

## MAY-JUNE REPRODUCTIVE PERFORMANCE OF RAMS SELECTED FOR EXTREME OR SLIGHT SEASONAL CHANGES IN SCROTAL CIRCUMFERENCE

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### Story In Brief

In 1981, 1982 and 1983, 610 ewes and 64 rams were utilized to measure the reproductive performance of rams during May and June in Oklahoma. Rams were selected that had either the most change or the least change in scrotal circumference during the seven months prior to the May-June breeding season. Rams that had the greatest decrease in scrotal circumference were called 'seasonal,' rams with the least change were called 'nonseasonal.' In 1981 and 1982 the nonseasonal rams had 22 percent more of the ewes exposed lamb, and a 10.2 percent increase in conception rate. In 1983 there was no difference in reproductive performance between seasonal and nonseasonal rams (mean ewes lambed per ewes exposed=13.2 percent). The ewes were anestrus during the 1983 season and the rams had reduced libido. Handling and hormone injections starting on June 15, 1983 increased estrus in the ewes, but not sufficiently to test differences between seasonal and nonseasonal rams. Only three of the individually tested rams mated and bred more than 5 percent of the ewes exposed.

### Introduction

Sheep lack year long fertility and only two sheep breeds (Dorset and Rambouillet) have acceptable fertility in the spring. The genetic basis for the extended breeding season is not well known, which makes selection to maintain extended fertility difficult. For over thirty years, researchers have tried to artificially induce fertile estrus in sheep during the anestrus period. The success rate has been low, and only a few sheep units currently artificially induce year long fertility. Techniques to induce breeding during the anestrus season are usually economically impractical.

The logical solution is genetic change or selection. A flock of 1/2 Finn, 1/2 Dorset sheep was established at the Southwest Livestock and Forage Research Station for the purpose of selecting a line of Finn-Dorset sheep that were more fertile during May and June. The results of this project have been reported in the Animal Science Research Report yearly since 1979. A recurring problem associated with the Finn X Dorset line was the inability to select rams that would settle ewes during spring breeding. Scrotal circumference was monitored, so an experiment was performed to determine if scrotal circumference measurements could be used to evaluate rams for the ability to breed out of season.

The purpose of the experiment was to determine the monthly change in scrotal circumference of mature rams and determine if scrotal circumference change was related to libido and the ability of rams to settle ewes during the spring.

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## Materials and Methods

During 1981 and 1982, 142 F<sub>2</sub> Finn X Dorset ewes, 308 western Rambouillet or Rambouillet cross ewes and 64 F<sub>2</sub> Finn X Dorset rams were involved in a spring breeding program (May-June) to evaluate the seasonal breeding habits of rams. The trial was repeated a third time during May and June 1983. The Finn X Dorset ewes were not available in 1983 so 160 additional Rambouillet ewes replaced them. Prior to the breeding season, the ewes were managed similarly each year and randomly allotted to individual rams by breed type, previous lambing history and condition score. As in the past two years, rams were individually exposed to ewes (27-29) from May-June. The 1983 breeding season was extended until July 8 because the breeding season was divided into two periods.

The trial was modified slightly in 1983 because the ewes exhibited little estrus activity. The 1983 breeding season was divided into two separate periods, May 3 to June 14 and June 15 to July 8. During the first period, May 3 to June 14, the protocol was the same as the previous two years and the second period involved artificial stimulation of estrus.

Starting on June 15, the ewes within each pasture were randomly divided into three groups. One group (n=6) within each pasture received one injection of 600 IU of pregnant mare serum (PMS) on June 18, a second group (n=6) received two injections of 20 ng progesterone on June 15 and 17 plus one injection of 600 IU of PMS on June 18. The remaining open ewes in each pasture served as untreated controls.

Over the three year period, 29 F<sub>2</sub> Finn X Dorset rams were selected from 64 rams based on the degree of scrotal circumference change from October through March. Rams were selected that had either the most change or the least change in scrotal circumference during the seven months prior to the May-June breeding season. The degree of change was calculated by subtracting the mean March-April scrotal circumference from the mean October-November scrotal circumference. The rams that had the greatest decrease in scrotal circumference from fall to spring were called 'seasonal' and the rams with the least change were called 'nonseasonal'.

All rams were evaluated monthly for reproductive soundness and measured for scrotal circumference. The procedures were described by Ringwall et al., 1983 Animal Science Research Report. The rams were fitted with a marking harness to monitor mating activity. Ewes were observed daily, and the marking harness marks indicating 1-2 mounts were recorded as light; 3-5 mounts were recorded as medium and 6 or more marks were recorded as heavy. Marks were recorded as questionable any time a mark appeared on a ewe's upper body surface indicating a ram had attempted to mount but not in a position to permit penetration.

## Results and Discussion

The summary of the reproductive performance of the F<sub>2</sub> Finn X Dorset rams used over the three seasons is given in Table 1. The 1981 and 1982 results have been previously discussed, but are included for a comparison with the 1983 results. In 1981 and 1982 the responses were similar, and the seasonal rams were considerably less fertile. The nonseasonal rams settled 34.5 percent more of the ewes exposed in 1981 and 17.4 percent more in 1982. Only one seasonal ram failed to settle fewer than 5 percent of the exposed ewes. Conception rate and percent ewes mated were also higher for the nonseasonal rams.

**Table 1. The reproductive performance of seasonal and nonseasonal F<sub>2</sub> Finn x Dorset rams exposed to white-faced ewes during May and June of 1981, 1982 and 1983.**

Year	Ram type	No. rams	No. ewes exposed	No. rams failed <sup>1</sup>	% ewes mated	% ewes lambded	% ewes conceived <sup>2</sup>
1981	Seasonal	3	82	1	54.3	31.7	57.8
	Nonseasonal	4	115	0	95.4	66.2	69.1
1982	Seasonal	5	134	0	47.8	33.6	70.3
	Nonseasonal	4	108	0	56.8	51.0	90.2
1983 <sup>3</sup>	Seasonal	7	167	6	19.8	7.2	36.4
	Nonseasonal	6	168	5	11.9	5.4	45.0
1983 <sup>3</sup>	Seasonal	5	127 <sup>4</sup>	3	30.7	13.39	43.6
	Nonseasonal	4	103	3	22.3	5.83	24.0

<sup>1</sup> Any ram that had fewer than 5% of the ewes exposed lamb.

<sup>2</sup> Percent ewes lambded of ewes mated.

<sup>3</sup> The 1983 breeding season was divided into two periods. Period one was prior to June 15 and is presented above the dotted line. Period two is below the dotted line and involves some ewes treated with PMS.

<sup>4</sup> Ewes were randomly selected for treatment to induce estrus.

The 1983 results were different from those for the previous two years. In 1983 during the first period (May 3-June 14), only two rams had more than 5 percent of the ewes exposed lamb (1 of 7 seasonal and 1 of 6 nonseasonal rams). Only 7.2 percent of the ewes exposed to the seasonal rams lambed, and 5.4 percent of the ewes exposed to nonseasonal rams lambed. The seasonal rams mated 19.8 percent of their ewes, and the nonseasonal mated 11.9 percent.

Conclusions are difficult to make regarding the performance of the two ram types. If only the first two years are reviewed, a distinct advantage exists with May-June breeding for those rams that had less change in scrotal circumference from October through April. These data from 1983 do not disprove the idea that nonseasonal rams are more fertile, but cannot offer evidence that supports the concept. The overall poor reproductive performance cannot be explained.

A combination of events probably contributed to the reduced reproductive performance. The 1983 breeding season was different from the previous two. A very cool and moist spring produced very abundant spring grass versus the warmer, dryer springs the previous two years that produced grass with a higher dry matter content. Approximately two thirds of the ewes lambed during January to March of 1983, so some of the ewes were anestrus due to a relatively short postpartum period.

Hormone injections were given starting June 15 to initiate cycling in the anestrus ewes. There were no differences in the percent ewes lambing between the three treatments. The progesterone treatment resulted in the lowest conception rate, but the difference was not significant. Treatment and handling of ewes may have stimulated the onset of estrous cycles (Table 2). Until June 18, the most ewes that had mated in any one week was 4.9 percent and the highest conception rate was 2.3 percent. In 1981 and 1982, the most mating activity and subsequent conception occurred from May 15 to May 28 and virtually no mating took place after June 15. A very obvious change in mating

**Table 2. Weekly mating activity and conception of Rambouillet ewes during May and June of 1983.**

Week <sup>1</sup>	% ewes mated <sup>2</sup>	% ewes conceived <sup>3</sup>
1	2.2	1.0
2	1.8	0.0
3	4.3	1.8
4	2.6	0.7
5	2.2	0.1
6	2.6	2.3
7	4.9	2.3
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8 <sup>4</sup>	32.8	3.5
9	9.2	3.6
10	22.0	1.2

<sup>1</sup>Week 1 = May 3-6, subsequent weekly intervals are seven days.

<sup>2</sup>Includes questionable mating marks.

<sup>3</sup>Percent ewes lambed of ewes mated.

<sup>4</sup>PMS injection day 1 of week 8.

activity was produced by handling and/or the injections. Following the PMS injection, 32.8 percent (Table 2) of the open ewes expressed estrus activity during the following week, but most of the mating marks were only light or questionable. Mating activity then decreased (9.2 percent) for a week, and 22 percent of the ewes mated the following week. Conception was not substantially changed by handling and injections.

The response of the nonseasonal vs seasonal rams to the ewes following hormone injections is given at the bottom of Table 1. The seasonal rams mated more ewes (30.7 percent vs 22.3 percent) and settled more ewes (13.4 percent vs 5.8 percent). The main reason for the advantage of the seasonal rams was that one additional ram started to breed ewes following the injections. Two out of five seasonal rams worked following the hormone injections to the ewes, while only one out of four of the nonseasonal rams settled any ewes.

Characteristics of the rams used during the three years are noted in Table 3. In 1981 and 1982, the two ram types had similar change in scrotal circumference and body weight. In both 1981 and 1982, nonseasonal rams had regained their October-November scrotal circumference by March-April (1981= +0.04cm, 1982= +0.24cm). The seasonal rams had smaller circumferences in March-April than in October-November (1981= -2.69cm, 1982= -2.50cm). These reduced scrotal circumferences in the seasonal rams are probably related to reduced reproductive performance.

In 1983, the characteristics of the rams were different from the previous two years (Table 3). The nonseasonal rams in 1983 have smaller scrotal circumferences (-1.32 cm) in March-April than in October-November. The seasonal rams had circumferences 5.60 cm less in April-May than in October-November. This could account for the reduced libido in all the rams in 1983. In 1983, rams were losing weight, whereas they gained weight in 1981 and 1982. In 1983, nonseasonal rams lost -12.8 lb and seasonal rams lost -22.4 lb. The changes in body weight are confounded with the changes in scrotal circumference.

Table 3. The scrotal circumference and body weight change<sup>1</sup> from October through April of seasonal and nonseasonal rams exposed to white-faced ewes during May and June of 1981, 1982 and 1983.

Year	Ram Type	No. rams	Average scrotal circumference change (cm)	Average body weight change (lb)
1981	Seasonal	3	-2.69	+24.0
	Nonseasonal	4	+0.04	+33.5
1982	Seasonal	5	-2.50	+21.0
	Nonseasonal	4	+0.24	+20.5
1983	Seasonal	7	-5.60	-22.4
	Nonseasonal	6	-1.32	-12.8

<sup>1</sup> Average change equals the average October and November measurement of scrotal circumference and body weight minus the average March and April measurements.

In another attempt to see if the season was abnormal, three seasonal and three nonseasonal rams that were individually mated to ewes in 1982 were group mated in 1983. The seasonal trio and nonseasonal trio were each placed with a group of test ewes (27 and 29 ewes respectively) on June 6. The results are given in Table 4. Prior to the hormone injections (as described previously), 14.8 percent of the ewes exposed to seasonal rams lambed, and 13.8 percent of the ewes exposed to the nonseasonal rams lambed. The trio of nonseasonal rams mated more ewes (34.5 percent vs 22.2 percent) but had a lower conception rate. Following hormone treatment of the ewes, the nonseasonal rams mated more ewes, settled more ewes and had a higher conception rate than the seasonal rams (Table 4). These results are in agreement with the average 1982 individual performance of the rams in the respective trios.

In conclusion, F<sub>2</sub> Finn X Dorset rams have reduced sexual activity during May and June in Oklahoma. The first two years of this study supported the concept that May-June ram fertility can be predicted on the bases of the degree of change in a ram's scrotal circumference from October to April. The 1983 reproductive performance was distinctly different from 1981 and 1982. The ewes were anestrus during the 1983 season, and the rams had reduced libido. The change in scrotal circumference prior to the 1983 breeding season was different from the changes in 1981 and 1982. Only three of the individually tested rams mated and bred ewes during the spring breeding season. Hormone injections did not increase sexual activity sufficiently to test for differences between the seasonal and nonseasonal rams.

**Table 4. The 1983 reproductive performance of Rambouillet ewes exposed<sup>1</sup> to a trio of seasonal or a trio of nonseasonal rams classified as seasonal vs non-seasonal from October 1981 through April 1982.**

Trio ram type	No. ewes exposed	% ewes mated	% ewes lambed	% ewes conceived <sup>2</sup>
Seasonal	27	22.2	14.8	66.7
Nonseasonal	29	34.5	13.8	40.0
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Seasonal	23	65.2	34.8	53.3
Nonseasonal	25	100.0	76.0	76.0

<sup>1</sup>Rams were exposed to ewes from June 6 to July 8. The breeding season is divided into two periods. Period one was June 6-June 15 which involved no artificial estrus stimulation. Period two was June 16-July 8 and involves some ewes that were treated with PMS. Period two is reported below the dotted line.

<sup>2</sup>Percent ewes lambed of ewes mated.