Considerations for Bulls Used in Natural Mating

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A complete breeding soundness evaluation (BSE) is certainly the mandatory first step in evaluating potential pregnancy outcomes with bulls used in natural mating. However, aspects of sexual behavior also need to be considered when evaluating abnormal performance; or normal performance considered by producers to be abnormal.

It is apparent that behavioral components contribute significantly to causes for non-pregnant cows in beef and dairy herds. Many believe that bulls with behavioral abnormalities constitute an additional 10% of bulls which should be classified as unsatisfactory potential breeders, in addition to those so classified with a routine BSE. Unfortunately, these bulls are missed with currently recommended BSE procedures. For purpose of discussion, we chose to divide these behavioral components into the four categories of libido, mating ability, mating behavior and social interactions.

Libido

Libido is defined as the sexual urge, or the willingness and eagerness to mount and attempt service of a female. Bulls vary in their expression of libido. There are some bulls who appear to have no desire to copulate with a receptive female. The genetic basis for libido has been well proven. Monozygotic twin bulls exhibit similarities in libido despite different management and nutritional regimes. Variations in libido among sire-son groups are greater than within such groups. Also, different breeds and lines within breeds of bulls have been reported to have differences in libido. One study has reported within breed heritability of .59 for libido of beef bulls. Finally, bulls of high and low libido when intact, remained in the same libido category following castration and replacement androgen therapy.

In free living animals, low libido was self limiting; but modern management systems, particularly the use of artificial insemination, have opened the possibility that bulls of lowered sex-drive could be used and their genes widely disseminated. It is important that males of high inherent reproductive capability be used, whether in A.I. programs or in natural mating.

Unfortunately, libido in bulls is not apparently related to any component of the present BSE, including scrotal circumference (SC). It is possible for a bull with a large SC and excellent semen quality to be of low libido and vice versa. In fact, the use of the electroejaculator to obtain bull semen precludes the necessity for the expression of any evidence of libido. We have also been unable to correlate any endocrine patterns with libido.

The producer must shoulder the responsibility for observing bulls with receptive females and eliminating those bulls with low libido. Careful observation of the herd at least once, and preferably twice, each day during a breeding season should allow a producer to see bulls detecting females in heat and successfully mating. Recording those females in heat each day is also a useful measure of breeding success. Less than one-half as many cows should be seen in heat the second 20 days of a breeding season as were seen in the first 20 days.

Contrary to popular opinion, there do not seem to be any good visual indicators of potential libido. In one study, 40 yearling and 2- year-old bulls were given a masculinity score from 1 (very feminine) to 10 (very masculine). In addition, the size of the crest of each bull was measured. There were bulls covering the range of masculinity scores and a great deal of variation was noted in crest size (from almost none to very large). However, no relationships were observed between these measures and either classification following BSE, libido and mating behavior, or pregnancy rates achieved in the breeding season.

Mating Ability

Mating ability is the ability to complete a service. This component appears to be more related to physical traits. Again, these physical traits are not normally evaluated in the BSE, but are apparent only when observing the bull during copulation. In one study of 483 bulls classified as satisfactory potential breeders following BSE, about 6% of these "satisfactory" bulls had abnormalities which prevented natural service. Abnormalities diagnosed included penile deviations, joint disease and vertebral problems. Factors affecting mating ability may impinge on libido if attempts at mating are a painful experience.

Mating Behavior

Mating behavior is that behavior exhibited immediately before, during and after service. The basic pattern of male sexual behavior appears to be innate in that bulls reared in complete isolation will often exhibit normal mating behavior when exposed to a receptive female. However, rearing young post-puberal males in bachelor groups may delay or inhibit expression of heterosexual mating behavior. While mating behavior, like libido, is influenced by genetic factors, there appears to be a learning component that may be influenced by rearing methods and other experiences.

Bulls appear to identify females in estrus more by visual stimuli than by olfaction. Lack of vision has been shown to greatly reduce the probability that bulls will identify and respond to sexually receptive partners, whereas lack of olfactory cues has little or no effect.

The physical effort which a bull exerts in finding a copulatory partner in the breeding pasture appears to be related to the number of females in pro-estrus or estrus. When this number is low or nil, the bulls may investigate the sexual status of most of the females daily. But, in general, females play the major role in selecting sexual partners and, when in estrus, will be in close proximity to the bull. As the number of receptive females in the herd increases, the bull initiates even fewer investigations of potential partners. When several females are in estrus or pro-estrus, a sexually active group (SAG) forms. This SAG is very mobile and regularly undergoes membership changes as it picks up new recruits and loses others. It usually remains in visual contact with the bull or bull group. The bull is attracted to the group by visual observance of homosexual mounting behavior.

Once attracted to a particular female, the bull tests her receptivity by tending behavior which includes licking and sniffing around the perineal region, flehman response, chin resting and mounting attempts. Mounting attempts may include sudden, rapid head movements, or raising the front feet off the ground. A non-receptive female generally makes evasive movements at this time and the bull goes in search of another partner.

The greatest single stimulus to a bull to mount and attempt service is an immobile object resembling the rear end of a cow. Physiological estrus is not a prerequisite and, in fact, the stimulus need not be female or even flesh and blood. The main criteria appear to be appropriate height, shape, adequate strength and immobility. Intromission is achieved by nerve endings of glans penis detecting warmth and moisture of the vulva. Bulls generally mount estrus cows more times than they service. The actual service takes about 1.3 seconds and is usually accompanied by intravaginal corkscrew of the penis.

The cow reportedly undergoes a refractory period after each service and generally is reluctant to be mounted. The bull also undergoes a quiescent period following copulation with the length of time between service varying among bulls and with the number of receptive females. Usually it is the bull which makes the first advance following service and he undertakes the same sequence of testing receptivity as previously described for the first encounter, i.e., he courts her into again becoming a receptive copulatory partner. Most females are bred 3 to 10 times during the estrous period.

Bulls are capable of prodigious reproductive activity. Active bulls average 30 to 35 services per day when first introduced to receptive females. This gradually declines over several days to average 20 services per day. When appropriately stimulated, bulls are amazingly capable of a great number of services in a limited period. In trials employing estrous synchronized females, beef bulls averaged 55 services (range 14 to 101) within a 30-hour observation period.

With this number of services within a limited time, the question arises of the relationship between decreasing spermatozoal numbers in successive ejaculates and fertility. We do not know what the minimal spermatozoal numbers for optimal fertility should be with natural mating. Studies on this question are difficult, but with frozen semen, spermatozoal numbers as low as .5 to 2.5 million per insemination have resulted in satisfactory fertility. As a mature bull can produce approximately 5 million spermatozoa per minute, it appears unlikely that sperm numbers per se are limiting fertility with successive multiple ejaculations.

Social Interactions

Social interactions cover a wide spectrum including male-female relationships, male-male aggression, dominance and others not so readily defined. In single bull herds, the male is generally at the top of the social hierarchy. (We have seen cases where an older, larger boss cow and a young, small, inexperienced bull make this statement incorrect, but those cases are rare). However, in multisire herds, there is a social ranking within the bull group. This is well documented in a study where the same 3 or 4 bulls were used in 5 consecutive years in the same cow herd. Bulls, cows and calves were blood-typed to ascertain parentage. These data show the dominant bull in the group sired 60% to 72% of the calves each year.

This study points out two important factors. First, older bulls should not be placed in the same pasture as young bulls. The old bulls will not "teach" young bulls how to breed cows and, in fact, will probably prevent them from breeding many cows. There is also the possibility of a permanent injury to a valuable young herd sire. Social ranking in bulls is largely controlled by age and/or seniority within the group. However, even with mature bulls, it is not always the older bull that is dominant. In 2 out of 5 years of this study, the oldest bull did not sire the greatest number of calves.

The same types of social interaction occur even with bulls of the same age. In a recently reported study, nine pairs of yearling bulls were exposed to as few as 13 and as many as 38 cows for a breeding season. There was considerable variation, but on the average, 1 of the 2 bulls sired 82% of the calves born. These two studies point out the effects of social interaction among bulls in a multiple sire breeding herd. It is easy to see that if the dominant bull in a multi-sire pasture is infertile, you can have real problems with getting cows pregnant. Additionally, there are indications that too many bulls in a pasture actually decreases fertility of the overall cow herd. It is reasonable to assume that these results reflect the influence of social ranking on the reproductive capabilities of the bulls.

Although lower ranking bulls are not excluded from mating in multi-sire situations, it is apparent that a social ranking significantly influences the sexual activity of bulls in mixed age groups. This has been verified in that groups of young bulls impregnated significantly more heifers over a 6-week mating period than groups of bulls of mixed ages. Although these studies have shown that dominant bulls sire more offspring than subordinate ones when used in multi-sire situations, it may not be due to greater libido. Preliminary data with yearling bulls indicated that the most dominant bull was not the bull with the most libido, nor was dominance particularly related to the biggest or fastest growing bulls.

Bull to Female Ratio

One additional factor which influences the mating efficiency of the bull is the number of females with which he is mated, or the bull to female ratio (BFR). However, there is actually little data to indicate a correct BFR and, in fact, this obviously depends on the breeding potential, libido and mating ability of individual bulls. In 3 reports with non-selected populations of bulls, these bulls detected 95 to 100% of the females in heat when used at BFR of 1:24 to 1:30. Another study used both high libido and low libido bulls at a BFR of 1:60. In this experiment, estrous detection was 90 to 98%.

While concrete recommendations are not possible, it appears our old guidelines of BFR of 1:25 to 1:30 are fairly low BFR for a breeding bull. Good reproductive efficiency can be expected when bulls are used at BFR of 1:40 and even 1:60 if bulls are selected, carefully evaluated and used properly. One study reported 3 bulls used at BFR of 1:60 achieved pregnancy rates of 72, 63 and 68% in the first 21 days of breeding with final pregnancy rates over 90%. However, in this study the ability of the individual sire was more important than the actual BFR. This work stressed the importance of developing methods to predict the reproductive performance of bulls used in natural mating.

Conclusions

Veterinarians and producers should observe bulls with cows in heat to determine that they have the desire and ability to mate successfully. As better tests become available, we will screen bulls on libido and mating ability. The normal mating behavior of the bull needs to be known and we must be aware of the role of social interactions in multiple sire breeding pastures. It is up to management to prevent or minimize these potential problems. Finally, our present practice of utilizing 1 bull to 25 or 30 females is, in most cases, a waste of bull power. Many bulls can serve 40, 50 or more cows during a breeding season, with normal pregnancy rates. However, these bulls need to be evaluated with a complete BSE and watched closely for mating ability and mating behavior.

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