DIFFERENT BREEDING SCHEDULES AT 6 MONTH INTERVALS IN FOUR BREEDS OF SHEEP

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INTRODUCTION

With a gestation of 5 mo and an interval of 1 to 2 mo from parturition to the resumption of estrous activity, sheep have the potential to lamb every 6 mo. Twice yearly breeding of ewes has been attempted, but results have been variable (Duncan and Black, 1978 ; Goot and Maijala, 1977 ; Whiteman *et al.,* 1972). Breed, location and timing of breeding seasons could influence the effectiveness of twice yearly breeding programs. None of the above studies have attempted to determine which twice-yearly lambing schedule gives maximum lamb production for a given breed. This research provides estimates of productivity of four breeds under three different twice-a-year schedules and of the ability of ewes of these breeds to conceive during lactation.

MATERIALS AND METHODS

This study was initiated at the U.S. Meat Animal Research Center (MARC), Clay Center, NE with breeding in the fall of 1984 and completed with the lamb crop born in the fall of 1989. It included five cycles of breeding, composed of fall and spring matings. During the experiment, 9 419 lambs were produced by 2 334 ewes and 257 rams. Breeds used were Dorset, Finnsheep, Composite I and Composite II. Breed composition was 50 % Finnsheep, 25 % Dorset, and 25 % Rambouillet for Composite I and 50 % Finnsheep, 25 % Suffolk, and 25 % Targhee for Composite II. Approximately 100 ewes of each breed were assigned to each of three schedules. Ewes were exposed for 32 d starting on August 13 and February 5 for schedule I, on September 15 and March 10 for schedule II, and on October 22 and April 11 for schedule III.

The breeding flock originated from another project terminated in 1984 at MARC (Fogarty *et al*., 1984). Ewes were exposed to fertile rams in single-sire pens. Weaning age ranged from 32 to 83 d. At 18 wks of age, a random sample of no less than six ram lambs was chosen to provide replacement rams. All ewe lambs were kept as potential replacements. Older ewes were culled for health reasons and at random to keep similar distributions of ewe ages among breeds within a schedule. Ewes were not treated with hormones to induce estrus.

Traits analyzed were weaning weight, weaning weight adjusted for conception rate, litter weaning weight, litter weaning weight per ewe exposed, conception rate and litter size at birth. Weaning weight adjusted for conception rate was calculated by multiplying individual lamb weaning weights by the respective breed's conception rate. Litter weaning weight per ewe exposed was calculated by multiplying litter weaning weights by the respective breed conception rate.

Data were analyzed using the MIXED procedure of SAS. The fixed effects included lactation status (dry, or lactating for conception rate and litter size analyses only), breed (Dorset, Finnsheep, Composite I, Composite II), cycle (1, 2, 3, 4, 5), season (fall, spring), schedule (I, II, III), age of ewe (1, 2, 3, 4, 5 and older) and sex of lamb or ratio of males to total number in litter (p = 0,…,1 for litter weaning weight and litter weaning weight per ewe exposed, male and female for weaning weight and weaning weight adjusted for conception rate). Sire within breed was included as a random effect. All two-way interactions were included in the initial model, those non-significant were deleted in later analyses. Lactation stress (0, 1, 2 or 3 lambs) was used in one analysis to examine its effects on conception rate and litter size. For weight traits, age of lamb at weaning was added as a covariate.

RESULTS AND DISCUSSION

Estimates of breed effects for weight traits, conception rate and litter size are given in table 1. Composite II litters were heavier than all others (P < 0.01). Differences among other breeds were small (P > 0.10). This result shows that using the right composite breed can be quite useful in 6 month lambing programs.

Table 1. Least squares means for breed effects

	Breed				
Item	Dorset	Finnsheep	*Composite I*	Composite II	SE[e]
Litter weaning weight, kg	32.67[a]	33.04[a]	32.48[a]	37.47[b]	1.09
Litter/exp, kg[f]	16.76[a]	20.65[b]	20.19[b]	22.67[c]	0.66
Weaning weight, kg	16.39[a]	12.94[b]	14.08[c]	16.53[a]	0.25
ww/cr, kg[g]	8.11[a]	8.57[b]	9.11[c]	10.34[d]	0.12
Conception rate, %	0.49[a]	0.49[a]	0.58[b]	0.53[c]	0.01
Litter size at birth	0.75[a]	1.36[b]	1.31[b]	1.25[c]	0.03

[a,b,c,d] Row values with different superscripts differ (*P* < 0.05).
[e] Pooled standard error based on most conservative number in a breed group.
[f] Litter weaning weight per ewe exposed.
[g] Weaning weight adjusted for conception rate.

Composite II ewes had the highest litter weaning weight per ewe exposed (P < 0.01) while Dorset ewes had the lowest performance of all breeds (P < 0.01). There was no significant difference between Finnsheep and Composite I. Ercanbrack and Knight (1985) reported that Finnsheep ewes had the lightest lambs but not the lightest litters. Oltenacu and Boylan (1981) found that Finnsheep produced the heaviest total weight of weaned lamb among Targhee, Suffolk and Minnesota 10.

Composite II ewes had the heaviest weaning weight adjusted for conception rate (10.34 ± 0.11 kg) followed by Composite I (9.11 ± 0.11 kg), Finnsheep (8.57 ± 0.12 kg) and Dorset lambs (8.11 ± 0.10 kg). All breed differences were highly significant. Composite II and Dorset lambs had similar weights at weaning (P > 0.10). Both breeds had heavier lambs (P < 0.01) than the other two breeds while Composite I lambs were heavier (P < 0.01) than Finnsheep lambs. Cochran *et al*. (1984) reported that lambs from Dorset dams had higher preweaning average daily gains and adjusted 90-d weights (0.26 kg/d and 28.3 kg) than lambs from ¼ Finnsheep (0.24 kg/d and 25.4 kg) or ½ Finnsheep (0.24 kg/d and 25.1 kg) dams (P < 0.01).

Breed means for birth litter size and conception rate are given in table 1. Finnsheep and Composite I ewes had significantly larger litters than Composite II and Dorset. The difference between Finnsheep and Composite I was not large (P > 0.10). Composite II litters were larger than Dorset litters (P < 0.01). Composite I ewes had the highest conception rate (P < 0.01), followed by Composite II (P < 0.01), Finnsheep and Dorset ewes. There was no significant difference between Dorset and Finsheep ewes (P > 0.10). Though all breeds had lower conception rates when lactating, the most marked difference was observed for Finnsheep (0.62 vs. 0.36).

Least squares means by season and schedule are given in table 2. Spring-born litters were heavier than autumn-born litters (P < 0.01) and had more litter weaning weight per ewe exposed (P < 0.01). Spring-born lambs had larger weaning weights adjusted for conception rate than autumn-born lambs (P < 0.01) and were 2.50 kg heavier at weaning (P < 0.01). Ewes giving birth in the spring had higher (P < 0.01) conception rates than ewes bred in autumn (table 2). Litters born in spring were larger (P < 0.01) than litters born in autumn.

Table 2. Least squares means for different schedules and seasons

	Schedule				Season of birth		
Item	1	2	3	SE[e]	Fall	Spring	SE[e]
Litter weaning weight, kg	35.06[a]	33.75[b]	32.95[c]	1.04	31.00[a]	36.83[b]	1.10
Litter/exp, kg[f]	20.73[a]	19.97[b]	19.51[c]	0.62	18.36[a]	21.78[b]	0.65
Weaning weight, kg	15.67[a]	14.91[b]	14.37[b]	0.48	13.72[a]	16.25[b]	0.36
ww/cr, kg[g]	9.28[a]	8.82[b]	9.01[ab]	0.20	8.44[a]	9.63[b]	0.15
Conception rate, %	0.58[a]	0.52[b]	0.47[c]	0.01	0.27[a]	0.77[b]	0.01
Litter size	1.41[a]	1.15[b]	0.95[c]	0.02	0.64[a]	1.70[b]	0.02

[a,b,c] Row values with different superscripts differ (*P* < 0.05).
[e] Pooled standard error based on most conservative number in a group.
[f] Litter weaning weight per ewe exposed.
[g] Weaning weight adjusted for conception rate.

Ewes bred in schedule I had heavier (P < 0.01) litters than ewes bred in schedule II and III. The weight difference between schedule I and II lambs was 1.31 kg (P < 0.01). Differences between schedule I and III and II and III were 2.11 and 0.80 kg, respectively (P < 0.01, P = 0.03). All ranks and significance statements were essentially the same for litter weaning weight and litter weaning weight per ewe exposed (table 2). Ewes in schedule I produced the largest weaning weights adjusted for conception rate, followed by ewes bred in schedule III and II. Only the difference between schedules I and II was significant. Schedule I lambs were heaviest followed by lambs from schedule II and III. Differences between lambs in schedule I and lambs in schedule II and III were large (P < 0.01). However, lambs born of ewes bred in schedule II and III did not differ for weaning weight (P > 0.10). For all four weight traits, spring born lambs were heavier than autumn born lambs and schedule I yielded the heaviest lambs.

Ewes bred in schedule I had higher conception rates and litter size (P < 0.01) than ewes bred in schedules II or III. Further, conception rates and litter size were higher in schedule II than in schedule III ($P < 0.01$).

Lactation stress or lactation status was included in different models. The four different levels of lactation stress were 0, 1, 2 or 3 lambs suckling. The only difference among levels of lactation stress was between dry and lactating ewes ($P < 0.01$). There were no differences ($P > 0.10$) among one, two, or three levels of lactation stress. This indicates that lactating or not lactating has a large effect on conception. However, prolificacy does not seem to have any direct negative effect on conception through lactation. Ewes with two lambs, and ewes with three lambs suckling had similar succeeding litter sizes ($P > 0.10$). However, ewes nursing one lamb had bigger succeeding litters (0.93 ± 0.03) than ewes nursing two (0.82 ± 0.03) or three (0.73 ± 0.07) lambs ($P < 0.01$). Lactating ewes (0.87 ± 0.02) had smaller ($P < 0.01$) litters than dry ewes (1.47 ± 0.01) ; except in schedule III ($P > 0.10$). In contrast, Land and McClelland (1971) reported the litter size of Finnsheep x Dorset ewes was unaffected by the occurrence of lambing six-months previously.

CONCLUSION

6 month lambing programs must use the correct breeding schedule. Further, using composite breeds can be of great benefit.

REFERENCES

Cochran, K.P., Notter, D.R. and McClaugherty, F.S. (1984) *J. Anim. Sci.* **59** : 329-337.

Duncan, J.G.S. and Black, W.J.M. (1978) *Anim. Prod.* **26** : 301-308.

Dzakuma, J.M. and Harris, O.L. (1985) *J. Anim. Sci.* **67** : 2212-2221.

Ercanbrack, S.K. and Knight, A.D. (1985) *J. Anim. Sci.* **61** : 66-77.

Fogarty, N.M., Dickerson, G.E. and Young, L.D. (1984) *J. Anim. Sci.* **58** : 301-311.

Goot, H. and Maijala, K. (1977) *Anim. Prod.* **25** : 319-329.

Kramer, C.Y. (1956) *Biom.* **12** : 309-310.

Land, R.B. and McClelland, T.H. (1971) *Anim. Prod.* **13** : 637-641.

Oltenacu, E.A. and Boylan, W.J. (1981) *J. Anim. Sci.* **52** : 998-1006.

Whiteman, J.V., Zollinger W.A., Thrift, F.A. and Gould, M.B. (1972) *J. Anim. Sci.* **35** : 836-842.