

REPRO TRACKS

by Cliff Lamb, Texas A&M University

Can you predict the fertility of a bull?

There has been renewed interest among researchers to have a better understanding of the contribution of bulls to fertility, especially as it relates to establishment of pregnancy and subsequent survival of the embryo and/or fetus.

Current research being conducted at multiple locations around the world is demonstrating that the bull (or bull DNA) may contribute to differences in pregnancy survival. This indicates that simply having a bull capable of breeding females with viable semen may not result in optimum fertility. Nonetheless, bull fertility is a complex issue and predicting fertility among bulls is not an exact science. Keep in mind that it takes a bull approximately 6 to 10 weeks for sperm to form and develop (spermatogenesis) before ejaculation.

Therefore, any negative insult on the bull prior to ejaculation may have a negative impact on fertility of an ejaculate. These insults could be acute, such as an injury or freezing of the testes, or prolonged, such as nutrition or herd health related. Therefore, a bull may have viable sperm one day and then may ejaculate nonviable sperm one week later, which complicates our ability to predict bull fertility.

Contributors

There are some key attributes of sperm that we know are critical for fertilization such as the morphology, metabolism for production of energy,

progressive motility, capacity for hyperactive motility, stabilization of plasma and acrosomal membrane lipids, acrosomal enzymes, and chromatin integrity. Some of these attributes are easy to determine under a microscope, and others are more complicated and require enhanced technology.

Historically, the assessment of male fertility has focused on the quantity and quality of sperm delivered to the female. Fertility of a bull generally increases with increasing numbers of viable sperm inseminated up to a threshold level. After this threshold level has been attained, the female population becomes the limiting factor and increases in sperm numbers do not result in further increases in fertility. However, although the minimum number of sperm may be critical for fertility the threshold for maximum fertility differs among bulls.

The equation

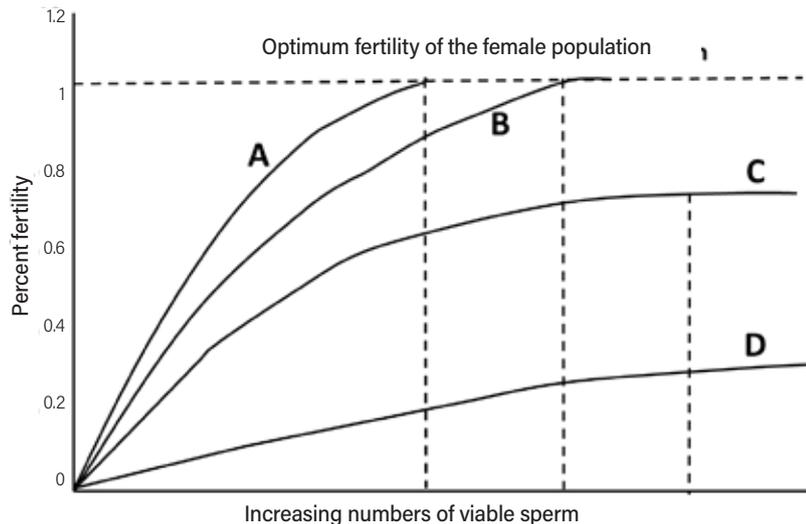
There are “compensable” and “uncompensable” characteristics of sperm (Figure 1). Compensable characteristics relate to the ability of the sperm to reach the ovum and initiate the process of fertilization

(lines A and B from Figure 1), whereas uncompensable characteristics relate to the competence of the fertilizing sperm to complete the fertilization process and sustain early embryonic development (lines C and D from Figure 1). Therefore, seminal deficiencies that may be seen as reduced fertility when numbers of sperm are below threshold, may be overcome or minimized by increasing sperm dosage and would be considered compensable. Reputable artificial insemination (AI) organizations routinely adjust the AI dose when compensable deficiencies are known.

Alternatively, deficiencies resulting in suppressed fertility regardless of sperm dosage would be considered uncompensable. Bulls with semen exhibiting unacceptable levels of abnormal sperm (i.e., misshapen sperm, chromatin integrity, acrosomal membrane lipids, etc.) are usually the main source of uncompensable traits.

Reputable AI organizations, however, will not process semen with unacceptable levels of abnormal sperm. In practice, the affect of uncompensable seminal traits may be high when using natural service

Figure 1: Relationship between pregnancy rate and the number of sperm inseminated. The semen of different bulls varies in fertility and in the rate at which the maximum fertility is achieved with increasing sperm dosage (modified from Sullivan and Elliott, 1968).



bulls which have not received a breeding soundness evaluation, and when using semen from non-accredited custom collection and freezing facilities.

As discussed, predicting fertility of bulls is usually more complex than simply increasing the volume of semen. However, beef producers should keep in mind that only

compensable seminal deficiencies can be overcome or minimized by increasing the sperm dosage, which reputable AI organizations account for. In contrast, uncompensable characteristics of semen quality result in suppressed fertility regardless of sperm dosage.

For producers who utilize natural service, a key practice to reduce the opportunities of having a bull with uncompensable seminal characteristics is to ensure that bulls undergo a breeding soundness examination (sometimes referred to as a BSE) annually prior to the initiation of the breeding season. **AJ**

Editor's note: Cliff Lamb is the animal science department head and a professor at Texas A&M University in College Station, Texas.

United States Postal Service

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

1. Publication title: **ANGUS JOURNAL**
2. Publication number: **0194-9543**
3. Filing date: **10/01/19**
4. Issue frequency: **Monthly**
5. Number of issues published annually: **12**
6. Annual subscription price: **\$50**
7. Complete mailing address of known office of publication: **3201 Frederick Ave., Saint Joseph, MO 64506**
8. Complete mailing address of headquarters or general business office of publisher: **3201 Frederick Ave., Saint Joseph, MO 64506**
9. Full names and complete mailing addresses of publisher, editor and managing editor: **Publisher—Mark A. McCully; Editor—Julie Mais; President—Brett Spader; 3201 Frederick Ave., Saint Joseph, MO 64506**
10. Owner: **Angus Productions Inc., 3201 Frederick Ave., Saint Joseph, MO 64506; American Angus Association, 3201 Frederick Ave., Saint Joseph, MO 64506**
11. Known bondholders, mortgages and other security holders owning or holding 1% or more of total amount of bonds, mortgages or other securities: **None**
12. Tax status: **Not applicable**
13. Publication title: **ANGUS JOURNAL**
14. Issue date for circulation data below: **August 2019**
15. Extent and nature of circulation
 - a. Total number of copies: average number copies each issue during preceding 12 months=**12,455**; number copies of single issue published nearest to filing date=**11,600**
 - b. Paid/requested circulation. (1) Paid/requested outside-county mail subscriptions: average number copies each issue during preceding 12 months=**11,734**; number copies of single issue published nearest to filing date=**10,778**. (2) Paid in-county subscriptions: average number copies each issue during preceding 12 months=**0**; number copies of single issue published nearest to filing date=**0**. (3) Sales through dealers, carriers, street vendors, counter sales and other non-USPS paid distribution: average number copies each issue during preceding 12 months=**0**; number copies of single issue published nearest to filing date=**0**. (4) Other classes mailed through the USPS: average number copies each issue during preceding 12 months=**0**; number copies of single issue published nearest to filing date=**0**
 - c. Total paid/requested circulation: average number copies each issue during preceding 12 months=**11,734**; number copies of single issue published nearest to filing date=**10,778**
 - d. Free distribution by mail. (1) Outside-county: average number copies each issue during preceding 12 months=**0**; number copies of single issue published nearest to filing date=**0**. (2) In-county: average number copies each issue during preceding 12 months=**0**; number copies of single issue published nearest to filing date=**0**. (3) Other classes mailed through the USPS: average number copies each issue during preceding 12 months=**324**; number copies of single issue published nearest to filing date=**316**. (4) Free distribution outside the mail: average number copies each issue during preceding 12 months=**0**; number copies of single issue published nearest to filing date=**0**
 - e. Total free distribution: average number copies each issue during preceding 12 months=**324**; number copies of single issue published nearest to filing date=**316**
 - f. Total distribution: average number copies each issue during preceding 12 months=**12,058**; number copies of single issue published nearest to filing date=**11,094**
 - g. Copies not distributed: average number copies each issue during preceding 12 months=**325**; number copies of single issue published nearest to filing date=**506**
 - h. Total: average number copies each issue during preceding 12 months=**12,383**; number copies of single issue published nearest to filing date=**11,600**
 - i. Percent paid/requested circulation: average number copies each issue during preceding 12 months=**98%**; number copies of single issue published nearest to filing date=**98%**
16. Electronic copy circulation: **None.**
17. Publication of statement of ownership: **Publication required. Will be printed in the October 2019 issue of this publication.**
17. Signature and title of editor, publisher, business manager or owner: **Kenny Miller, secretary, 08/28/19.**

AJ