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EXPLORING MATING LOADS FOR MODERN BEEF BULLS

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INTRODUCTION

One of the biggest challenges facing cow/calf producers today is cutting their costs of production. One possible strategy for lowering costs is to increase the production efficiency of the cow herd. A key area to focus on is the reproductive function of the beef bull because natural mating accounts for over 95% of the pregnancies achieved each year in the 33.7 million beef cows in the U.S.

It is becoming apparent that perhaps because of increased selection pressure on scrotal circumference, the modern beef bull is more fertile than the bull of yesterday, yet the majority of beef bulls are still being mated at traditional bull to female ratios of 1:20 to 1:30. Utilizing bulls to their full breeding potential is one of the quickest and simplest ways a producer can cut costs. Unfortunately, however, determining a bulls breeding potential has been either elusive in the case of yearling bulls or labor intensive in the case of mature bulls.

As a predictor of natural service fertility, most beef bulls undergo a breeding soundness examination prior to either sale or breeding; however, sex drive and mating ability are not commonly measured though both are essential for impregnation of females. Tests have been developed to measure a bulls mating ability or serving capacity. However, past studies investigating the relationship between serving capacity and herd fertility have been inconclusive with some researchers finding no relationship and other researchers reporting serving capacity tests to be an accurate predictor of bull fertility. Many of these studies differed in testing procedures and utilized bulls of different ages with varying levels of sexual experience; thus, differences in the findings may rest with these factors. Because most cattle producers in the United States are purchasing bulls at 12 to 15 months of age (virgins), most serving capacity work in the United States has focused on the serving capacity testing of yearling bulls.

ASSESSMENT OF BULL FERTILITY

Over the past several years we have performed a series of experiments to: 1) determine if serving capacity could be evaluated in virgin yearling beef bulls under field conditions, and 2) determine if serving capacity test results of yearling bulls is a good measure of bull fertility as determined by pregnancy rates after a breeding season under pasture mating conditions.

After a two year experiment (1986-87) utilizing a total of 150, 13-15 month old Angus bulls on a Kansas ranch, we concluded that: 1) serving capacity tests can successfully be conducted on yearling beef bulls under field conditions, 2) that sire has a profound impact on a bulls serving capacity, and 3) that providing sexual experience to low serving capacity bulls can

improve their serving capacity and should be a standard part of the test for this category of bulls.

The next step was then to determine the accuracy and usefulness of the serving capacity test results by assessing the pasture mating fertility of identified low and high serving capacity bulls. The pasture mating experiments summarized in Table 1 were conducted in several states over several years using over 1000 heifers or cows and different breeds of yearling bulls. Bulls were all tested in a similar fashion and, within experiment, low and high serving capacity bulls were similar in standard measures of fertility (breeding soundness component scores) with the exception of serving capacity.

Table 1. Summary of Selected References on the Pasture Mating Fertility of Serving Capacity Tested Yearling Bulls.

Exp. Ref.	Age of Bulls (mo)	No. Of Bulls[4]	Bull to Female Ratio	Single or Multi-Sire	Length of Breeding Season (days)	Preg. Rate and Conc. Date Comp.
Kansas St. Univ.[1]	20	2 LSC 2 HSC	1:30	Multi	66	No sig diff[6]
MARC[2]	15	10 LSC 10 HSC	1:25	Single	3	No sig diff
MARC[2]	15	10 LSC 10 HSC	1:9[5]	Single	1	No sig diff
Colo. St. Univ.[3]	15	6 LSC 6 HSC	1:33	Multi	44	LSC > HSC

[1]Unpublished data, 1987.
[2]J. Anim. Sci. 67:60, 1989.
[3]J. Of Theriogenology 36:1015, 1991.
[4]LSC = Low Serving Capacity; HSC = High Serving Capacity.
[5]All 9 heifers were in heat at once on the day of breeding.
[6]No sig diff = no significant difference.

Because of the industry impracticality of offering sexual experience to bulls before testing, the only sexual experience these bulls had was that obtained in repeated (up to 4 tests) serving capacity tests. The results are consistent. There was either no significant difference in pregnancy rate or conception date between low and high serving capacity bulls; or low serving capacity bulls had significantly higher pregnancy rates and earlier conception dates compared to high serving capacity bulls. These results can partially be explained by post breeding season serving capacity tests. In all cases low serving capacity bulls improved in their serving capacity. For low serving capacity bulls, the sexual experience provided during pasture mating, and, perhaps more physiological maturity were presumably the factors contributing to their drastic improvement in serving capacity. These results demonstrate that some yearling bulls are slow

learners and/or timid, but will improve if offered sexual experience beyond the serving capacity tests. Results from these studies and other recent studies all agree that serving capacity tests are a poor predictor of yearling bulls actual pasture mating fertility.

Purebred producers in the U.S. face a great dilemma because the industry has evolved to the predominant sale and purchase of bulls at 12-15 months of age. Bulls of high mating potential are obviously worth more to buyers (Table 2) because buyers need to purchase fewer bulls given the same number of cows. Unfortunately however, as outlined earlier, serving capacity testing of yearling bulls (less than 18 months) is ineffective and recent efforts aimed at searching for alternatives to serving capacity testing of yearling bulls to predict their inherent mating potential as mature bulls have been unsuccessful.

Table 2. Effect of Serving Capacity on Yearling Bull Sale Prices, Gardiner Angus Ranch, Ashland, Kasnas[1]

Year	Serving Capacity[2]	Average ($)	Diff[3] ($)
1986	Medium (13)	1208	
			258
	High (23)	1465	
1987	Medium (17)	2494	
			392
	High (36)	2886	
1988	Medium (40)	2932	
			244
	High (27)	3250	
1989	Medium (29)	2932	
			108
	High (48)	3359	
			560
	Super-High (15)	3600	
1990	Medium (27)	3007	
			352
	High (48)	3359	
			535
	Super-High (26)	3894	
1991	Medium (32)	2938	
			660
	High (66)	3598	
			1652
	Super-High (7)	5250	

[1]Sale bulls were 18-20 months old and had received sexual experience before serving capacity testing.
[2]Medium serving capacity, 2 or 3 services; high serving capacity, 4-6 services; super high serving capacity, 7 or more services in 20 minutes. Numbers in parentheses are the number of bulls represented in each classification.
[3]Difference = High-Medium sale price or Super High-High sale price.

ASSESSMENT OF OPTIMAL MATING LOAD

Because of the disparaging results seen with trying to identify individual yearling bull mating potential, and the labor intensity of serving capacity testing mature bulls, it seemed impractical to continue to pursue this avenue. Instead we felt it was important to better determine the optimum mating load for modern beef bulls because of the considerable potential increasing mating loads offers for lowering costs of production. Using estrus synchronization we were able to place very heavy mating loads on bulls in a short period of time; plus, estrus synchronization may enhance reproductive efficiency by allowing for a shortened breeding and calving season. Earlier work by several researchers provided evidence for increased mating loads for beef bulls both with and without estrus synchronization.

We initiated a study last spring (1990) in cooperation with Noffsinger Ranches of Walden, Colorado, to try and answer the earlier stated objective. Fortunately, this cattle operation owns their own feedlot and traditionally have a short breeding season for heifers and then feed out all open heifers, therefore we were able to impose some rather nontraditional bull to female ratios without ending up with an economic disaster.

A group of 800 cycling heifers were divided into four experimental groups: (1) non-synchronized heifers with two bulls per 100 heifers (control group); (2) synchronized heifers with two bulls per 100 heifers; (3) synchronized heifers with four bulls per 100 heifers; and (4) synchronized heifers with six bulls per 100 heifers. Each group had two replicates. The breeding season lasted only 28 days. The 28 bulls, mostly two- and three-year-olds, were selected based on their similarity for semen quality (greater than 80% normal sperm), scrotal circumference (greater than 34 cm) and structural soundness.

The outcome of this research was somewhat surprising. Using more bull power did increase the pregnancy rate, but only slightly, and not necessarily the profit. After 28 days, 82% of the non-synchronized heifers in the control group were pregnant compared to 77% in the two-bull synchronized group (See Figure 1). Interestingly, there was no difference in the average day of conception between the two-bull control group and the two-bull synchronized group. The nonsynchronized heifers cycled as if they were synchronized, resulting in 40% conceiving within the first six days of the breeding season, compared to 38% of the synchronized heifers. Eighty-four percent of the synchronized heifers in the six- bull group were pregnant by the end of the test period. The group that represented the industry standard (though these were synchronized), one bull to 25 females (4 bulls per 100 heifers), had an 83% pregnancy rate. Comparing the synchronization programs, a bull-to-heifer ratio of one to twenty-five (4 bulls per 100) was most profitable. Improving the pregnancy rate six percentage points was enough to justify using four bulls per hundred rather than two.

The first three treatments (1:50 nonsynchronized; 1:50 and 1:25 synchronized) were repeated in an identical experiment at the same location during the summer of 1991 and the results were similar. Eighty percent of the nonsynchronized heifers were pregnant (BFR 1:50) compared to 82 and 86% of the synchronized heifers in the two bull and four bull groups, respectively.

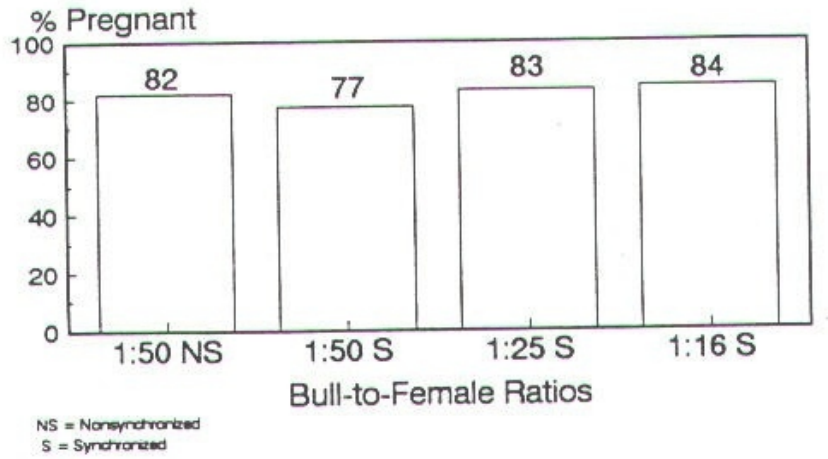

Figure 1. Pregnancy results by difference bull to female ratios.

By extrapolation, the results of this research have implications for producers who do not even use synchronization. Our results simply point out that many mature bulls are capable of much greater reproductive efficiency than is currently being required of them. Observations at select ranches which are successfully using mature bulls at ratios of 1:50 or greater bear this out.

HOW DOES TERRAIN AFFECT MATING LOADS?

Breeding pasture topography and size is generally thought to have a profound effect on bull to female ratios. But, after hundreds of hours spent observing cattle behavior during the breeding season, it is this author's opinion that estrus females generally seek out the bull despite the terrain. Most cattlemen however, feel that the rougher the terrain and the more extensive the stocking rate, more bulls will be required to effectively find and service estrus females. No literature has been found by the author which investigates this effect on mating load. Therefore, in an attempt to assess this effect on bull mating loads, a barge cow/calf ranch in Northwest Colorado which operates under semiarid to mountainous terrain with extensive stocking rates was enlisted. Because of topographic constraints this ranch has two distinct herds. On the west side of the ranch, 500 cows remained with the traditional bull to cow ratio of 1:16. On the east side the ratio for another 500 cows was increased to 1:26. The ten year average bull to female ratio on this ranch was 1:16 and the average calving rate for the same ten year period was 90%.

The results over both years the experiment was conducted, showed that there was no difference in pregnancy rate (96%) or average day of conception between the two herds, providing evidence that at least in this particular type of rough terrain the mating load could be increased by over half with no adverse effects on pregnancy rates.

HOW DO MATING LOADS DIFFER FOR YEARLING VS. MATURE BULLS?

Because of the inexperience factor and incomplete physiological development associated with the use of virgin yearling bulls one would expect lower yearling bull fertility as measured by

pregnancy rates compared to mature bulls. Our data bears this out. Using similar type heifers across years, (600 heifers -- year 1, 800 heifers -- year 2 and 3) yearling bulls achieved an overall pregnancy rate of 78% in year 1 during a 44-day breeding season. In contrast, mature bulls achieved an overall pregnancy rate of 82% in year 2 and 3 during only a 28-day breeding season. These experiments were not designed to directly compare the fertility of yearling vs. mature bulls and, thus, the results are confounded by factors such as year and bull to female ratios. Yet, these results coupled with pasture observation, provide an indication of the greater mating efficiency and fertility of mature bulls.

SUMMARY

In summary, our research has demonstrated that: 1) serving capacity tests are unable to predict yearling bull fertility, 2) the optimal bull to female ratio for estrus synchronized heifers is 1:25, 3) that most mature bulls are capable of greater mating loads than is required of them in most situations and 4) that excess bull power may not be required where stocking rates are extensive or the topography is less than ideal.

CONCLUSIONS

I'm often asked what my recommendation is for mating loads of mature experienced bulls with adequate scrotal circumference during a short breeding season (60 days). Based on previous research, our research, and observations at numerous ranches in both the U.S. and Australia, that are placing bulls under heavy mating loads and operate under varying types of terrain, I feel confident recommending a bull-to-female ratio of 1:50 in multiple sire breeding situations. In the case of those few bulls that cannot handle this mating load, there will likely be other bulls in the pasture capable of impregnating even more than 50 females. By stretching their bull power these producers have been able to concentrate on buying quality bulls because they are able to pay more for them since they have found they need fewer bulls than in the past.

If you are now at a bull-to-female ratio of 1:20 to 1:30, should you go to 1:50 in one year? NO! Because there are so many factors that vary from one operation to the next, especially terrain, I recommend you increase bulls mating load gradually. Specifically, an increase of 5 to 10 cows per bull per year until pregnancy rates decline or you can't sleep at night, whichever comes first!