Repro Tracks

by **Cliff Lamb,** University of Florida

Fertility factors

Fall has approached, and many cattlemen will have completed their spring breeding season and have diagnosed pregnancy in their herds. This is the period of time that I receive numerous phone calls associated with poor fertility. It is not always easy to retrospectively figure out exactly why pregnancy rates to artificial insemination (AI) or during the breeding season were different from one year to another. However, the one thing that has become quite apparent is that generally the first area of blame for poor fertility is not likely associated with poor fertility!

Discovering the cause

Invariably, when a producer perceives to have a fertility issue, they first consider the synchronization system and products, semen, AI technician or mineral program. In my experience, these areas of focus usually have little to do with poor responses. Hopefully by answering these questions, producers may have a better understanding of all of the factors associated with poor fertility.

What factors influence fertility in a herd?

Fertility is influenced by many factors, and one of the best methods to look at these factors is with the use of the "Equation of Reproduction." The equation focuses on four primary areas: (1) percentage of females detected in standing estrus and inseminated; (2) inseminator/bull efficiency; (3) fertility of the herd; and (4) fertility of the semen. The majority of reproductive failure occurs because cows do not become pregnant during a defined breeding season. Therefore, the goal of any breeding program (AI or natural service) is to maximize the number of females that become pregnant. In many cases, when it comes to reproductive management, the things you do well will not compensate for the mistakes you make. Instead, the mistakes you make cancel out all the things you do well.

What factor of the Equation of Reproduction has the greatest influence on fertility?

Obviously all four areas have an influence on fertility; however, detection of estrus has become less critical in recent years with the development of fixed-time AI (TAI) protocols. Detection of estrus is eliminated in these protocols, and more females are submitted to AI. In addition, if the estrus-synchronization protocols used are those recommended by the Beef Reproduction Task Force (*http://beefrepro.unl.edu*), the likelihood of the actual synchronization system causing an issue is limited. Similarly, the efficiency of the inseminator often is not a concern if that person has the necessary experience. Therefore, fertility of the herd likely has a greater impact on breeding season pregnancy success than any other factor associated with the Equation of Reproduction.

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What is fertility of the herd?

Fertility of the herd may be the hardest factor to evaluate. Herd fertility includes cycling status, embryonic mortality, body condition (plane of nutrition) and disease. No doubt the primary herd fertility issues that impact reproductive success is postpartum anestrus in cows and failure to attain puberty in heifers. Most beef cows experience a period of postpartum anovulation (lack of recurring ovulatory cycles) or anestrus (lack of expression of estrus) that occurs for between 30 and 120 days after they calve. Suckling and nutrition are two primary factors that affect the duration and onset of postpartum estrous cycles. From a nutritional standpoint, a good rule of thumb to keep in mind is to remember that the condition at which a cow calves generally influences the duration of postpartum anestrus.

Once females have initiated cyclicity, they are largely able to become pregnant, but fertility now is affected by embryonic or fetal losses. For example, fertilization rates are reported to be between 89% and 100% when animals are detected in estrus and semen is present at the time that ovulation occurs. While fertilization usually takes place, pregnancy rates are usually around 55% to 70%. Although natural causes (poor oocyte quality, disease, chromosomal abnormalities, etc.) contribute to much of this loss, management practices also play a role. Specifically, nutritional, heat and shipping stress can be particularly detrimental to embryo and fetal survival.

How does shipping stress affect embryonic survival?

When cattle are loaded onto a trailer and hauled to a new location, they become stressed and release hormones related to stress. These hormones lead to a release of different hormones that change the uterine environment in which the embryo is developing. Therefore, shipping cows between days 7 and 42 can be detrimental to embryo survival and cause as much as a 10% decrease in pregnancy rates. There are major developmental stages that may be affected by shipping during this period of time, such as blastocyst formation, hatching, maternal recognition of pregnancy and adhesion to the uterus.

How does nutritional stress affect embryonic survival?

Changes in nutritional status can have a tremendous influence on embryonic survival through many mechanisms. For example, research has shown that heifers fed 85% maintenance requirements of energy and protein had reduced embryo development on Day 3 and Day 8 compared to heifers fed 100% maintenance, indicating decreased embryonic growth. Therefore, changes in nutrition can have a tremendous impact on embryo survival and the ability of females to conceive during a defined breeding season. A significant amount of work is being done in this area to fully understand the negative effects of nutritional stress on embryo and fetal development.

Additional research has recently been published to demonstrate the negative effects of shifting diets of heifers from drylot to grazing around the time of breeding.

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Heifers switched from a drylot to pasture are not accustomed to grazing, forced to eat a novel diet and exert increased energy during the period following AI. These factors combined may be the reason some heifers developed in a drylot and moved to forage after insemination have reduced fertility. Therefore, keeping consistency in management during the breeding season is important to achieving optimum pregnancy success.

How about bull effects?

One of the most frequent questions I receive relates to differences in fertility among bulls. There are definitely differences among bulls (natural service or AI) in the ability to achieve pregnancy success. However, in most cases it is virtually impossible on an operation to discern these differences. The determination of fertility differences between bulls requires the insemination of several thousand animals under the same management practices.

Very often, producers will conclude on a limited number of inseminations or observations that one bull may be more fertile than another bull, yet they do not have a sufficient number of observations to make this conclusion. In fact, in spite of the number of inseminations of many bulls at major semen companies, they are unable to come up with sufficient valid data to determine differences in pregnancy rates among bulls.

For example, Fig. 1 demonstrates (with 95% confidence) three different scenarios in which a 10% difference exists between bulls:

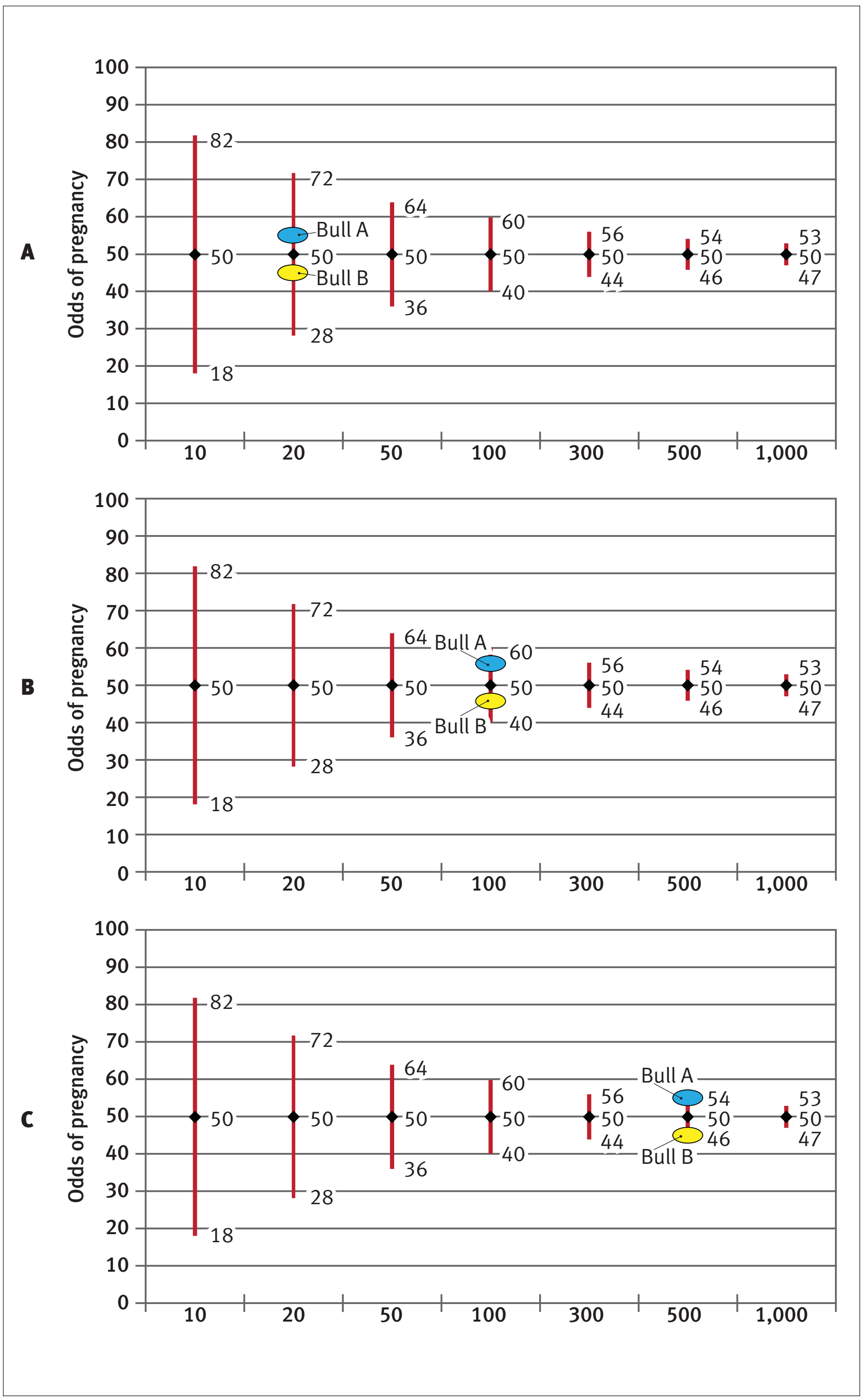
A) This scenario demonstrates a producer who inseminates 20 cows per bull with semen from two bulls (Bull A and Bull B). The producer concludes that a difference in fertility exists because he got a 55% pregnancy rate with Bull A and a 45% pregnancy rate with Bull B. Unfortunately, with only 20 cows per group, the producer can really only make this conclusion if he had pregnancy rates that varied by 44% (i.e., 72% vs. 28%);

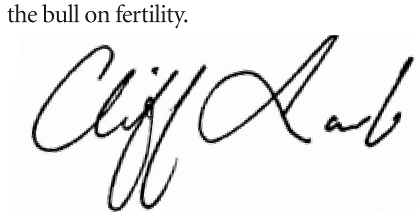
B) This scenario demonstrates a producer who inseminates 100 cows per bull with semen from two bulls (Bull A and Bull B). The producer concludes that a difference in fertility exists because he got a 55% pregnancy rate with Bull A and a 45% pregnancy rate with Bull B. Unfortunately, with only 100 cows per group, the producer can really only make this conclusion if he had pregnancy rates that varied by 20% (i.e., 60% vs. 40%); and,

C) This scenario demonstrates a producer who inseminates 500 cows per bull with semen from two bulls (Bull A and Bull B). The producer concludes that a difference in fertility exists because he got a 55% pregnancy rate with Bull A and a 45% pregnancy rate with Bull B. In this case, 500 cows per group was sufficient for the producer to conclude that Bull A may be more fertile than Bull B.

Therefore, it is also important to truly evaluate whether it was just a random chance that resulted in poorer fertility rather than concluding that there definitely is an effect of the bull on fertility.

Fig. 1: 95% confidence intervals in three scenarios in which a 10% difference in pregnancy rates is obtained with: A) 20 cows per bull; B) 100 cows per bull; and, C) 500 cows per bull





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