Scrotal Circumference
And Its Potential Usefulness

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Reproduction efficiency of both cows and bulls plays a major role in determining net return for cow-calf producers. Because of the importance of reproductive efficiency, much research has been directed toward understanding factors affecting the reproduction process and how it might be improved.

More recently, several research centers have included the measure of scrotal circumference (SC) as a part of these studies. Some of the early work on testis weight and SC and their relationships to semen traits was performed with dairy bulls. Results indicated that there was a high relationship between SC and total sperm output in young bulls and that larger SC was also favorably related to measures of semen quality.

There has been some related work in other species. In sheep and mice it has been noted that testis diameter is higher in those breeds or lines having the highest ovulation rate.

Studies on testis size, SC and relationship with other reproductive traits in beef cattle were initiated at the San Juan Basin Research Center, Hesperus, Colo., in 1969.

Taking the SC measurement

Scrotal circumference is taken with a flexible plastic or metal tape and is recorded in centimeters. The tape is formed into a sliding loop around the neck of the scrotum and slid slowly and carefully downward until the largest circumference is obtained. Care should be taken, especially in cold weather, to palpate the testes to the bottom of the scrotum before measurement. A chute which allows measurement from behind is ideal for taking the measurement.

Scrotal circumference also appears to be highly related to earliness of puberty in heifers and moderately but favorably related to measures of cow fertility and productivity.

Most veterinarians take SC as a part of the breeding soundness exam. The Society for Theriogenology has adopted the following scoring system for "Breeding Soundness Examination" for beef bulls at 12 to 14 months of age (see Table 1). SC plays an important part in the total score obtainable, accounting for 40 of the possible 100 points. Somewhat larger values for SC are used for bulls of older ages.

Increase in SC with age

Scrotal circumference is highly related to both age and weight as one might expect. The correlations of SC with age and weight were .78 and .84 respectively in a Colorado study.

Adjustment factors for the effects of age and age of dam differences on SC of yearling bulls should be developed for each breed.

Repeatability and heritability

Studies at Colorado and elsewhere have shown the SC measurement to be highly repeatable both between people taking the measurement and between measurements by the same person.

Table 1. Breeding Soundness Scoring System.

Classification	Very Good	Good	Fair	Poor
Motility Score	20	12	10	3
Percent Motility	over 70	50-70	30-50	under 30
Abnormal Sperm Score	40	24	10	3
Percent Abnormals	under 10	10-24	24-35	over 35
SC Score	40	24	10	10
SC (cm)	over 34	30-34	under 30	under 30
TOTAL SCORE	**100**	**60**	**30**	**16**

Table 2. Heritability Estimates for SC in Beef Bulls.

Estimate	Age	Source	
.26	yearling	King et al.	1983
.38	yearling	Latimer et al.	1982
.60	weaning	Latimer et al.	1982
.52	yearling	Lunstra	1982
.69	yearling (adj. for weight)	Lunstra	1982
.68	yearling	Coulter	1979

Table 3. Correlations of Scrotal Circumference with Semen Traits in Yearling Beef Bulls.

	Motility Percent	Percent Normal Sperm	Percent Primary Abnormalities	Percent Secondary Abnormalities
Scrotal Circumference	.25	.58	−.51	−.42

These correlations have exceeded .90 in all cases and usually are over .95 (as compared to a perfect repeatability value of 1.0). Therefore the SC measurement is highly accurate if care is used in obtaining it.

Scrotal circumference appears to be highly heritable (see Table 2). In addition, there appear to be breed differences as well as considerable variability among bulls within breeds. Relatively high heritability, coupled with large within-breed variation, indicates that selection would be effective in increasing SC as well as changing traits that are genetically correlated with SC.

These findings may constitute a major breakthrough in genetically improving herd reproduction efficiency since most other reproductive traits have been found to be of low to moderate heritability.

Example 1. Assume the following values:

Heritability of SC = .5
Genetic correlation of SC with AP = −.9
Genetic standard deviation of SC = 1.4 cm.
Genetic standard deviation of AP = 24 days
Selection differential for sires = 4 cm.

Then:

Response in male offspring = heritability × selection differential

$$R = .5\left(\frac{4.0 \text{ cm.} + 0 \text{ cm.}}{2}\right)$$

$$= 1.0$$

Correlated response in AP of female offspring = R × genetic regression

$$CR = 1.0 \times -.9\left(\frac{24}{1.4}\right)$$

$$= 15.44 \text{ days}$$

Relationships with semen traits

Early studies indicated a high relationship between testis size and total sperm output in young bulls. Also, there are several studies indicating a high relationship between the measure of SC and testis weight. Recent research at the Colorado station indicates that SC is favorably related to semen quality traits. These correlations are shown in Table 3.

As scrotal circumference increases, motility and percent normal sperm increase, and sperm abnormalities decrease. In addition, earlier studies at Colorado showed SC to be favorably related to semen volume (.29), sperm concentration (.46), and total sperm output (.42). Work at other research centers indicate similar relationships.

Relationship to age at puberty

Working at the Roman L. Hruska Meat Animal Research Center, Lunstra et al (1982), reported that SC was a more accurate predictor of when a bull reached puberty than either age or body weight, regardless of breed or breed cross. Puberty was defined as the time when a bull first produced an ejaculate of at least 50 × 10^6 sperm with a minimum of 10 percent motility. Bulls reached the measure of puberty at an average SC of 27.9 cm.

In a Colorado study, Brinks et al (1978), the estimate of genetic correlation between SC in yearling bulls and age at puberty in half-sib heifer mates was −.71. In a similar study in Montana, King et al (1983), reported an estimated genetic correlation of −1.07. Both estimates indicate a strong, favorable relationship since age at puberty in half-sib heifers (half sisters) decreases as SC in yearling bulls increases.

If one selects bulls with larger SC, what changes in SC and age at puberty (AP) are expected in the offspring? Example 1 (above) helps explain.

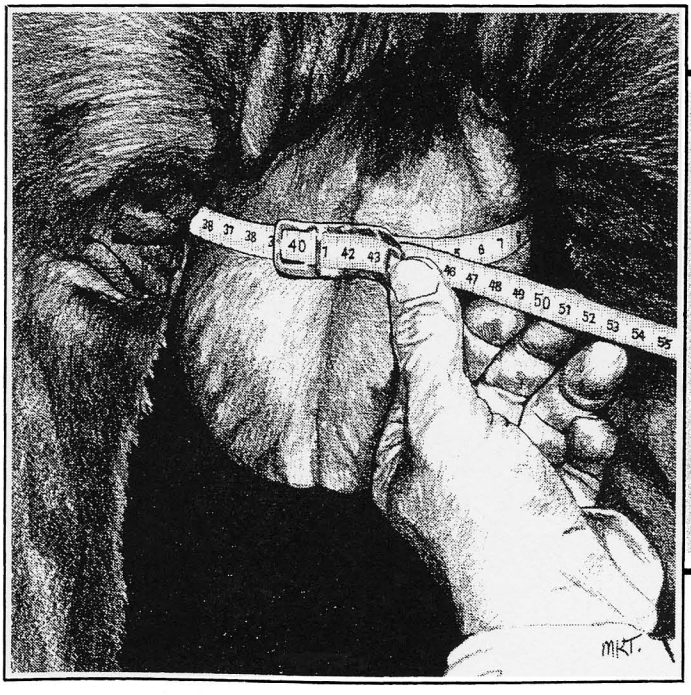
Thus, for each 4.0 cm. superiority of sires above the population mean (breed or herd average), one would expect 1.0 cm. increase in SC of male offspring and 15.44 days earlier puberty in female offspring.

Further studies at Colorado indicate that early age at puberty in females is favorably related to subsequent measures of fertility and productivity. Results indicate that selection for earlier age at puberty should result in earlier conception dates during the breeding season and higher MPPA (most probable producing ability) values, presumably through higher milk production. Further research on the relationship of SC in bulls to measures of fertility and productivity in females is underway.

Summary

In summary, SC measurements are easy to obtain, are highly repeatable and have a high heritability value. Scrotal circumference is a valuable indicator of total sperm output, semen quality and puberty in bulls. Scrotal circumference also appears to be highly related to earliness of puberty in heifers and moderately but favorably related to measures of cow fertility and productivity.

Thus, selection for increased scrotal circumference in yearling bulls should improve the inherent fertility and productivity potential of the beef cow herd. And it appears that the industry has a highly useful measure as a basis for selection. AJ



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