SEASONAL CHANGES IN SCROTAL CIRCUMFERENCE AND SEXUAL FLUSH IN MATURE FINNISH LANDRACE X DORSET RAMS

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Story in Brief

Scrotal circumference, sexual flush, body weight and body condition score were recorded monthly on 31 mature Finn x Dorset F_2 rams for 2 years. All rams were classified as seasonal or nonseasonal based on the decrease in scrotal circumference from October to April. Rams with the greatest decreases in scrotal circumference were classified as seasonal. The objective was to determine if rams have the same seasonal scrotal circumference changes from year to year. During the first year, seasonal rams attained a maximal fall scrotal circumference of 34.18 cm followed by a minimal scrotal circumference of 29.07 cm. Maximal fall scrotal circumference of nonseasonal rams was 30.74 cm and decreased to 29.83 cm in the spring. Change in scrotal circumference of individual rams was consistent from the first year to the second. Both ram classes had seasonal changes in sexual flush, but nonseasonal rams had greater intensity and quantity of flush throughout the year. We conclude that seasonal rams have repeatable annual changes in scrotal circumference. The majority of nonseasonal rams had similar circumference changes during the year as seasonal rams, but the magnitude of the changes was greatly reduced.

(Key Words: Rams, reproduction, scrotal circumference, season, testes)

Introduction

The most limiting factor to increased efficiency of sheep production is seasonal infertility. The term seasonal is used to mean the lack of optional fertility during some periods of the year. Seasonal reproduction is partially dependent on the duration of light in a day, and both ewes and rams undergo physiological changes throughout the year.

The mature ram is well suited for studying methods to improve fertility because the primary reproduction organ, the testis, can be readily observed and measured. Plus, the ram has distinct color changes of the skin (sexual flush) which occur with changing reproductive stages.

Several breeds have been evaluated for changes in scrotal circumference throughout the year. Suffolk, Lincoln, Columbia and Polypay rams have a minimal scrotal circumference in January and February in North America (Mickelsen et al., 1982). Suffolk and Managra breeds in Manitoba have maximal scrotal circumference in September through November and minimal circumferences during March to April (Sanford and Yarney, 1983). Rambouillet in Oklahoma have a maximal scrotal circumference in October to November, with the smallest circumference in February to March.

If rams with constant scrotal circumference are more independent of changes in daylength, these rams may sire daughters that are less

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seasonal in their reproductive cycles. The ability to identify rams and verify that they are less responsive to light cues has not been reported. The purpose of the following study was to identify rams which have the least and greatest change in scrotal circumference from fall through spring and to determine if these rams repeat the same scrotal circumference profile from year to year.

Materials and Methods

Thirty-one F_2 Finn x Dorset rams, born during the springs of 1980 and 1981, were maintained under Oklahoma pasture conditions until spring of 1984. Rams were managed in a single group throughout the study, with the exception of the May and June breeding period. Rams were weighed each month and supplemented with alfalfa and grain when forage was limited during dry and (or) winter periods. Condition scores (on a scale of 1 = extremely emaciated to 9 = fat deposits over the lumbar vertebrae and ribs) were assigned each month.

Starting in May 1982, two independent scrotal circumference measurements were made on each ram while the ram was resting on his rump. The testes were held firmly in the lower portion of the scrotum and measured with a fiberglass tape measure. The testes were palpated between scrotal circumference measurements for testicular or epididymidal abnormalities.

Sexual flush was also monitored throughout the study. Flush was scored for quantity and intensity. The intensity of flush was scored: 0 = no color, 1 to 3 = shades of pink, 4 to 5 = light red, 6 to 7 = red, 8 = dark red, and 9 = purple. The quantity of flush was scored: 0 = none, 1 = a band of color no wider than 1 cm within each inguinal region, 2 = a band of color no wider than 3 cm within each inguinal region, 3 = a band of color wider than 3 cm but still within each inguinal region and not including the teat, 4 = a band of color which included the inguinal area, the teat and spotting of color between the two teats, and 5 = a solid band of color across the two teats and including both inguinal regions.

For the purpose of evaluating the consistency of changes in total circumference, rams with the greatest (n=8) and least (n=7) change in scrotal circumference between October and April were selected from the original 31 rams. The degree of change was calculated by subtracting the mean March and April scrotal circumference from the mean October to November scrotal circumference. Rams that had the greatest decrease in scrotal circumference from fall to spring were classified as seasonal and rams with the least change were classified as nonseasonal. The classification of rams was based on measurements from October 1982 to April 1983.

Data were analyzed by multivariate analysis of variance (MANOVA) performed on the regression coefficients. A full sinusoidual regression model with 12 months per period was fit to each ram for the variables scrotal circumference, sexual flush, body weight and condition score. The independent variables for the model were month, sine of month, cosine of month, month X cosine of month and month X sine of month.

Results and Discussion

Scrotal circumference for seasonal rams changed at a greater rate each month during 24 consecutive months ($P<.01$, figure 1). Seasonal rams had maximal scrotal circumferences during September of each year (34.18

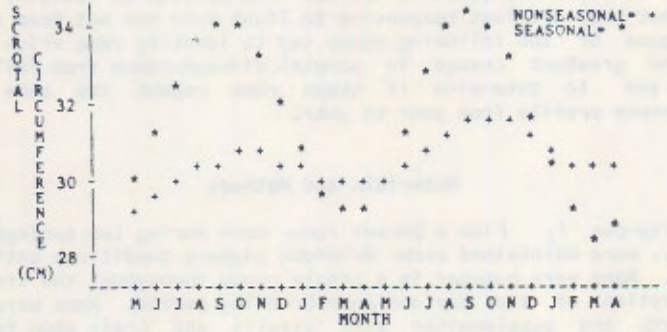

Figure 1. Scrotal circumference of seasonal and nonseasonal rams over a two year period.

and 34.39 cm). In contrast, nonseasonal rams had maximal scrotal circumferences of 30.74 cm in November of the first year and 31.59 cm in October of the second year. Seasonal rams had minimal scrotal circumferences during March of both years (29.07 and 28.58 cm) and the minimal scrotal circumferences for nonseasonal rams were 29.83 cm during April of the first year and 30.28 cm during March of the second. However, there was an interaction for scrotal circumference between ram classification and month. Seasonal rams had the largest scrotal circumference during the fall months, but the smallest during the early winter months. The only time of year that nonseasonal rams had a larger scrotal circumference than seasonal rams was from February through April (figure 1). During the normal fall breeding season, rams less responsive to season had smaller scrotal circumferences.

The classification of the rams based on the degree of scrotal circumference change from fall to spring was essentially the same for both years. The Spearman correlation coefficient for ram ranks between years was .82 ($P<.001$). Initially, when ranked from the least scrotal circumference change to the greatest, nonseasonal rams ranked 1st to 7th, while seasonal rams were 8th to 15th. Except for two rams, all seasonal rams remained in the upper half, and nonseasonal rams remained in the lower half when ranked on scrotal change the second year. The rams were not reclassified based on scrotal change during the second year, but maintained their seasonal and nonseasonal designation from the first year.

The influence of season on intensity of sexual flush is summarized in figure 2. Maximal flush intensity preceeded maximal scrotal circumference by one month for both ram classes. The flush intensity profiles were different for the two ram classes ($P<.05$) Seasonal rams had maximal flush intensity prior to nonseasonal rams the first year but both groups were similar the second year. The quantity of flush was also affected by ram class ($P<.04$, figure 3). Nonseasonal rams had a larger area of flush during the fall which was also the time of maximal flush intensity (figure 3).

Nonseasonal rams had heavier body weights throughout the study ($P<.05$). However, there were no significant differences in seasonal weight changes between the two ram classes. Body condition also tended to be greater ($P<.10$) for nonseasonal rams during the two year study.

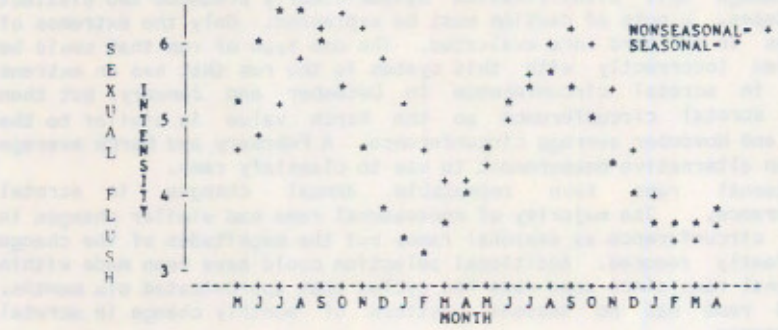

Figure 2. Sexual flush (intensity) of seasonal and nonseasonal rams over a two year period.

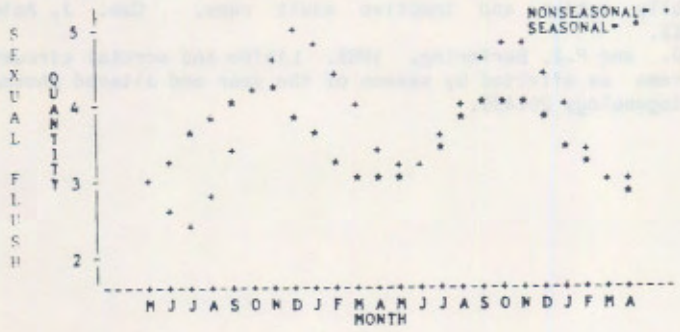

Figure 3. Sexual flush (quantity) of seasonal and nonseasonal rams over a two year period.

The seasonal change in body weight and condition score were expected since the rams were maintained under pasture conditions and subjected to seasonal changes in pasture forage. However, two sources of evidence indicate that change in scrotal circumference is not strongly influenced by change in body weight. Nonseasonal and seasonal rams were similar in body weight change, but the scrotal circumference profiles were distinctly different for the two ram types. In addition, change in scrotal circumference for individual rams was consistent from the first year to the second (Spearman rank correlation = .82, $P<.001$) but individual change in body weight was not consistent (Spearman rank correlation = -.39, $P>.5$).

Although this classification system clearly produced two distinct ram classes, a note of caution must be expressed. Only the extremes of the rams in our herd were evaluated. The one type of ram that could be classified incorrectly with this system is the ram that has an extreme decline in scrotal circumference in December and January, but then regains scrotal circumference so the March value is similar to the October and November average circumference. A February and March average may be an alternative measurement to use to classisfy rams.

Seasonal rams have repeatable annual changes in scrotal circumference. The majority of nonseasonal rams had similar changes in scrotal circumference as seasonal rams, but the magnitudes of the change were greatly reduced. Additional selection could have been made within nonseasonal rams since some rams had cycles that approximated six months, while 4 rams had no seasonal pattern of monthly change in scrotal circumference.

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