EFFECT OF TIME OF EARLY WEANING AND TIME OF LAMBING ON ACCELERATED LAMBING IN POLYPAY SHEEP

C.V. Hulet, J.N. Stellflug and A.D. Knight
U.S. Department of Agriculture, Science and Education,
Agricultural Research Service, U.S. Sheep Experiment Station
Dubois, Idaho 83423, in cooperation with
the University of Idaho, Moscow, Idaho

Received for publication: August 31, 1982
Accepted: June 2, 1983

ABSTRACT

Effects of early weaning, lactation, and day-of-year lambing on the ability of Polypay ewes to rebreed following winter and summer lambings were evaluated. Winter lambing ewes did not successfully rebreed while lactating. However, when winter-born lambs were weaned at 31 days postpartum, more ewes rebred and produced summer lambs (35.7%) than when lambs were weaned at 41 days postpartum (23.6%). Ewes that lambed during the early part of the winter lambing period had an advantage over later lambing ewes in the percentage which subsequently lambed the following summer. This was apparently the result of a difference in length of breeding exposure rather than a higher fertility rate during the early part of the breeding period. When summer lambing ewes were rebred during the early part of the summer breeding period (late summer to early fall), stress associated with lactation did not affect subsequent winter lambing performance. Summer lambing ewes belonging to a late weaning (80 days) treatment group did not differ ($P>0.05$) from those belonging to an early weaning (31 days) treatment group in winter fertility, prolificacy, day-of-year lambing or lambing interval.

INTRODUCTION

The potential to have ewes lamb twice a year has long been recognized because of their 144 to 150 day gestation period. Authors of early reports in the literature emphasized the possibility for twice-a-year lambing if the breed used possessed a naturally long breeding season and if ewes could be successfully rebred while lactating or, alternatively, be rebred following early removal of their lambs (1,2,3). Successes with some breeds were reported (4,5). However, increasing availability of exogenous hormones during the 1950's and 1960's led to an enthusiasm for hormone therapy as a method of achieving accelerated lambing without having to rely upon breeds with a naturally long breeding season.

A considerable amount of literature accumulated between 1933 (6) and the present (7,8,9) regarding artificial control of rebreeding by means of hormone therapy. Nevertheless, use of hormone therapy by the sheep industry to increase reproductive performance has been very limited. In 1957, Hammond (10) suggested that although investigations into the use of exogenous hormones should be continued, ultimately a better solution would be the use of breeds or crosses with a less restricted breeding season. In the United States, increasingly stringent

requirements of the Federal Food and Drug Administration and insufficient market incentives for drug companies to produce the necessary hormones have made it almost impossible to continue with the use of exogenous hormones to achieve accelerated lambing frequencies. In other countries, the cost and availability of the hormones, variable results from hormone use, and lack of technical skills among producers have delayed application of hormone therapy. Indeed, these problems have led to a re-emphasis of breed and management considerations for achieving early postpartum rebreeding. Such factors as lactation, nutritional status, season of year and length of breeding season, variation in postpartum breeding response both among and within breeds, and the sudden introduction of the ram (ram effect) all need additional study before consistently successful accelerated lambing can be achieved without hormone therapy. The objectives of this study were to determine effects of early weaning, lactation and day-of-year lambing on the ability of Polypay ewes to rebreed following winter and summer lambings as evidenced by lamb production during the next lambing period.

MATERIALS AND METHODS

Three experiments with Polypay ewes (a composite breed developed from a Polled Dorset-Targhee x Finnsheep-Rambouillet foundation) were included in the study. In the first two experiments, ewes produced lambs during the early winter (January and February) and were then put with fertile rams to be rebred for late summer lamb production. In the third experiment, ewes lambed during the summer (July and August) and were reexposed to fertile rams during the normal fall breeding season for early winter lamb production. No yearling ewes were included in the study.

Ewes were managed at the U.S. Sheep Experiment Station near Dubois, Idaho, under fenced range conditions during most of the grazing season, but were herded on open sagebrush-wheatgrass range during the fall. When grazing was not available, ewes were kept in drylot and fed pelleted alfalfa hay.

Experiment 1: Ewes had been bred during the late summer of 1977 and started lambing on January 22, 1978. As ewes lambed, they were randomized (by lambing date) into two groups. Lambs of group 1 ewes were early weaned at weekly intervals when lambs averaged 35 days of age. Group 2 ewes served as controls and their lambs were not early weaned. Ewes of both groups were put with fertile rams approximately 35 days postpartum (the day group 1 lambs were weaned).

Experiment 2: This experiment was continued over a two-year period. Changes were incorporated based upon results from Experiment 1. Ewes started lambing on January 16 in 1979 and on January 12 in 1980. As in Experiment 1, each year as ewes lambed, they were randomized (by lambing date) into two groups. Lambs of group 1 ewes were weaned at weekly intervals when they averaged 31 days of age. Lambs of group 2 ewes were weaned at weekly intervals when they averaged 41 days of age. Ewes of both groups were put with fertile rams approximately 31 days postpartum (the day lambs of group 1 ewes were weaned). Thus, rams were with group 2 ewes for approximately 10 days before their lambs were weaned. All ewes were removed from breeding by April 18.

Experiment 3: Ewes which lambed during the summer of 1980 were randomized (by lambing date) into two groups. Lambs of group 1 ewes were early weaned at approximately 31 days of age. Lambs of group 2 ewes were not early weaned (these lambs were weaned at about 80 days of age). Ewes of both groups were put with fertile rams approximately 31 days postpartum (the day lambs of group 1 were weaned).

Results of 1981 and 1982 winter and summer lambings were also included in the study for additional data to examine the relationship between winter lambing date and subsequent summer lambing performance. Breeding for the winter lambing commenced a week earlier in 1980 than in 1979, and a week earlier in 1981 than in 1980. The first of the winter lambs was born on January 6 in 1981 and on December 26 (1981) in 1982. All lambs born during weekly intervals were weaned together at an average age of about 31 days. The ewes were put with fertile rams within one day after lambs were weaned. Rams remained with the ewes until April 15, 1981, and until April 6, 1982.

Traits analyzed included fertility (ewes lambing of ewes present at lambing time), prolificacy (lambs born per ewe lambing), lambing day of year, lambing interval, and milk score. All ewes were lambed out under shed lambing conditions at the U.S. Sheep Experiment Station. Only full-term births were used in calculating average lambing date and lambing interval. Ewe milk score (ranging from 0 through 5 with 0 indicating no milk and 5 indicating very good milk) was assigned within a few hours of lamb birth. Statistical analyses of data were by least-squares analysis of variance (11). The mathematical model included effects for age of dam, weaning treatment, age of dam x weaning treatment interaction and, where appropriate, year and year x weaning treatment interaction. The ordinary variance-ratio obtained in the fixed model analysis of variance was considered adequate for assessing statistical significance for sources of variation in fertility, a binomially distributed (0 or 1) trait (12).

RESULTS AND DISCUSSION

The first attempt (Experiment 1) to rebreed ewes in February and March without hormone therapy resulted in only one of 78 ewes (1.3%) in the lactating group rebreeding and lambing the following summer. Of ewes belonging to the early weaning group, 12 of 80 (15%) rebred and subsequently lambed. Although the factors which influence recommencement of sexual activity after lambing are not fully understood (5, 13, 14, 15), proximity of lambing to the end of the normal breeding season probably has an important relationship to the duration of the postpartum interval (16, 17). March is near the end of the normal season of breeding activity for Rambouillet ewes at the U.S. Sheep Experiment Station (18). Evidence suggests that Polypay ewes go into anestrum at a time comparable to or slightly later than that of Rambouillets. Recognizing that shortening the duration of lactation might enhance the likelihood of successful rebreeding of ewes during the late part of the breeding season, an experiment was designed to compare fertility, lambing rate, lambing date, and lambing interval following early weaning of winter-born lambs at 31 and 41 days postpartum (Experiment 2). Results are shown in Table 1.

Of the traits considered, only fertility of the 31-day (36%) and the 41-day (24%) weaning treatment groups differed (P<0.10). Prolificacy, lambing date (day of year), lambing interval, and milk score of the 31-day and 41-day weaning groups were similar. There was a tendency for 2-year-old dams to be slightly less fertile than older dams (P≈0.13). Other main effects and interactions included in the model did not approach significance for any of the traits measured.

TABLE 1. Least-squares means for summer reproductive performance of twice-a-year lambing ewes by 31-day and 41-day weaning of previous winter season lambs

Item	Weaning age of previous lamb crop[a]	
	31 days	41 days
Ewes present at lambing	117	121
Ewes lambing	40	24
Fertility, %	35.7 ± 5.1[†]	23.6 ± 5.5
Prolificacy, %	154.3 ± 11.7	139.0 ± 15.1
Lambing day-of-year	219.6 ± 2.1	219.5 ± 2.7
Lambing interval	194.0 ± 1.8	195.9 ± 2.4
Milk score[b]	3.45 ± .17	3.49 ± .22

[a] Age at which lambs born during the previous winter lambing season were weaned.
[b] Milk scores range from 0=no milk through 5=very good milk.
[†] Fertility mean of 31-day weaning age group is greater (P<0.10) than that of the 41-day weaning age group.

Reports in the literature are somewhat conflicting regarding a "lactation anestrus." Authors of several studies have suggested that early weaning tends to advance the time of first ovulation and estrus following parturition (19, 20, 21). Other authors have noted that lactation does not affect the time of first postpartum ovulation (5, 17). Results presented in Table 1 indicate that conception in the fertile ewes of both 31-day and 41-day weaning groups occurred about seven weeks postpartum. However, as evidenced by summer lambing performance, the recurrence of ovulation and estrus before the onset of normal seasonal anestrus was greater in the 31-day weaned group. Fletcher (13) and Restall and Starr (15) noted that although lactation did not affect time of first postpartum ovulation, a greater percentage of non-lactating than lactating ewes ovulated before breeding activity stopped as ewes went into their normal seasonal anestrus.

Because of the apparently higher fertility of ewes that belonged to the 31-day weaning treatment group (as evidenced by summer lambing performance), the decision was made to lengthen the effective post-lactation breeding period of all ewes by weaning all winter-born lambs

(beginning in 1981) at 31 days of age. In 1981, of 167 ewes which had lambed during the winter, 44 (26%) lambed the next summer. About 95% of these summer lambing ewes had lambed the previous winter before February 3. In 1982, of 194 ewes which had lambed during the winter, 105 (54%) lambed the next summer. About 92% of these summer lambing ewes had lambed the previous winter before February 4. Results of 1981 and 1982 winter and summer lambings are shown in Table 2.

Available grazing during the fall and early winter of 1982 was somewhat better than that available during the same period of 1981. As a result, ewes came into the winter lambing period in better body condition in 1982 than in 1981, a factor which may have contributed to the superior 1982 summer lambing percentage. Plane of nutrition has been observed by several authors to be importantly related to the onset of post-partum ovulation and estrus (5, 17).

TABLE 2. Summer fertility of ewes which lambed during the previous winter lambing season

Winter lambing date	No. winter lambing ewes	Winter breeding date	Breeding period, days,	No. ewes lambing, summer	% ewes lambing to total exposure period	% ewes lambing to equivalent opportunity period[a]
1981						
Jan. 5-12	89	Feb. 10	64	29	32.6	17.9
13-19	33	17	57	7	21.2	21.2
20-26	21	24	50	5	23.8	19.0
27-Feb. 2	10	Mar. 3	43	1	10.0	10.0
Feb. 3-9	4	10	36	1	25.0	25.0
10-18	7	17	29	1	14.3	14.3
19-27	3	25	21	0		
1982						
Dec. 26-Jan. 6	22	Feb. 3	62	15	68.2	31.8
Jan. 7-13	74	10	55	48	64.9	41.9
14-20	42	17	48	22	52.4	35.7
21-27	10	24	41	4	40.0	40.0
28-Feb. 3	11	Mar. 3	34	6	54.5	45.5
Feb. 4-10	10	10	27	4	40.0	30.0
11-17	25	17	20	6	24.0	20.0
18[b]						

[a] The equivalent opportunity period was calculated for each weekly interval group as the interval: (Day ram turned in + 147 + days of ram exposure for the last weekly interval group) - (Day ram turned in + 147).

[b] In 1982 ewes with a winter lambing date later than February 17 were not put into breeding.

During both 1981 and 1982, the summer fertility advantage of ewes which had lambed early in the winter lambing season was apparently the result of a longer period of ram exposure rather than a higher fertility rate during the early part of the winter breeding period. Ewes lambing at the beginning of the winter lambing season were exposed to breeding for 64 days in 1981 and for 62 days in 1982. Later lambing ewes had correspondingly shorter breeding periods. In 1981, ewes lambing during the week February 19 to 27 were exposed to breeding for only 21 days; and in 1982, ewes lambing during the week February 11 to 17 were exposed to breeding for only 20 days (ewes lambing after February 17 were not exposed for breeding). When ewes in each weekly interval group were evaluated on the basis of an equivalent opportunity to rebreed (an opportunity of equal length in days to that of the last group put into breeding), fertility differences among groups were generally small (Table 2). Only the small group (3 ewes) put into breeding on March 25, 1981, failed as a group to produce any summer lambs (the comparable group of ewes in 1982 were not exposed to breeding). By March 25, some degree of seasonal anestrus might be expected to be superimposed on the anestrus of puerperium. However, such a conclusion cannot be supported by results of this experiment. A study designed to examine this relationship in Polypay sheep would be useful.

Lees (16) suggested that during the period of shortening day length, the increasing intensity of breeding activity is probably sufficient to partially offset the effects of lactation anestrus, which then reasserts its influence as the days begin to lengthen. Results of Experiment 3 (Table 3) appear to conform to this pattern. In contrast to the winter

TABLE 3. Least-squares means for winter reproductive performance of twice-a-year lambing ewes by early (31 days) and late (80 days) weaning of previous summer season lambs

Item	Weaning age of previous lamb crop[a]	
	31 days	80 days
Ewes present at lambing	38	35
Ewes lambing	36	33
Fertility, %	94.6 ±3.7	94.4 ±4.1
Prolificacy, %	172.7 ±13.5	173.5 ±11.8
Lambing day-of-year	59.2 ±3.0	56.3 ±2.7
Lambing interval	205.3 ±3.0	199.8 ±2.6
Milk score[b]	2.76 ±.20	2.49 ±.18

[a] Age at which lambs born during the previous summer lambing season were weaned.

[b] Milk scores range from 0=no milk through 5=very good milk.

rebreeding results of Experiment 2, fall rebreeding results (Experiment 3) showed no indication of a real effect due to early weaning (lambs weaned at 31 days vs those weaned at approximately 80 days of age) on fertility

or any of the other reproductive traits measured. Ewes with summer-born lambs which were not early weaned had a slightly earlier winter lambing date (by 3 days) and a shorter lambing interval (by 5.5 days), but differences were not significant (P>0.10). Although these results do not demonstrate the absence of a period of "lactation anestrus" following summer lambing, they do show that biological restraints to successful summer and fall rebreeding were somewhat less restrictive than those encountered during winter rebreeding.

REFERENCES

1. Simirnov, L. Prolificacy of the Romanov sheep. Anim. Breed. Abstracts 4:195-196 (1935).

2. Polovceva, V.V. Methods of increasing the number of lambings. Anim. Breed. Abstracts 5:409 (1937).

3. Phillips, R.W., Schott, R.G. and Simmons, V.L. Seasonal variations in the occurrence of conceptions in Karakul sheep. J. Anim. Sci. 6:123-132 (1947).

4. Hulet, C.V. and Foote, W.C. Physiological factors affecting frequency and rate of lambing. J. Anim. Sci. 26:553-562.

5. Hunter, G.L. Increasing the frequency of pregnancy in sheep. I. Some factors affecting rebreeding during the postpartum period. Anim. Breed. Abstracts 36:347-378 (1968).

6. Cole, H.H. and Miller, R.F. Artificial induction of ovulation and oestrum in the ewe during anoestrum. Am. J. Phys. 104:165-171 (1933).

7. Britt, J.H. Prospects for controlling reproductive processes in cattle, sheep, and swine from recent findings in reproduction. J. Dairy Sci. 62:651-665 (1979).

8. Hunter, G.L. Increasing the frequency of pregnancy in sheep. II. Artificial control of rebreeding, and problems of conception and maintenance of pregnancy during the postpartum period. Anim. Breed. Abstracts 36:533-553 (1968).

9. Thimonier, J. Hormonal control of oestrus cycle in the ewe (a review). Livestock Production Science 6:39-50 (1979).

10. Hammond, J. Fertility and the production of fat lambs. Agri. Rev. 3:23-27 (1957).

11. Harvey, W.R. Least-squares analysis of data with unequal subclass numbers. U.S. Dept. of Agri., ARS-H4 pp. 53-122 (1975).

12. Li, J.C.R. Statistical Inference I. Edwards Brothers, Inc., Ann Arbor, Michigan, 1964, pp. 471-475.

13. Fletcher, I.C. Effects of lactation, suckling and oxytocin on postpartum ovulation and oestrus in ewes. J. Reprod. and Fert. 33: 293-298 (1973).

14. Kann, G. and Martinet, J. Prolactin levels and duration of postpartum anoestrus in lactating ewes. Nature 257:63-64 (1975).

15. Restall, B.J. and Starr, B.G. The influence of season of lambing and lactation on reproductive activity and plasma LH concentrations in Merino ewes. J. Reprod. and Fert. 49:297-303 (1977).

16. Lees, J.L. Inhibitory effect of lactation on the breeding activity of the ewe. Nature 203:1089-1090 (1964).

17. Hunter, G.L. and Van Aarde, I.M.R. Influence of season of lambing on postpartum intervals to ovulation and oestrus in lactating and dry ewes at different nutritional levels. J. Reprod. and Fert. 32: 1-8 (1973).

18. Hulet, C.V., Shelton, M., Gallagher, J.R. and Price, D.A. Effects of origin and environment on reproductive phenomena in Rambouillet ewes. I. Breeding season and ovulation. J. Anim. Sci. 38:1210-1217 (1974).

19. Barker, H.B. and Wiggins, E.L. Estrual activity in lactating ewes. J. Anim. Sci. 23:973-980 (1964).

20. Mallampati, R.S., Pope, A.L. and Casida, L.E. Effect of suckling on postpartum anestrus in ewes lambing in different seasons of the year. J. Anim. Sci. 32:673-677 (1971).

21. Shevah, Y., Black, W.J.M., Carr, S.R. and Land, R.B. The effect of lactation on the resumption of reproductive activity and the pre-ovulatory release of LH in Finn x Dorset ewes. J. Reprod. and Fert. 38:369-378 (1974).