SDSU Extension

BEEF

Chapter 23

Bull Nutrition and Facilities

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Introduction

Bulls that are in good body condition, physically fit and disease free are critical for a successful breeding season. This chapter will focus on nutrition and facilities. Seedstock producers are the primary individuals managing the development program of bulls that are sold up to the age of one- and two-years old. For commercial cow-calf producers, feeding programs usually include feeding the purchased bull(s) from delivery until the breeding season begins and bulls that are retained from one breeding season to the next.

Nutritional Management

Nutritional management is important throughout the year to ensure bulls are in proper body condition for a successful breeding season. Underfeeding can negatively impact reproductive performance. However, overfeeding bulls also has negative effects on reproductive performance, especially when excess fat is deposited in the scrotum. The additional fat increases the temperature in the scrotum, which reduces sperm production and the quality of stored sperm. Being overly fat also increases stress on the bull and limits his ability to travel and possibly service cows that are in estrus (heat). Body condition score (BCS) will fluctuate throughout the year. Body condition should be highest immediately prior to breeding, ideally BCS 6, and is usually lowest at the completion of the breeding season.

Calfhood Nutrition

Nutrition while bull calves are still suckling usually is not directly managed, except during severe environmental conditions such as drought. Research has shown that calfhood nutrition is an important phase of development that has lifelong implications for a herd bull (Brito et al., 2007a; 2007b; 2007c). High quality nutrition during calfhood has been shown to result in higher gonadotropin secretion, which in turn resulted in larger testicles at a year of age (Brito et al., 2007a). Calfhood nutrition and health also affects the age when a bull reaches puberty and testicle size of yearling bulls (Barth, 2012). Lunstra et al. (1988) and Bagu et al. (2004) reported smaller scrotal

Key Points

- Managing nutrition programs to avoid over- and under-feeding bulls is important to reproductive success.
- The optimal body condition score for bulls at the start of the breeding season is 6.
- Facilities should be designed to allow bulls ample room and shelter to ensure a successful breeding season.

circumference in yearling bulls raised by first-parity heifers compared to older cows. Hence, lower milk production by first-parity heifers has been suggested as a potential reason for delayed reproductive development of bull calves.

Based on this research, it is important to ensure consumption of a high quality diet; however, this can be difficult to assess due to lack of accurate information on dam milk production and nutrient intake. Brito et al. (2007a) indicated that meeting the nutrient needs of the bull calf allowed for proper reproductive development; however, supplying additional nutrients beyond requirements did not enhance reproductive performance. Good nutrition and health starts with ensuring that calves receive adequate colostrum intake at birth. When low milk production or forage quantity or quality is suspected, supplying additional nutrients through creep feed is an option. However, creep-feed intake needs to be controlled to avoid consumption of excess nutrients.

Post-weaning to Yearling Nutrition

There is no "magic" diet or feed ingredient for bull development. Diets need to be balanced for each situation, which includes 1) age of bull, 2) weight of bull, 3) desired body condition, 4) desired average daily gain (ADG), and 5) environment. Table 1 provides the daily nutrient requirements for growing bulls. The key to success is balancing a diet to provide these nutrients.

Selected feed ingredients will differ by operation; however, caution should be used with specific feedstuffs. Cottonseed products have a naturally occurring substance, gossypol, which can be toxic (Lusby et al, 1991). Gossypol can be found in the entire plant (kernels, hulls, leaves and stems); however, it is concentrated within the cottonseed. There are two forms of gossypol – free and bound. The free form is toxic. Gossypol bound to a protein is considered the non-toxic form. The majority of the gossypol in whole cottonseeds is the free form. Cottonseed oil extraction methods influence the amount of gossypol in the cottonseed meal. When heat is used in extraction, increased protein binding occurs; however, solvent extraction without heat leaves more of the gossypol in the "free" form. Gossypol impacts reproductive performance in young males near puberty more than it impacts older, mature males. Chase et al. (1994) reported bull fertility was hindered when cottonseed products were fed at high levels and/or for long periods of time. Feeding cottonseed products at a "normal" level (3-5 lb/day) to breeding animals does not appear to cause reproductive problems (Martin, 1990).

Most seedstock producers sell bulls as yearlings to avoid the additional costs associated with holding them to two-year-olds. Nutritional management shifts from the seedstock producer to the commercial producers at the time of delivery. Nutrition is still important for continued proper reproductive development and breeding success.

Bulls developed at bull stations are often fed a "high energy" diet that will ensure that the bull's genetic potential for growth can be expressed. However, there are debates over whether bull nutrition during growth and development should be "high energy" or "high forage". There is not a clear answer to this question. Bull purchasers need to develop a feeding program that will allow for desired animal performance and positive reproductive performance.

Yearling or "Post-purchase" Nutrition

Commercial producers' bull nutrition programs start when the bulls are delivered after purchase. Producers should assess bulls' body condition score upon arrival and develop a feeding program to move the bulls to a BCS of 6. If highly conditioned bulls are purchased, a program to gradually reduce the fleshiness of the bull before the breeding season should be implemented. The feeding program should be designed similar to the bulls' previous feeding system, with any ration modifications made gradually, in order to reduce metabolic disturbances.

The nutrient requirements for growing bulls are shown in Table 1. Nutrient requirements change as bulls mature. Larger bulls consume more dry matter; thus, they can be fed less nutrient dense diets as compared to lighter animals. Table 1 shows that 900-pound bulls have a higher daily dry matter intake (18.9 to 19.6 lb/day) compared to 500-pound bulls (12.2 to 12.6 lb/day). However, the crude protein requirement as a percentage of dry matter decreases as the bulls grow from 500 to 900 pounds

Table 1: Daily nutrient requirements for growing beef bull calves post-weaning (Mature Size 2000 lb). *Nutrient requirements calculated from NRC, 2000.*

Diet Nutrient Density[a]								
Body Wt., lb	**ADG, lb/d**	**DMI, lb/d**	**CP, % DM**	**NEm, Mcal/lb**	**NEg, Mcal/lb**	**TDN, % DM**	**Ca, % DM**	**P, % DM**
500	1.0	12.2	9.8	0.56	0.30	58	0.34	0.18
	2.0	12.6	12.9	0.65	0.38	65	0.53	0.26
	3.0	12.6	16.3	0.76	0.48	72	0.73	0.34
600	1.0	13.9	9.4	0.56	0.30	58	0.32	0.17
	2.0	14.5	12.0	0.65	0.38	65	0.46	0.23
	3.0	14.5	14.9	0.76	0.48	72	0.61	0.30
700	1.0	15.6	9.1	0.56	0.30	58	0.29	0.17
	2.0	16.3	11.4	0.65	0.38	65	0.40	0.21
	3.0	16.3	13.9	0.76	0.48	72	0.53	0.26
800	1.0	17.3	8.7	0.56	0.30	58	0.27	0.16
	2.0	18.0	10.7	0.65	0.38	65	0.37	0.19
	3.0	18.0	12.9	0.76	0.48	72	0.47	0.24
900	1.0	18.9	8.3	0.56	0.30	58	0.25	0.15
	2.0	19.6	9.9	0.65	0.38	65	0.34	0.19
	3.0	19.6	11.9	0.76	0.48	72	0.42	0.22

[a] ADG = Average Daily Gain; DMI = Dry Matter Intake; CP = Crude Protein; NEm = Net Energy of Maintenance; NEg = Net Energy of Gain; TDN = Total Digestible Nutrients; Ca = Calcium; and P = Phosphorus. Estimated CP was calculated from metabolizable protein in NRC (2000).

(9.8 to 16.3% vs. 8.3 to 11.9%). Higher levels of dietary protein need to be fed to lighter bulls because of the rapid lean muscle growth that occurs during early development.

Nutrient requirements are influenced by the targeted rate of gain. There are many possible rations that could be used to develop bulls at a desired rate of gain prior to the first breeding season. Table 2 provides a few examples of rations for a 700-pound bull with a desired ADG of 2.0 lb per day. The ration for any situation is primarily driven by the availability and cost of feed ingredients. The key is developing a palatable ration that meets the desired animal performance goals at the least cost.

During the post-weaning period, both under- and over-nutrition can have negative impacts on bull productivity. Under-nutrition results in delayed puberty (VanDemark et al. 1964.) Over-nutrition can reduce semen production and quality (Schilling and Krajnc, 1964). Diets should be balanced to meet the nutrient requirements for the desired rate of gain and BCS should be monitored to ensure that the bulls are not being under- or over-fed.

Table 2: Five example rations for 700-pound bulls to gain 2.0 lb per day.

Example	**A**	**B**	**C**	**D**	**E**
	As-Fed Basis (lb/d)				
Alfalfa Hay (14% CP, 52% TDN)	11	---	10	---	---
Grass Hay (11% CP, 57% TDN)	---	10	---	---	5
Mature Prairie Hay (6% CP, 51% TDN)	---	---	4	13	2.5
Corn Silage (8.3% CP, 70% TDN)	---	14	---	---	5
DDGS* (30% CP, 83% TDN)	---	1	---	3.5	20
Corn (9% CP, 88% TDN)	6	3	6.5	3.0	---
Predicted ADG, lb/d	2.07	2.08	2.07	2.06	2.07

Ideally, bulls should be in a BCS of 6 at the start of the breeding season because bulls normally lose 100 to 200 pounds (1.0 to 1.5 body condition scores) during the breeding season. Typically, most diets to develop beef bulls contain from 0 to 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 to 70% concentrate). Almquist (1982) reported that higher energy diets advanced the onset of puberty and hastened testicular development and function without enhancing testicular size. However, higher energy levels fed to Simmental and Hereford bulls did not result in earlier sexual development (Pruitt et al., 1986). Caution should be used when feeding additional energy beyond requirements because it may cause over-conditioned animals.

Conditioning Prior to the Breeding Season

Yearling bulls should have a BCS of 6 at the start of the breeding season. Body condition should be assessed at least 60 days before initiation of the breeding season (ideally, 90 to 120 days) to allow time to adjust nutritional management for under- or over-conditioned bulls. If yearling bulls are over-conditioned (BCS greater than 6.5), they should gradually be stepped down in condition to avoid nutritional disorders and adverse effects on semen production. Because mature sperm is produced over a 60-day period before ejaculation, nutritional effects of over- or under-feeding on sperm quantity and quality may have some carryover effect. The general method of stepping down over-conditioned bulls is to place them on a diet similar to the previous ration, but limit the intake to 60 to 70% of previous intake, then remove 10% of the grain per week until the desired level is achieved. Bulky feeds such as forages should be used to replace the grain. Ideally, yearling bulls should continue to gain 1.5 to 2.0 pounds per day, because they are still growing.

Thin bulls (BCS less than 5) should be put on a ration with a higher level of energy to increase rate of gain. This can be accomplished by reversing the process described above. Gradually increase the percentage of concentrate by 10% per week until reaching a ration that will achieve a rate of gain that will increase body condition. This must be a gradual process to avoid nutritional disorders associated with over-feeding grain such as acidosis, founder, or bloat. If bulls, either recently purchased or previously owned, are in good condition; then provide a ration that will ensure they maintain condition and are adapted to a high-forage diet prior to turnout to breeding pastures.

Breeding Season Nutrition

There is limited opportunity to manage bull nutrition during the breeding season. The bulls are basically on the same plane of nutrition as the cows. However, you should assess the BCS of bulls during the breeding season as well as observe bulls' ability to service the cows and any health concerns. Bulls often lose from 100 to 200 pounds (1.0 to 1.5 body condition score) during the breeding season. A bull that becomes extremely thin during the breeding season may need to be replaced because his ability to service the cows could be reduced.

Post-breeding Season Nutrition

Nutritional management post-breeding is influenced both by the age of the bulls and the amount of weight loss experienced during 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 good body 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 (DM basis.) Intake will average between 1.5 to 2.5% of body weight. Rations should be modified based on available feed ingredients and to manage the bulls to maintain moderate body condition.

Nutrient requirements for growing and mature bulls at lower rates of gain are provided in Table 3. When crude protein (% DM) is calculated from metabolizable protein, some recommended CP values fall below 7% of DM. Research has shown that feed intake declines rapidly as the CP content of the diet falls below about 7% because of a ruminal protein deficiency (Moore and Kunkle, 1995).

Yearling bulls or bulls in thin condition may need to be fed more nutrient dense diets to prepare for the next breeding season. Yearling bulls need to continue to grow following the breeding season as they do not reach mature weight until four years of age. If expected bull mature weight is 2000 pounds, a reasonable weight at the initiation of the second breeding season would be 1500 to 1600 pounds. If the bull weighs 1350 pounds at initiation of the first breeding season and lost 200 pounds during the breeding season, he will weigh 1150 pounds at

Table 3: Daily nutrient requirements for maintenance and gain (to regain body condition) of growing and mature bulls (Mature weight 2000 pounds). *Information calculated from NRC, 2000.*

Diet Nutrient Density[a]								
Body Wt., lb	**ADG, lb/d**	**DMI, lb/d**	**CP, % DM**	**NEm, Mcal/lb**	**NEg, Mcal/lb**	**TDN, % DM**	**Ca, % DM**	**P, % DM**
1000	0.5	23.8	6.1	0.45	0.20	50	0.17	0.12
	1.7	25.2	7.5	0.61	0.35	60	0.25	0.14
	2.7	24.6	9.1	0.76	0.48	70	0.32	0.17
1100	0.5	25.6	5.9	0.45	0.20	50	0.17	0.12
	1.7	27.0	7.1	0.61	0.35	60	0.23	0.14
	2.7	26.4	8.4	0.76	0.48	70	0.29	0.16
1200	0.5	27.3	5.8	0.45	0.20	50	0.17	0.12
	1.7	28.9	6.8	0.61	0.35	60	0.22	0.13
	2.7	28.2	7.9	0.76	0.48	70	0.27	0.16
1300	0.5	29.0	5.8	0.45	0.20	50	0.17	0.12
	1.7	30.7	6.5	0.61	0.35	60	0.21	0.13
1600	0.5	33.9	5.5	0.45	0.20	50	0.17	0.12
	1.7	35.8	5.8	0.61	0.35	60	0.18	0.12
2000	0.0	37.2	5.6	0.39	0.00	46	0.17	0.13

[a] ADG = Average Daily Gain; DMI = Dry Matter Intake; CP = Crude Protein; NEm = Net Energy of Maintenance; NEg = Net Energy of Gain; TDN = Total Digestible Nutrients; Ca = Calcium; and P = Phosphorus. Estimated CP was calculated from metabolizable protein in NRC (2000).

the end of breeding. This example indicates that this bull would need to gain between 350 to 450 pounds prior to the second breeding season. In this situation, the bull's ration should be formulated to support an ADG of 1.5 to 2.0 pounds.

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 analyze potential feeds and formulate a ration based on bull age, size, and desired performance. For example, during the winter feeding program, feeding roughage at 2% of body weight plus 3.0 to 6.0 pounds of grain per day (total diet CP content of 10 to 11% and TDN content of ~55 to 65%) will often meet the targeted rate of gain in young bulls. When preparing young bulls for their second breeding season, starting early will mean less grain or concentrates will be needed in the ration.

Two Breeding Seasons per Year

Bulls used in both spring and fall calving herds require additional management to ensure they will be prepared to service cows in both breeding seasons. With two breeding seasons per year, bulls have a shorter time to regain lost weight before the next breeding season. At 18 month of age, young bulls should be at 70% of mature weight (e.g. 1400 pounds for 2000 pound mature weight). If the bull completes the first breeding season weighing 1150 pounds, he would need to gain 250 pounds in about 5 months to reach 1400 pounds, which would require 1.67 pounds ADG. Nutrient levels from a grazing only diet may not be adequate to reach the target weight and BCS, thus these bulls may require supplementation. Mature bulls ending the first breeding season in good condition may be able to consume enough high quality forage to allow adequate recovery prior to the second breeding season without additional feed.

Minerals and Vitamins

This chapter does not address mineral and vitamin nutrition in depth for bull diets. For detailed information on mineral and vitamin nutrition for beef cattle, see Chapter 20.

Numerous minerals have been evaluated to determine if they have an impact on bull reproductive performance. Arthington et al. (2002) reported increased fertility for bulls fed a

combination of inorganic and organic zinc at 40 ppm however, higher levels of inorganic zinc (60 ppm) also improved fertility. The recommended zinc level is 30 ppm (NRC, 2000). However, the more recent data suggest that this level may be too low.

Selenium is another mineral that impacts reproductive performance. Selenium deficiency reduced viability of sperm (Underwood and Suttle, 1999). Within South Dakota, there are regions that are deficient in selenium as well as regions known for toxicity problems. Use caution before adding additional selenium to any diets.

Facilities

Bull facilities do not need to be elaborate; however, bulls should have ample room for exercise and feeding space and should be protected from severe weather. Exercise is key to keeping bulls active and physically fit for each breeding season. Pens should be large enough so bulls can exercise and have enough space to get away from each other. Midwest Plan Service (1987) suggests 500 ft2 for unpaved lots with mounds and 800 ft2 for unpaved lots without mounds for 1500-pound bulls. Mature herd bulls are larger than 1500 pounds, so additional space should be provided. If pen size is limiting, encourage exercise by locating water and feed sources at the maximum distance apart. Managing bulls in a pasture provides adequate space for exercise and for bulls to get away from each other when fighting occurs.

Pens need to be well drained to help minimize foot problems. Winters can be harsh in South Dakota and the northern Great Plains; so providing shelter that is adequate enough to prevent frostbite to the scrotum is advised. Shelter can be in the form of an open-sided pole shed, good windbreaks, or tree shelter. Twenty five to 30 square feet per bull is recommended within a shed. Shelter should allow the option of spreading bedding in case of extreme cold temperatures. If testicles are frostbitten or receive any other injury, two months are required after the testicles are healed for production and storage of normal sperm to occur. If frostbite to the scrotum is suspected, reproduction ability should be tested by a veterinarian well before the breeding season begins, in case a replacement bull is needed.

The amount of bunk space depends on the feeding system; bunk space for free choice feeding should be 8 to 12 inches; however, 30 to 36 inches is recommended if limit feeding once daily (Midwest Planning Service, 1987).

Ideally, bull facilities should be located where the bulls cannot see any heifers and cows. Avoiding sight of the females will tend to keep bulls quieter and they will do less riding and fighting. Good fences are a must; this may mean several strands of barbed wire or an electric fence. Some bulls require a combination of barbed wire and electric fence.

Summer facilities or pasture should provide a forage supply, fresh clean water, and shade. In a perfect world, prior to breeding season bulls would be a good distance away from females, with a minimum of two fences or several pastures between them and breeding females.

A bull's seniority is the major factor influencing its social ranking; the dominant bull in a breeding cadre is likely to be an older bull (Chenoweth 1997). Mixing of older bulls results in more fighting than mixing younger bulls (Tennessen et al., 1985). Therefore, it is important not to introduce a young (yearling) bull into a herd with an older, more mature bull. If possible, keep bulls in stable social groups and avoid mixing bulls, especially bulls of various ages. 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 responsive females. This leads to females being bred by more than one bull and to an increased risk of bull injury.

Summary

Seedstock and commercial beef producers want quality beef bulls that, as a yearling, are capable of producing quality semen and which are physically able to seek out cows and heifers on pasture, with the end result of successful matings. Nutritional management plays an important role in ensuring that they can fulfill expectations. The recommended BCS for bulls at the start of the breeding season is 6; thus, nutritional programs should be designed with this target BCS in mind. Facilities need to ensure a safe environment that will allow the bulls to exercise, have access to clean water and feed, and reduce the possibility of injuries.

References

Almquist, J. O. 1982. Effect of long-term ejaculation at high frequency on output of sperm, sexual behavior, and fertility of Holstein bulls; Relation of reproductive capacity to high nutrient allowance. J. Dairy Sci. 65:814-823.

Arthington, J. D., L. R. Corah, and D. A. Hill. 2002. Case study: The effects of dietary zinc concentration and source on yearling bull growth and fertility. Prof. Anim. Sci. 18: 282-285.

Bagu, E. T., S. Madgwick, R. Duggavathi, P. M. Bartlewski, D. M. W. Barrett, S. Huchkowsky, S. J. Cook, and N. C. Rawlings. 2004. Effects of treatment with LH or FSH from 4 to 8 weeks of age on the attainment of puberty in bull calves. Theriogenology 62:861-873.

Barth, A. D. 2012. Managing Bull Development to Optimize Fertility. Proceedings, Applied Reproductive Strategies in Beef Cattle. Pp. 121-126.

Brito, L. F., A. D. Barth, N. C. Rawlings, R. E. Wilde, D. H. Crews Jr., P. S. Mir, and J. P. Kastelic. 2007a. Effect of nutrition during calfhood and peripubertal period on serum metabolic hormones, gonadotropins and testosterone concentrations, and on sexual development in bulls. Domes. Anim. Endocrinol. 33:1-18.

Brito, L. F., A. D. Barth, N. C. Rawlings, R. E. Wilde, D. H. Crews Jr., Y. R. Ehrhardt, and R. A. Kastelic. 2007b. Effect of feed restriction during calfhood on serum concentrations of metabolic hormones, gonadotropins, testosterone, and on sexual development in bulls. Reproduction 134:171-181.

Brito, L. F., A. D. Barth, N. C. Rawlings, R. E. Wilde, D. H. Crews Jr., P. S. Mir, and R. A. Kastelic. 2007c. Effect of improved nutrition during calfhood on serum metabolic hormones, gonadotropins, and testosterone concentrations, and on testicular development in bulls. Domes. Anim. Endocrinol. 33:460-469.

Chase, C. C., Jr., P. Bastidas, J. L. Ruttle, C. R. Long and R. D. Randel. 1994. Growth and reproductive development in Brahman bulls fed diets containing gossypol. J. Anim. Sci. 72:445-452.

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

Davies, D. V., T. Mann and L. E. A. Rowson. 1957. Effect of Nutrition on the Onset of Male Sex Hormone Activity and Sperm Formation in Monozygous Bull-Calves. Proceedings of the Royal Society of London. Series B, Biological Sciences Vol. 147: 332-351.

Lunstra, D. D., K. E., Gregory, and L. V. Cundiff. 1988. Heritability estimates and adjustment factors for the effects of bull age and age of dam on yearling testicular size in breeds of bulls. Theriogenology 30:127-136.

Lusby, K., D. Herd, and R.D. Randel. 1991. "Recommendation Statement" on feeding cottonseed and cottonseed meal to beef cattle in Texas and Oklahoma. In. Cattle research with gossypol containing feed (eds. Jones, Kinard, and Mills), National Cottonseed Products Association. p. 93.

Martin, S. D. 1990. Gossypol effects in animal feeding can be controlled. Feedstuff, August 6, 1990. P. 14.

MWPS. 1987. Beef Housing and Equipment Handbook. 4th ed. MWPS, Iowa State Univ., Ames, IA.

Moore, J. E. and W. E. Kunkle. 1995. Improving forage supplementation programs for beef cattle. Proc. Florida Ruminant Nutr. Symposium. P. 65. Univ. of Florida, Gainesville, FL.

National Research Council. 2000. Nutrient Requirements of Beef Cattle. 7th Revised Edition, 1996: Update 2000. National Academy Press. Washington, D. C.

Pruitt, R. J., L. R, Corah, J. S. Stevenson, and G. H. Kiracofe. 1986. Effect of energy intake after weaning on the sexual development of beef bulls. II. Age at first mating, age at puberty, testosterone, and scrotal circumference. J. Anim. Sci. 63:579-585.

Schilling, E. and A. Krajnc. 1964. Intensive feeding of young bulls and its effect on ejaculate and testes. Züchtungskunde 37:1-16. Anim. Breed Abstr 33: 2317.

Tennessen, T., M. A. Price, and R. T. Berg. 1985. The social interactions of young bulls and steers after re-grouping. Appl. Anim. Behav. Sci. 14:37-47.

Underwood, E. J. and N. F. Suttle. 1999. Mineral Nutrition of Livestock. 3rd Edition. CABI Publishing, New York.

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.