View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by DigitalCommons@University of Nebraska

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Range Beef Cow Symposium

Animal Science Department

2009

Bull Management and Nutrition

Julie Walker
South Dakota State University, julie.walker@sdstate.edu

George Perry
South Dakota State University, George.Perry@sdstate.edu

Russ Daly
South Dakota State University, russell.daly@sdstate.edu

Ken Olson
South Dakota State University, Kenneth.Olson@sdstate.edu

Follow this and additional works at: https://digitalcommons.unl.edu/rangebeefcowsymp

 Part of the Animal Sciences Commons

Walker, Julie; Perry, George; Daly, Russ; and Olson, Ken, "Bull Management and Nutrition" (2009). *Range Beef Cow Symposium*. 277.
https://digitalcommons.unl.edu/rangebeefcowsymp/277

This Article is brought to you for free and open access by the Animal Science Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Range Beef Cow Symposium by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Proceedings, The Range Beef Cow Symposium XXI
December 1, 2 and 3, 2009, Casper, WY

BULL MANAGEMENT AND NUTRITION

Julie Walker[1], George Perry[1], Russ Daly[2] and Ken Olson[1]
[1]Departments of Animal and Range Sciences and [2]Veterinary Science
South Dakota State University

Proper management and nutrition of bulls is essential to ensure cow/calf producers maximize reproductive efficiency and genetic improvement of the calf crop. In addition, the herd bull influences overall herd fertility more than any other single animal, and loss of fertility by a bull can cause substantial loss to a potential calf crop. Each cow produces one calf per year; however, bulls should contribute to the calf crop by 25 to 60 times via siring 25 to 60 calves. Additionally, bulls influence their daughters' production in the cow herd. Therefore, bull selection can be the most powerful method of genetic improvement in the herd, but bulls with low fertility, structural problems and low libido reduce the percent calf crop weaned.

The number of cows bred during the breeding season plays the largest role in percent calf crop weaned, and percent calf crop weaned is the single most important factor influencing profitability in beef operations. The weaning weight is influenced by the bull selection. Since greater than 90% of the beef cows in the United States are bred by natural service, it is important that bulls be managed to optimize breeding performance.

Producers spend the necessary time to find quality bulls based on EPD's, but how is the bull managed from purchase to breeding or between breeding seasons can affect the longevity of a bull? Has the nutrient requirements of the bull(s) been met during these periods or are the bulls placed into a pasture to be forgotten about until the next breeding season?

There are several factors that influence bull fertility. First, a bull must be developed properly and have reached puberty to be fertile. Second, physical characteristics, such as scrotal circumference, mating ability, and semen quality play a role in a bull's fertility. Third, libido and social dominance influence a bull's ability and desire to service cows. This paper will start with nutrition.

Puberty and bull development

The most commonly used definition of puberty in bulls is when an ejaculate collected via electroejaculation contains a minimum of 50 x 10^6 total sperm with at least 10% progressive motility. The age and weight that puberty occurs is affected by feeding different energy levels of feed. High levels of energy can increase weight, height, and scrotal circumference without effecting age at puberty or first mating, showing nutritional effects on bull development without affecting sexual development. Highly fitted or excessive conditioned bulls may fatigue rapidly, contributing to fewer cows serviced. Ideally, bulls should be in a condition score of 6 (9 point system) since bulls normally lose about 100 to 200 pounds

during the breeding season. This weight loss should come from energy stored as fat (condition) rather than muscle tissue. This is especially important for young bulls since they are still growing.

Furthermore, extremely low energy can delay puberty and potentially impair sperm production. In addition, bulls that are undernourished at a young age may never develop appropriately when compared to bulls that are properly fed (VanDemark et al., 1964).

The age and weight at which puberty occurs also varies greatly among breeds and level of nutrition during development; however, research with various breeds suggests that a practical indication of eminent puberty is when scrotal circumference is between 27 and 29 cm (Lunstra et al., 1978). However, simply because a bull can produce semen does not translate directly to fertility. Sperm quality and quantity continues to increase for several months after the initiation of semen production. Only about 35%, 60%, and 95% of 12, 14, and 16 month old bulls, respectively, are reproductively mature and produce good quality semen (Barth, 2000).

Nutrition

Seedstock producers are the primary individuals managing the development program of bulls being sold. For commercial cow-calf producers, feeding programs usually include feeding purchased bull(s) from delivery until the breeding season and bulls retained from one breeding season to the next. Bulls are often managed as one group even though there may be large differences in age, size, and body condition.

The debate over the correct method for developing bulls is not settled: Should you develop bulls at a moderate rate of gain or develop bulls on a ration that is capable of supporting high rates of gain so genetic differences can be measured for selection and marketing purposes? Bulls put into many bull test stations are placed on rations to support high rates of gain. Many seedstock producers have established specific feeding programs to fit the desired animal performance where bulls show their genetic potential and are cost efficient.

The key to a well-developed feeding program is that nutrient requirements are meet and animals are not under-or over-fed. It does not matter if they are developed with a high-grain ration or forage-based program. While the effect of underfeeding is obvious, overfeeding bulls also has negative effects on reproductive performance. Excess external fat cover is not only found on the back of the bull, but also in the scrotum. The increased scrotal temperatures associated with over conditioned bulls can reduce sperm production and the quality of stored sperm. Being overly fat also increases stress on the bull and limits his ability to travel so he can search out and service cows that are in estrus.

Let’s focus on five time periods; 1) Pre-weaning nutrition, 2) Post-weaning nutrition, 3) Conditioning prior to breeding season, 4) Breeding season, and 5) Post breeding season.

Pre-weaning nutrition:
Nutrition management of beef calves (including bull calves) is to maintain them on their dam until normal weaning at 6 – 9 months of age. Under normal environments, the plane of nutrition from dam's milk and forage should be adequate for normal growth rates of bull calves. It is important that adequate nutrition is available to the dam. Additional management options such as early weaning or creep feeding can be considered when the calves' plane of nutrition is less than desired; however, the cost should be considered when making your decision.

Post-weaning nutrition:
During the time period from weaning to first breeding season is when producers are determining rations. We suggest developing bulls at moderate rates of gain instead of high rates of gain. Since bull selection is based on genetic information such as EPDs, more producers are using a moderate plane of nutrition to develop breeding bulls during the post-weaning phase. Nutrient requirements for growing bulls can be found in NRC (2000) or through the extension service. There are many possible rations that could be used to develop bulls at the desired animal performance prior to the first breeding season. The best ration depends heavily on the availability and cost of feed ingredients. The key is developing the ration to meet the desired animal performance without over- or under-developing the bull.

During the post-weaning period both under-nutrition and over-nutrition can have negative impacts. Under-nutrition results in delayed puberty and over-nutrition can reduce semen production and quality. Limited data is available in the area of bull nutrition. Diets should be balanced to meet the nutrient requirements for the desired animal performance and body condition score should be monitored to ensure that the bulls are not being under- or over-nourished. Typically, many of the diets to develop beef bulls contain from 40 – 60% concentrate. For breeds that are known to reach puberty later, a common practice is to place the bulls on a slightly higher plane of nutrition (60 – 70% concentrate). The theory is to hasten the onset of puberty; however, with breeds that reach puberty early; additional energy is not beneficial and may cause over-conditioned animals.

Conditioning prior to the breeding season:
Yearling bulls should have a body condition score of 5.5 to 6.5 (9 point scale) at the start of the breeding season. Once body condition has been assessed, management is needed for over-conditioned bulls and thin bulls. If yearling bulls are over-conditioned they need to be "let down" to prepare them for the breeding season. Gradual changes are needed when changing diets to be more or less concentrated to reduce the possibilities of metabolic disorders and impaired breeding performance. Because mature sperm is produced over a 60-day period before ejaculation; nutritional effects of over- or under-feeding on sperm quantity and quality will have some carryover effect. The general method of stepping down bulls is to gradually replace a portion of the concentrate in the ration with forage over several weeks until the bulls are consuming forage or forage plus a supplement. Ideally, this should start at least 30 to 60 days prior to turn-out and yearling bulls should continue to gain 1.5 to 2.0 pounds per day.

Thin bulls should be put on a ration with a higher level of energy to increase rate of gain. If bulls purchased or previously in your ownership are in good condition you will need to ensure that they are adapted to high-forage rations prior to turn out.

Breeding Season Nutrition:
There is limited opportunity to manage bull nutrition during the breeding season. They are basically on the same plane of nutrition as the cows. However, you should assess the body condition score of bulls during the breeding season as well as observe bulls' ability to service the cows. Bulls often lose from 100 to 200 pounds during the breeding season. If bull(s) get extremely thin during the breeding season you may want to replace him because his ability to service the cows will probably be reduced.

Post-breeding season:
The need for proper growth and development still exists and continues after the breeding season, especially for young bulls that are still growing. Nutritional management post-breeding is influenced by both age of bulls and amount of weight loss during the course of the breeding season. Once the breeding season is over, producers usually turn bulls out to a separate pasture to regain lost weight and prepare them for the next breeding season. Mature bulls in fairly good condition after the breeding season can be managed on pasture or an all-roughage diet without supplements during the winter. Hay quality should be 8 to 10% crude protein and fed at 2% of body weight. Rations should be modified based on available feed ingredients and to manage the bulls to maintain moderate body condition.

Young bulls are still growing so the ration should be formulated to gain 1½ to 2 pounds per day depending on the magnitude of weight loss during breeding. The need to supplement young bulls on summer/fall pasture will depend on the quality and quantity of forage available. The best method for developing a diet for bulls is to test potential feeds and formulate a ration based on age, size and desired performance. For example, during the winter feeding program, feeding roughage at 2% of body weight plus 3 to 6 pounds of grain so total diet protein content is 10 to 11% will often provide the targeted rate of gain in young bulls.

Minerals and Vitamins:
Minerals and vitamins are important for successful animal growth and breeding performance. As you develop a ration for your bulls remember to include a quality mineral and vitamin program.

Two Breeding Seasons per Year:
Some producers have both spring and fall calving herds, hence double-using bulls. This puts additional management onto these producers to ensure that bulls will be prepared to serve cows at each breeding season. With two breeding seasons per year, bulls have a shorter time to replenish their weight loss before the next breeding season. Young bulls may need to gain 2 to 2 ½ pounds per day to recover from weight loss.

Even with the best nutrition program some bulls have low fertility or other reproduction problems which will limit their servicing capacity. We will highlight some management that

can be completed to increase the probability of high performing and fertility bulls and other things to measure to decide if bulls are fertile or not.

Facilities

Facilities vary widely among operations. It may include pens/pastures, fences, water/waterer, forage supplies, corrals, working areas and natural barriers. The key is having facilities that can safely handle fighting bulls and ensures the safety of those working with the cattle. Pens and pastures should be large enough to ensure bulls adequate exercise to prepare them for the breeding season. To encourage bulls to get exercise, locate feeding areas away from water. Bunk space should be 24 to 30 inches per bull if all bulls are being fed at the same time, space can be reduced to 8 to 12 inches with a self feeder.

Social Dominance

Typically social ranking (dominance) is controlled by size, age and seniority within the group. This ranking may affect the number of cows a given bull will service in a multiple-sire herd. Livestock managers must be aware of these relationships to ensure normal breeding rates. For example, a dominant bull with poor semen quality or low libido could reduce pregnancy rates for an entire herd even when more fertile subordinate bulls are present.

A bull's seniority is the major factor influencing his social ranking; the dominant bull in a breeding cadre is likely to be an older bull (Chenoweth, 1997). Therefore, it is important not to introduce a young (yearling) bull into a herd with an older, more mature bull. Introducing young bulls into a herd with an older bull can be avoided by separating cows into single-sire breeding groups. In multiple-sire breeding groups, multiple bulls tend to breed the same sexually active cows, this increases the risk of bull injury.

The number of breeding pastures is often limited within a beef operation. When running multiple-sire breeding groups with a variety of ages, it is important to group bulls together based on multiple-sire groups before the breeding season. This allows them to determine the social ranking prior to turning them into the cow herd.

Bull to Cow ratio

Since variation exists between bulls in their desire to mate (libido), recommendations for bull to cow ratios range from 1:10 up to 1:60. Practically bull to cow ratios vary greatly depending on the capability of individual bulls and the situation they are placed in (e.g., synchronized or nonsynchronized herds). Bull age also affects bull to cow ratios. Yearling bulls have a lower serving capacity than older bulls. Therefore, it is important to remember that young bulls should be utilized at a lower bull to cow ratio than older bulls.

Individual 2- and 3- year old bulls with high reproductive capacity have been used in nonsynchronized single-sire breeding groups with bull to cow ratios of 1:60 with no decrease in estrous detection or conception (Chenoweth, 1997). However, when multiple sires are used on a single group of females, additional bulls will be required since several bulls will breed the same cow. In addition, when cows are synchronized and bred by natural service, greater pressure is placed on the herd bull. Therefore, additional bulls will be needed to

breed the same number of cows when compared to the number of bulls needed to breed nonsynchronized cows (Healy et al., 1993).

Maximum bull to cow ratios will vary depending on mating ability, semen quality, and libido of individual bulls. Bull to female ratios can usually be increased in single-sire breeding groups; however, bulls should be observed closely during the breeding season to ensure that they continue to mate successfully. Poor performance of a bull in a single-sire breeding group will affect the entire calf crop of that group.

Health

A good health program is essential for the herd bulls. The best method for developing a health protocol is by working with your local veterinarian. You should determine the vaccinations to be given, parasite control, and other specific procedures most suited to your location. Health problems can be divided into 1) affecting the individual bull or 2) infectious diseases that may affect the herd as well as the bull's fertility.

Conditions that affect the individual bull are: 1) Johne's disease, 2) Lameness due to injury or infection, 3) Pinkeye, 4) Vesiculitis, and 5) Other conditions. Those conditions can influence the bull's ability to service the female or depress the semen quality.

Some possible herd conditions are: 1) Bovine Viral Diarrhea (BVD), 2) Trichomoniasis, 3) Leptospirosis, 4) Vibriosis, 5) IBR-Infectious Bovine Rhinotracheitis (Red Nose). All of these conditions impact the profitability through reduced number of calves born.

Breeding Soundness Evaluation (BSE)

The American Society for Theriogenology developed minimum guidelines for a bull to pass a BSE. A BSE includes a physical examination, measurement of scrotal circumference, and evaluation of semen quality. To successfully complete a breeding soundness evaluation, a bull must have at least 30% sperm motility, 70% normal sperm morphology, and a minimum scrotal circumference based on age (Table 1; Chenoweth et al., 1992). Bulls should be tested approximately six weeks to one month prior to the breeding season by a veterinarian. This allows for time to retest bulls where unsatisfactory results are obtained or time to find a replacement herd bull.

Table 1. Minimum scrotal circumference requirements for bulls to successfully pass a BSE based on the age of bulls (Chenoweth et al., 1992).

Minimum scrotal circumference requirements based on age					
Age in months	≤ 15	$> 15 \leq 18$	$> 18 \leq 21$	$> 21 \leq 24$	≥ 24
Scrotal circumference (cm)	30	31	32	33	34

Mating Ability

The purpose of the physical examination portion of a BSE is to determine a bull's mating ability. Mating ability can be described as the physical capabilities needed to successfully breed a cow. A bull must be able to see, smell, eat, and move normally to successfully breed cows. The physical examination closely scrutinizes a bull's eyes, teeth, feet, legs, and nutritional level (evaluated by body condition score). Any disease or injury that affects

joints, muscles, nerves, bones, or tendons may cause a bull to be structurally unsound. In addition to structural unsoundness, diseases or injuries to the penis or prepuce can result in an inability to breed via natural service. These abnormalities will only be detected by careful examination or observing an attempted mating of a cow. A bull that has high quality semen but is unable to physically breed cows is unsatisfactory for natural service.

Scrotal Circumference

As scrotal circumference increases, so does the daily production of high-quality sperm. There is a positive genetic correlation between a sire's scrotal circumference, the scrotal circumference of his sons, and the pregnancy rate of his daughters. Furthermore, a negative genetic correlation exists between a sire's scrotal circumference and age of puberty in his daughters. This indicates that bulls with a larger scrotal circumference will likely sire sons with larger scrotal circumference. Furthermore, daughters should reach puberty at younger ages.

There are two commonly used methods for measuring scrotal circumference, a scrotal measuring tape or the Coulter scrotal measuring tape. Scrotal circumference is measured by placing a measuring tape around the scrotum at the widest point and measuring the circumference of the scrotum. A scrotal circumference measurement is an indirect estimate of the mass of testicular tissue; moreover, amount of testicular tissue is directly related to sperm quantity and quality. Studies on 1,944 bulls of various breeds and ages indicated that as scrotal size increased, the probability of a bull passing a BSE also increased (Cates, 1975). Additionally, bulls with small scrotal circumference at a year of age tended to have small scrotal circumference at two years of age.

Semen Quality

Semen quality includes ejaculate volume, sperm cell motility, and sperm cell morphology. It is important to remember that substandard nutrition, extreme environmental temperatures, and disease can reduce semen quality, and that the quality of semen from a single bull may change over time.

Sperm motility is calculated by evaluating the percentage of spermatozoa in a sample ejaculate that have progressive (headfirst) movement under a microscope.

Sperm morphology is calculated by evaluating the percentage normal spermatozoa in a sample ejaculate compared to sperm with primary and secondary abnormalities. Primary abnormalities originate in the testis during spermatogenesis. Secondary abnormalities originate in the epididymis, during sperm transport, or with handling of the sperm. Primary and secondary abnormalities refer to the origin of the defect and not to the severity of the defect. Therefore, both primary and secondary abnormalities are equally important when evaluating sperm quality.

Sperm morphology influences pregnancy rates. Bulls with less than 20% abnormal sperm elicit greater pregnancy rates compared to other bulls (Wiltbank and Parish, 1986; Table 2). Therefore, selection of bulls with greater than 80% normal sperm can increase overall pregnancy rates in a herd.

Table 2. Bulls were selected randomly or had ≥80% normal sperm cells. All bulls had a scrotal circumference >32 cm and successfully passed a breeding soundness evaluation (Wiltbank and Parish, 1986).

	Year 1		Year 2	
	Random Group	≥80% Normal Sperm	Random Group	≥80% Normal Sperm
Cows Exposed	655	675	1282	808
No. of Bulls	26	27	51	33
No. Pregnant	571	656	1179	769
% Pregnant	87%	93%	85%	90%
% Increase		6%		5%

Is a single BSE valid for the life of a bull?

Sperm production is a continuous process. However, a BSE is conducted at a specific point in time, and measures the sperm production at that specific point time. Therefore, the results of a BSE may change over time. Out of 34 young bulls (< 2 years) that failed their first BSE, 26 of these bulls successfully passed a second BSE and were classified as satisfactory potential breeders in a study conducted at the University of Missouri (Elmore et al., 1975). Furthermore, it has been shown that semen quality in young bulls can improve for up to 16 weeks following puberty.

Conversely, a bull that successfully passes a BSE can fail a subsequent BSE. Sperm production is a continuous process and many factors can affect it. Injury, disease, fever, and extreme environmental conditions are four of the main factors that can decrease sperm production. Injury to the penis or testis can also result in infertility in bulls. In light of these facts, it is important to realize that the results of a single BSE are not valid for the life of a bull, and testing a bull annually, usually a month prior to breeding season is recommended.

Libido

Libido refers to the desire to mate and is not part of the BSE. Libido is thought to be a highly inherited trait with heritability ranging as high as 0.59. This is because there is more variation in libido between sons of different sires than between sons of the same sire. It is important to remember that scrotal circumference, semen quality, and mating ability (evaluated in a BSE) are not related to libido. Therefore, a bull that passes a BSE may have poor libido or a bull with good libido may fail a BSE.

Libido has positive effects on pregnancy rate and, as such, can influence the success of an entire breeding season. For this reason, it is important to evaluate a bull's desire to mate prior to the start of breeding season. This can be done by placing a bull in a pen with an estrous female and record the bull's eagerness to mate over a five minute period. A bull's eagerness can range from no sexual interest to successfully mating with the female. Libido can be more practically evaluated by closely watching a bull after introducing him to a cow herd.

Conclusion

Proper nutrition is needed to ensure that the bull's reproductive development and performance is maximized. Since reproductive traits are not highly heritable, greater selection intensity is required to achieve genetic improvement. Selection intensity for female reproductive traits is usually low, since selection of replacement females in commercial herd is usually based on age, or weight and not reproductive performance. As a result, greater selection intensity is required in selection of herd bulls to achieve the desired level of genetic improvement. Structurally sound bulls with a large scrotal circumference and high semen quality should be selected as herd sires. Moreover, it is important to remember that semen quality of an individual bull changes over time and, for a bull to be fertile, libido and mating ability should be evaluated periodically.

References

Barth, A. D. 2000. Bull breeding soundness evaluation. 2nd ed. Published by Western Canadian Association of Bovine Practitioners.

Cates, W. F. 1975. Observations on scrotal circumference and its relationship to classification of bulls. Proc. Ann. Mtng. Soc. for Theriogenology. Cheyenne, WY. pp. 1-19.

Chenoweth, P. J., J. C. Spitzer, and F. M. Hopkins. 1992. A new bull breeding soundness evaluation form. Proc. Ann. Mtng. Soc. for Theriogenology San Antonio, TX. pp. 63-71.

Chenoweth, P. J. 1997. Bull libido/serving capacity. Vet. Clin. North Amer. Food Anim. Prac. 13:331-344.

Elmore, R. G., C. J. Bierschwal, C. E. Martin, and R. E. Youngquist. 1975. A summary of 1127 breeding soundness examinations in beef bulls. Theriogenology. 3:209-218.

Healy, V. M., G. W. Boyd, P. H. Gutierrez, R. G. Mortimer, and J. R. Piotrowski. 1993. Investigating optimal bull:heifer ratios required for estrous-synchronized heifers. J. Anim. Sci. 71:291-297.

Lehrer, A. R., M. B. Brown, H. Schindler, Z. Holzer, and B. Larsen. 1977. Paternity tests in multisired beef herds by blood grouping. Acta Vet. Scand. 18:433-441.

Lunstra, D. D., J. J. Ford, and S. E. Echternkamp. 1978. Puberty in beef bulls: hormone concentrations, growth, testicular development, sperm production, and sexual aggressiveness in bulls of different breeds. J. Anim. Sci. 46:1054-1062.

Nutrient Requirements of Beef Cattle (NRC) 2000.

VanDemark, N. L., and R. E. Mauger. 1964. Effect of energy intake on reproductive performance of dairy bulls. I. Growth, reproductive organs, and puberty. J. Dairy Sci. 47:798-802.

Wiltbank, J. N., and N. R. Parish. 1986. Pregnancy rate in cows and heifers bred to bulls selected for semen quality. Theriogenology. 25:779-783.