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Management of Bulls for Natural Service

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Introduction

One of the most important components of the "bottom line" for cow-calf producers is getting cows pregnant. Profits are determined by the maximum number of cows becoming pregnant in the shortest period of time and raising that calf until weaning. In today's market, one 600 pound calf represents about $750.00 of gross income. The difference in value between the first calf born and the last calf born in just a 30 day period is approximately 80 pounds and $100.00. If we start looking at the potential price differences over a 60 or 90 day calving period, the amount of money gained or lost can add up in a hurry.

There are several components that contribute to the dollars made or lost in any given year, some of which are out of the producers control such as drought affecting growth rates. But, many are within the control of or at least influenced by the producer. These include, but are not limited to, the distribution of calves born during the calving season, the length of the calving season, the timing of the calving season, and disease prevention and control for both the calves and adults in the herd. Calving distribution and length of the calving season combine to reduce weaning weight variability, which can greatly influence individual calf value. The aim of timing of the calving season is to maximize gains by timing growth curves with nutrient/forage availability while minimizing input costs such as feeding stored forages during the least physiologically demanding period of the cow's production cycle.

The discussion to follow is not intended to exhaustively review the literature for all influences upon the profit margins of cow-calf producers, but to point out some important areas in the management of bulls for natural service.

Breeding Soundness Examination

In the NAHMS Beef 2007-08 Part II survey it was reported that only 8% of all beef operations utilize artificial insemination (AI) as part of their management scheme. Nearly 20% of operations with inventories greater than 200 cows utilized AI in some fashion. When questioned about bull use compiled responses revealed that 94.2% of all cows and 79.2% of all heifers in the USA are exposed to bulls for natural service as the only means inducing pregnancy. The respondents also reported that they expect mature bulls to service 25-35 (some up to 50) and yearling bulls to service 17 females in a breeding season. Using an average bull:cow ratio of 1:25, this means that each bull represents approximately $18,750 worth of gross income per year.

It would follow that if a single animal in the herd made this much contribution to the total income there would be specific attention to management of this resource. However, when

producers were asked about one aspect of bull management, semen testing (Breeding Soundness Examination (BSE)), only 26.8% of respondents reported using BSE on a regular basis. The range was 18.1% for less than 50 cow operations to 61.1% of herds with greater than 200 cows. If bulls were purchased, leased, or borrowed the range changed for less than 50 and greater than 200 to 58.9% and 95.6%, respectfully (average of 71.3%). It would seem that most producers want delivery of a bull with the potential to be a satisfactory breeder but once delivered they assume nothing will change and the bull will remain fertile and a good breeder thereafter.

There are several acquired causes of bull infertility, sub-fertility, or reduced breeding capacity, both temporary and permanent, which may strike at any age and time. These include but are not limited to orchitis, epididymitis, vesiculitis, testicular degeneration, traumatic injuries to the penis and prepuce, and limb injuries or arthritis (especially of the hind limbs)(Hopkins 2007, Engelken 2008). Some of these conditions are visible to the producer and therefore are treated or the bull is culled when detected. However, most of the inflammatory conditions would only be detected if a thorough BSE were performed.

Current standards set by the Society for Theriogenology for a passing BSE are as follows: normal physical exam including feet/legs, eyes, vesicular glands, ampullae/prostate, inguinal rings, penis/prepuce, testes/spermatic cord, epididymides, scrotum (shape), and any other physical abnormality that could affect the ability of the bull to breed; sperm motility of greater than 30%; sperm morphology of greater than 70% normal; and age dependant minima for scrotal circumference (30cm at 12 months of age to 34cm for greater than 24 months of age). One area of the bull's ability to impregnate cows that is not evaluated with any consistency in the USA is libido and/or serving capacity. The evaluation of desire and/or ability of the bull to breed has been left to the observation of the producer and only seems to be critically evaluated when a potential problem is noted. This is most likely due to the time requirements of performing a good libido/serving capacity test. The assumption is made that if the bull is physically fit and has a passing BSE that he will have the desire and ability to breed cows, however, on occasion an observant producer will detect a "lazy" or "clumsy" bull.

Yearling bulls may require time and even some assistance in "learning" how to breed cows (personal observation). They have strong libido but may become frustrated, tired and quit mounting because they were not able to execute intromission. They usually "learn" with time how to perform this task. However, in one case an owner observed this behavior over several attempts over several days. The young bull was separated from any females in a pen while the tail of a female in estrus was tied to the side via a tail tie to the heifer's neck to expose the vulva. The bull was brought to the heifer in a 20'x20' pen. After a couple of mounts intromission was successful. The young bull mounted and successfully bred the heifer another 3 times over 15 minutes. They were separated, the tail tie released and both moved back to pasture. The owner reported observing successful breedings of other heifers over the next couple of days (personal observation).

Nutritional Effects on Bull Fertility

When yearling bulls were fed restricted nutritional diets this resulted in reduced testicular mass, smaller ejaculate volumes, smaller seminal vesicles, and reduced sperm production (Swecker, et al 2007). While feeding excessive energy levels have been shown to result in abnormal foot growth from laminitis (Barth, et al 2008). Also, there is increased risk of ruminitis which can lead to liver abscesses and the development of vesiculitis (Barth, et al 2008). There can also be effects upon sperm morphology which is thought to be due to excessive scrotal fat which changed testicular thermal regulation (Barth, et al 2008, Swecker, et al, 2007).

Puberty in the bull takes place between 37 and 50 weeks and most producers recognize the need for a good plane of nutrition during this time. However, research has shown that development of the critical cell lines such as Leydig and Sertoli cells take place much earlier. Proliferation and maturation of these cell lines takes place between 5 and 25 weeks of age. These cells are influenced by serum levels of FSH and LH (Rawlings, et al 2008). In a series of experiments conducted to evaluate the effects of varied nutrition (mostly variations in concentrate/energy) during the postnatal period and pubertal to 70 week period showed that feeding adequate to high levels of nutrition between 5 and 25 weeks resulted in earlier onset of puberty and increased testicular size when compared to the low nutritional group (Barth, et al 2008). They also demonstrated changes in FSH and LH levels compared to controls. It would follow that the mature testicular size is determined by the proliferation and maturation of the Sertoli cells which are influenced by the plane of nutrition early in the bull's life. It was concluded that a target average daily weight gain in the calfhood period of 5-25 weeks should be greater than 1.2kg/day (2.6lbs/day) with an adequate nutritional plane after that (Barth, et al 2008).

The National Research Council recommends the following nutrient levels for an 800kg (1760lbs) bull: net energy for maintenance = 13.32 Mcal/day, metabolizable protein = 572 g/day, calcium = 25 g/day, and phosphorus = 19 g/day (NRC 1997). Other critical micronutrient recommendations are as follows: potassium= 0.6%, magnesium= 0.1-0.2%, copper = 10 ppm, zinc = 30 ppm, and selenium = 0.1 ppm (NRC 1997).

Disease Prevention

The negative effects of any disease process such as respiratory disease such as decreased weight gain and poor feed conversion has the potential to delay puberty in weanling and yearling cattle (Engelken 2008). Elevations in scrotal/testicular temperature, even for short periods, have been shown to initiate testicular degeneration resulting in higher numbers of abnormal sperm in an ejaculate and even azoospermia. This may be transient or permanent. These elevations can be caused by fever, elevated environmental temperatures, inflammation of the scrotal skin and excessive scrotal fat and have all been shown to have adverse effects. Frostbite of the scrotum has also been shown to initiate testicular degeneration. (Hopkins, 2007)

It is therefore recommended to vaccinate and booster vaccinate bull calves in the pre-weaning period against respiratory diseases, clostridial disease, and removal of internal and external parasites with appropriate anthelmintics and anti-ectoparasite treatments (Engelken 2008). These vaccinations, vaccinations against venereal diseases such as vibriosis, and anti-parasitics should be repeated annually in advance of the breeding season. It should also be pointed out that due to some regional variations in disease risks individual vaccination protocols should be developed with a local veterinary practitioner. An adequately functioning immune system is required for these vaccinations to be effective and to respond to bacterial and viral challenges, therefore, it is necessary to ensure adequate levels of nutrition especially energy, copper, zinc, and selenium are fed.

Conclusion

An individual bull represents a very large contribution to the gross income of a beef producer and therefore deserves to be developed and managed accordingly. This means that attention to nutrition as early as 5 weeks of age can have effects on its ability to be a successful breeder at maturity. A functional immune system is essential for the bull to remain healthy and to respond to preventative vaccinations and therefore adequate nutritional levels of protein, energy, micro and micro-nutrients (minerals) are necessary. Even with attention to these details every bull should receive a breeding soundness exam every year prior to the breeding season so that only animals with the greatest potential to be a successful breeder are used. The proper management of natural service bulls will help to ensure that the greatest number of calves are born in the earliest part of the calving season and therefore contribute to maximize profits for the cow-calf producer.

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