I).

The behavior of the lamb–heifer group that had been penned together was tested in the field on 23 January and again on 18 February. The two tests gave

TABLE I

Mean minimum diameters and minimum distances (m) between treated and control lamb–heifer groups with standard deviations for 45, 62 and 90-day-old lambs tested twice in a 122-ha paddock between January and March 1986

Test dates	Treated			Control		
	Diameter		Distance between	Diameter		Distance between
	Lambs	Heifers		Lambs	Heifers	
Treatment 1: 45-day-old lambs						
Initial						
1–22				≤15	≤15	996±295
1–23	MD[1]	MD	≤161			
Final						
2–18	4±2	14±11	≤161			
2–19				3±0.8	13± 6	688± 91
Treatment 2: 62-day-old lambs						
Initial						
2–3				4±0.8	15± 7	913±289
2–4 a.m.	3±0.8	12± 5	275±314			
2–4 p.m.			647±228			
Final						
3–6				3±2	24±16	600±356
3–7	2±0.7	18±14	377±316			
Treatment 3: 90-day-old lambs						
Initial						
3–3				5±2	23±17	636±409
3–24	4±1	16± 9	12± 10			
Final						
3–25				3±0.9	16± 9	736±406
3–28	7±4	23±34	≤161			

[1]MD = missing data.

similar results and as hypothesized, the animals stayed together in a single group. The single group occupied an area having a minimum diameter of 15 m (Table I). In January, the lambs stayed with the heifers throughout the day and grazed up to 1400 m from the corral. These lambs intermingled with the heifers while grazing and lying during both field tests. The lambs normally walked behind or to the side of the heifers while traveling. Length of penning did not affect ($P > 0.05$) interspecific distance. Therefore, 30 days of penning 45-day-old lambs with heifers appears adequate to establish a bond. Lack of association between control lambs and heifers was similar ($P > 0.05$) after both the initial and final field tests. The mean pooled test of interspecific distance for the treated lamb–heifer group (15 m) compared to the control lambs and heifers (842 m) were greatly different ($P < 0.0005$).

The treated lamb–heifer pairs, treated lamb–heifer group and control animals were initially tested together on 24 January. The 16 lambs and 13 heifers (one uncontrollable control heifer was removed from study) grazed various parts of the 122-ha paddock during the day. Characteristically the control heifers and the heifers from the treated lamb–heifer group formed semi-independent loose social sub-groups. The group-treated lambs also formed a loose social sub-group that consistently stayed within 20 m of the heifers. The treated lambs showed no preference to stay with the heifers they had been penned with over the control group of heifers. The control lambs followed the bonded lambs, but formed a less stable sub-group than the 7 bonded lambs. The pair-treated lambs were most often located between the group-bonded lambs and the control lambs. When the control lambs lagged behind, the pair-treated lambs would intermittently run back and forth between the treated and control sub-groups of lambs. The heifers did not appear to have developed an attachment to the lambs, as evidenced by their independent movement with respect to the lambs. The treated lambs stayed close to the heifers, but the control lambs did not stay with the heifers in either test and frequently lagged behind the other lambs in the combined-group tests.

The 16 lambs and 13 heifers were tested for the final time on 21 February. All 16 lambs were within 180 m of at least one heifer between 08.00 and 13.45 h. Unlike the first test, the heifers tended to stay together as a single group (36 ± 25 m diameter) throughout the day. The treated group of lambs tended to stay closest to the heifers, and the control lambs on average remained within 21 m of the treated lambs, but tended to stay on the outer perimeter of the entire animal group. Again, the pair-treated lambs tended to stay between the treated and control group of lambs. The 7 control lambs became separated from the group at 14.00 h and remained by themselves within 120 m of the corral in a 3 ± 0.5-m minimum size area. The remaining lambs and heifers continued moving south and spent the remainder of the day separated from the control lambs by 613 ± 739 m.

Treatment 2: 62-day-old lambs

The 7 control lambs and 5 control heifers were tested together on 3 February and again on 6 March. These tests gave little evidence of association between the two animal species. The mean minimum intraspecies diameter was $\leqslant 40$ m for both species during both tests, while the mean minimum distance between the lambs and heifers exceeded 200 m during both trials (Table I).

The initial test of the lamb–heifer group which had been penned together was conducted on 4 February. The lambs separated from the heifers in the afternoon (Table I). Intermittent rain fell from 09.45 to 12.45 h. It did not rain during the final field test on 7 March, yet the mean minimum distance between the lambs and heifers was 377 ± 316 m. The mean minimum diameter of the area necessary to enclose the lambs or heifers was similar during the initial and final tests (Table I).

The frequency of interspecific distances $\leqslant$161 m and >322 m between treated lambs and heifers differed ($P<0.05$) and was 22 and 35%, and 28 and 15% for the initial and final field tests, respectively. The frequency of interspecific distances $\leqslant$161 m and >322 m between the control lambs and heifers also differed ($P<0.10$) and was 8 and 21%, and 39 and 32% for the initial and final field tests, respectively.

Pooled over both tests, the treated group was found to have more (29%) interspecific distances $\leqslant$161 m compared to the control group (14%). Conversely, fewer (22%) of the distances between the lambs and heifers in the treated group were >322 m compared to the control group, in which more (35%) of the distances exceeded 322 m. These trends were significant ($P<0.005$).

The combined 14 lambs and 11 heifers were initially evaluated on 5 February. The lambs stayed with the heifers for only 35 min; thereafter, the lambs and heifers were widely separated. The lambs stayed together as two sub-groups in close proximity (160–240 m) to the corrals. The heifers stayed together as one group that grazed an area 600–1300 m south of the corral. The heifers and lambs came together twice while watering at the corral, but did not stay together. The final field test was conducted on 8 March. Again, the lambs and heifers remained as two separate groups throughout the day, with a mean minimum separation of 915±416 m. Mean minimum diameters of the areas occupied by the lambs and heifers were 6±3 and 53±40 m, respectively. In contrast to the first test, the lambs ventured farther from the corral for longer periods of time.

Treatment 3: 90-day-old lambs

The control lambs and control heifers were initially tested on 3 March and again on 25 March. During both tests, the mean minimum diameter area required to enclose the lambs or heifers was $\leqslant$40 m. The mean minimum distance maintained between the lambs and heifers exceeded 200 m during both tests (Table I).

The treated lamb–heifer group was initially tested on 4 March. The mean minimum diameters of the areas enclosing the lambs, the heifers and the lamb–heifer group were 4±1, 16±9 and 17±9 m, respectively. The maximum distance of separation between the two animal species groups never exceeded 15 m. The mean minimum diameters of the areas enclosing the lambs, the heifers and the lamb–heifer group on 28 March were 7±4, 23±34 and 25±20 m, respectively. Comparing the initial and final field tests, the mean minimum distance between the lamb–heifer group and the mean minimum distance between the control lambs and heifers did not differ ($P>0.05$).

Analysis of the frequency classes of distances between the treated lamb–heifer group and control lambs and heifers when pooled over both field tests showed the distances to differ ($P < 0.0005$) between the treated and control lambs and their respective heifers. All of the interspecific distances in the treated lamb–heifer group were ≤160 m, in contrast to the control lambs and heifers that were separated by distances almost equally split between ≤160 and >322 m, respectively.

On 5 March, all 25 animals remained together as a single group. The mean minimum diameters of areas occupied by the lambs, the heifers and the lamb–heifer group were 8±6, 34±22 and 48±36 m, respectively. The mean minimum diameters of areas occupied on 27 March by the lambs, the heifers and the lamb–heifer group were 17±12, 58±27 and 72±29 m, respectively.

Treatments 1 and 3

Based on the analysis of frequency classes, the 45- and 90-day-old lambs did not differ ($P > 0.05$) in the distance the sheep and cattle were from each other in the treated lamb–heifer groups. Each age group was evaluated at 65 different times with distances that ranged between 50 and 161 m. In contrast, the minimum distance between the control lambs and heifers was different ($P < 0.005$) when the 45- and 90-day-old lambs were compared (Table I). Separations between the 45-day-old control lambs and heifers were >322 m, while the 90-day-old control lambs and heifers were split almost equally between distances ≤160 m and >322 m.

DISCUSSION

We arbitrarily established a priori that a strong bond had been established when interspecific distances of ≤161 m were maintained between lambs and heifers during grazing, walking and resting. Heifer genotype and ambient weather conditions apparently did not influence the field evaluations. Interspecific distances between treated lambs and heifers rarely exceeded 20 m, while 600–1000 m separations characterized the distances between control lambs and control heifers. However, a greater separation within the 62-day-old treated lamb–heifer group compared to the 45- and 90-day-old treated lamb–heifer groups indicated that the bond was much weaker. During field testing of the 62-day-old treated group, two heifers were observed to chase, butt and kick at the lambs. We wondered if the abusive action exhibited by these two heifers was also occurring during the pen confinement and was preventing the close attachment observed in the other two treated groups.

The apparent unidirectional bond which the treated lambs exhibited toward the heifers and the heifer's independence yet tolerance of the lambs suggests that interspecific bonding may be age-dependent. If this is true, it may partially explain why the 90-day-old lambs, although not statistically different

($P \geqslant 0.05$), appeared more independent and, possibly, not as closely bonded to the heifers as were the 45-day-old lambs. Also there was a tendency for the lambs as they aged to go farther from the corral. Maturity may help to explain this spatial distribution. Both 45- and 90-day-old lambs formed bonds to non-abusive growing heifers following 30 days of pen confinement. The bond was not strengthened (shorter interspecific distance) following 60 days of pen confinement compared to the strength of the bond as tested at 30 days for lambs originally placed with heifers when 45 and 90 days of age. However, subsequent research suggests that for the bond to endure on the range, a period of pen confinement > 30 days may be necessary.

When control and treated groups were combined, heifers formed one or more heterogeneous groups, while the lambs tended to form two distinct sub-groups, one control and one treated. Vocalization by lambs was common. The treated lambs consistently stayed close to the heifers whereas the control lambs followed the treated lambs. The two, 45-day-old lambs that had been individually treated did not form a stable group, as evidenced by their constant shifting between the control and treated group of lambs when all 45-day-old lambs were tested together. This agrees with Baldry (1979), who indicated that 4 or 5 sheep are the minimum number necessary to form a stable group. The control lambs, when tested alone, did not cover as much of the pasture as they did when combined with the treated lambs because treated lambs followed the heifers.

If cross-specific attachments (bonding) can be successfully established between lambs and cattle, and if this association can be maintained indefinitely under free-ranging conditions, exciting possibilities exist for ecologically sound multispecies grazing strategies. Overall, lambs tended to form more compact groups, less variable in size, as compared to the heifers (4 ± 2 vs. 18 ± 14 m, respectively). This greater spatial separation among cattle may provide safe space for bonded sheep if threatened by predators. Studies have shown that cows with calves will fight off dingos (*Canis familiaris dingo*) (Arnold and Dudzinski, 1978) and coyotes (*Canis latrens*) (Blackford, 1985). Cattle fencing may be sufficient to hold sheep in a paddock if sheep will stay with cattle, eliminating the need to construct more costly sheep fences. Less time will be required to locate livestock because sheep will be found close to the cattle. If coyote predation can be controlled by non-lethal means, a more ecologically sound balance may result within the plant–animal system.

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