Effects of Age and Flock Size on Flocking Behavior in Rambouillet and Rambouillet × Polypay Female Sheep[1]

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Summary

The flocking instinct in range sheep facilitates management and minimizes predation losses. Breeds vary greatly in flocking tendencies, but little is known about effects of age and flock size on flock cohesiveness. The flocking instinct in female Rambouillet and Rambouillet × Polypay sheep observed in this study appeared to develop at a young age. When 2-, 6-, 16- and greater than 26-month-old (mature) sheep were combined in all possible combinations comparing 7 sheep per age group and 2 age groups (14 sheep) per comparison, only the 2-month-old and mature sheep failed to consistently stay together during a 5-hour observation period. Separations may have been due in part to aggressive agonistic behavior on the part of some of the mature ewes toward the young lambs. Close ages within combined groups resulted in the most compatible cohesive associations. The mature ewes were consistently associated with the most dispersed age group combinations. No differences ($P = 0.38$) were observed in flock cohesiveness when larger groups of 56 sheep containing varying proportions of the four age groups were observed under free ranging conditions. Other studies have shown that when flock size becomes large, smaller subgroups form. This did not occur in the small flock sizes and age combinations observed in this study. Effects of age, flock size, season of year, weather conditions, vegetative cover and topography need to be studied with large numbers of sheep to answer management questions involving range flock management.

Key words: behavior, flocking, sheep, management.

Introduction

Although intraspecies cohesiveness or flocking behavior in some breeds of adult sheep is well recognized (Hunter, 1960), age effects and numbers of sheep within and among ages independent of maternal attachment is not clear. Young ewe lambs from our New Mexico flock just weaned from their dams refused to stay with a group of adult ewes bonded to cattle (flerd). In contrast, a group of yearling ewes tenaciously stayed close to peer yearling ewes bonded to cattle (Anderson et al., 1988). In attempts to increase the numbers of young bonded lambs in flerds we observed that when group size approached or exceeded 12, lambs frequently became independent of cattle and formed small independent lamb groups. However, when the original small confinement groups were maintained as separate units until the lambs were 6 months or more of age, the small flerd could be combined into larger groups and would maintain close affinity quite consistently (Hulet, 1989). Bonded older lambs, yearlings and mature ewes have been maintained in large groups (> 80) with cattle with consistent close affinity of the sheep to cattle over long periods of time (> 3 years). These contrasting behaviors raised the question as to the age at which the flocking instinct, independent of maternal attachment, expresses itself.

The objective of this study was to determine if the flocking instinct in Rambouillet and Rambouillet × Polypay crossbred range sheep is age dependent and evaluate the influence group size has, within and over age groups, on flocking affinity.

Materials and Methods

The 280 Rambouillet and Rambouillet × Polypay crossbred female sheep used in this study consisted of four age groups of 70

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sheep each: 2 months, 6 months, 16 months and mature sheep. Mature sheep were at least 26 months and no more than 7 years of age, with an approximate mean age of 4 years. The sheep were randomly allotted into 20 equal subgroups of 14 sheep (Table 1, cells A to T). Each subgroup was composed of two groups of seven sheep derived from a 1:1 ratio of 10 possible age combinations. Each age group was replicated once. Sheep in each of the four ages were weaned at approximately 60 days of age. Beginning approximately 5 days following birth, the 2-month-old sheep and their dams were put on alfalfa pasture. The 6-month-old sheep were managed separate from the ewe-lamb pairs on similar alfalfa pasture. The 16-month-old and mature sheep had similar exposure to the 2- and 6-month-old lambs during their first 1 to 1 ½ years, but had been grazing together on native arid rangeland prior to the initiation of this study.

These 20 age-combination treatment groups (A through T) to be tested for flocking cohesiveness were randomized among five observation days. The four combinations thus allotted to each day were then randomized to one of four pastures. Four observers were assigned at random to the four pastures and then rotated in order among pastures, so that each observer observed twice in each pasture. The appropriate sheep to be tested were maintained within their own age groups before each field evaluation. The day before the tests began, age groups were assembled at a corral centrally located to the pastures. Each afternoon the groups to be tested the next day were assembled from the four age groups and maintained in separate pens overnight. This allowed a uniform time period for the unacquainted sheep to make an initial adjustment to their new groupings.

Groups to be tested were released into the assigned pastures between 0800 and 0815 hours and observed for cohesiveness. Observations were made consecutively every 15 minutes for 5 hours. Following each day's test, the sheep were returned to the corral and recombined with their appropriate age-group peers. The measure of cohesiveness was the minimum diameter of an imaginary circle enclosing both age groups and the distance between the perimeters of circles enclosing each age group. The diameters and distances were measured by holding a measuring tape at arm's length and recording the length or width of an average sheep, the diameter of each circle enclosing all sheep of a given age and the distances between the perimeters of these circles. Actual sheep length/width was measured before the field observations so that accurate distances could be calculated from distances recorded in the field using the measuring tape held at arm's length. After the 20 initial groups of 14 sheep per group had been tested (Table 1), larger combinations of 56 sheep per group were tested as before in random sequence and order. This procedure resulted in the columns being tested the first day, the rows the second day and the diagonal elements (cells A, F, K, P, Q, R, S and T) the third day. Cells Q, R, S and T were not included in the columns or rows, only in the diagonal elements. The columns and rows were randomized to the same four pastures used initially. The replicated diagonal elements were assigned at random to two pastures. Field observations were recorded as before except that the observations involved the relationship among four age-group combinations varying from 7 to 35 sheep per age group in the rows and columns and 14 sheep per age group in the diagonal-element test groups.

Data for the 10 age combinations (14 animals per group) were analyzed in a completely randomized design model using the GLM Procedures (SAS Institute, 1985). Data from the 10 groups of 56 animals each were analyzed in a randomized complete block design using experience (used once vs. used more than once) as a block.

Table 1. Twenty cells (A to T) each containing 14 sheep based on the 10 possible combinations of maturity 2, 6, 12 and greater than 26[a] months of age combined in 1:1 ratio groups having 7 sheep per age with experimental groups replicated once.

Months of Age	Months of Age			
	2	6	12	> 26
2	(A) 2 & 2	(B) 2 & 6	(C) 2 & 12	(D) 2 & > 26
6	(E) 6 & 2	(F) 6 & 6	(G) 6 & 12	(H) 6 & > 26
12	(I) 12 & 2	(J) 12 & 6	(K) 12 & 12	(L) 12 & > 26
> 26	(M) > 26 & 2	(N) > 26 & 6	(O) > 26 & 12	(P) > 26 & > 26
2	(Q) 2 & 2			
6		(R) 6 & 6		
12			(S) 12 & 12	
> 26				(T) > 26 & > 26

[a] Mature sheep ranged in age between 26 months and 7 years and had an approximate mean age of 4 years.

Results and Discussion

Days, pastures and observers had no effects (P = 0.48, P = 0.47 and P = 0.50, respectively) on sheep-group cohesiveness. However, age did influence (P = 0.10) cohesion. Only the group containing the two extreme ages (2-month-old and mature) differed (P = 0.02) from the other age groups in mean group diameter. The least square mean group diameters for all the age pairs considered together are arrayed from the smallest to the largest in Table 2.

It is of interest that mature ewes were consistently associated with the four most dispersed age-group combinations. The only age combination which did not consistently stay together in a cohesive group was the 2-month-old and the mature sheep. This combination separated repeatedly into two distinct and independent groups. This may have been due to the more "impermeable" nature of

older groups of animals as observed by Stricklin and Mench (1987). We observed a greater incidence of aggression of mature ewes toward 2-month-old lambs. Aggression based on age differences was not apparent in other groups. Physical abuse may partially explain the separations seen in the group having the maximum diversity of ages. Physical abuse has also been shown to decrease interspecific associations (Anderson et al., 1987). The difference may also be partially due to rearing environment. Zito et al. (1977) observed that social behavior was strongly dependent on rearing environments such as rearing in a flock, individually with a ewe or artificially with other lambs. The 2-month-old lambs observed in this study had been weaned to an intra-age peer group an average of 15 days before introduction to the group of mature ewes. It seems peculiar that 2-month-old lambs recently weaned from their mature dams (< 26 months of age) would consistently maintain a cohesive relationship with 6-month-old lambs and 16-month-old yearlings, but would not stay with mature ewes. It appears likely that these lambs clearly differentiate between their dams and alien ewes and remember as well as continue to experience aggression from alien mature ewes. All of the younger age groups tended to have a less cohesive relationship with the mature ewes (Table 2), and the straight mature ewe groups maintained a more dispersed or looser association among themselves than other combinations of ages.

The different proportions of various age groups in the larger flock tests (56 sheep per group) had no effect (P = 0.38) on flock cohesiveness. It was thought that more experience of sheep in multiple age combinations might result in larger flock diameters, but experience did not make a difference (P = 0.25).

Little is known about flocking behavior in sheep except that certain breeds seem to characteristically have stronger gregarious tendencies than other breeds. Merinos and Rambouillets are recognized as having strong flocking tendencies, whereas Romneys and Dorset Horns are regarded as having poor or loose flocking tendencies. Hunter (1960) discussed the differences in gregariousness among breeds and the greater tendency for the less gregarious breeds to split into subgroups occupying separate areas. Arnold et al. (1981) observed that Merinos rarely formed sub-groups, Southdowns usually formed a few sub-groups and Dorset Horns always formed many sub-groups. Squires (1975) observed that the pasture environment (intermittent shade vs. no shade) had an important effect on grazing distribution patterns and sub-group formation in sheep. Arnold and Pahl (1967) found that sub-groups of various sizes were formed among young Merino sheep under abundant feed conditions and that Dorset Horns and Border Leicesters formed smaller subgroups than Merinos at a given age. Sub-groups as small as two or three sheep have been described by Dudzinski and Arnold (1967) and Lynch (1974) under extremely poor forage conditions.

Lambs are characteristically weaned from their dams by management at 50 days to 5 months of age. The replacement stock are placed in range bands at about 12 months of age. Range flock herders frequently speak of "breaking" yearling ewes to the herd when they assume responsibilities for them. Although this study suggests that establishing a cohesive herd would be no problem, it must be remembered that most range flocks have from 800 to 1,500 ewes which may behave much differently from groups of 56 head per group. Further studies are required to more clearly understand the flocking phenomenon in sheep and factors which contribute to it.

Literature Cited

Anderson, D.M., C.V. Hulet, J.N. Smith, W.L. Shupe and L.W. Murray. 1987. Heifer disposition and bonding of lambs to heifers. Appl. Anim. Behav. Sci. 19:27-30.

Anderson, D.M., C.V. Hulet, W.L. Shupe, J.N. Smith and L.W. Murray. 1988. Response of bonded and non-bonded sheep to the approach of a trained border collie. Appl. Anim. Behav. Sci. 21:251-257.

Arnold, G.W. and P.J. Pahl. 1967. Sub-grouping in sheep flocks. Proc. Ecol. Soc. Aust. 2:183-189.

Arnold, G.W., S.R. Wallace, and W.A. Rea. 1981. Associations between individuals and home-range behavior in natural flocks of three breeds of domestic sheep. Appl. Anim. Ethol. 7:239-257.

Dudzinski, M.L. and G.W. Arnold. 1967. Aerial photography and statistical analysis for studying behavior patterns of grazing animals. J. Range Manage. 20:77-83.

Table 2. An array of least square mean diameters (ls mean) ± standard errors (SE) for 10 age-group combinations of 14 sheep (7 per age).

Age group combinations[a] (months of age)	Ls means (m)	SE
2 + 6	3.81[b]	2.45
6 + 6	3.90[b]	2.45
2 + 16	4.63[b]	2.45
16 + 16	4.66[b]	2.45
6 + 16	5.21[b]	2.45
2 + 2	5.51[b]	2.45
6 + >26	5.58[b]	2.45
16 + >26	6.55[b]	2.45
>26 + >26	7.38[b]	2.45
2 + >26	16.55[c]	2.45

[a] Mature sheep ranged in age between 26 months and 7 years and had an approximate mean age of 4 years.

[b,c] Lsmean diameters with the same superscript are not different (P > 0.02) according to the GLM Procedure (SAS Institute, 1985).

Hulet, C.V. 1989. A Review: Understanding sheep behavior, a key to more efficient and profitable lamb and wool production. SID Research J. 5:26-33.

Hunter, R.F. 1960. Aims and methods in grazing-behavior studies on hill pasture. Proc. 8th Int. Grassld Congr. pp. 454-457.

Lynch, J.J. 1974. Merino sheep: some factors affecting their distribution in very large paddocks. In: Behavior of ungulates and its relationship to management. (Eds. Geist, V., Walther, F.) Internl. Union for Conserv. Nature No. 24, pp. 697-707.

SAS Institute. 1985. SAS User's Guide: Statistics, Version 5 Edition. Statistical Analysis Systems Institute, Incorporated. Cary, NC.

Squires, V.R. 1975. Environmental heterogeneity as a factor in group size determination among grazing sheep. Proc. New Zealand Soc. Anim. Prod. 35:184-190.

Stricklin, W.R. and J.A. Mench. 1987. Farm animal behavior: Social organization. Vet Clinics of North America: Food Animal Practices 3:307-322.

Zito, C.A., L.L. Wilson and H.B. Graves. 1977. Some effects of social deprivation on behavioral development of lambs. Appl. Anim. Ethol. 3:367-377.