

# Improving Pregnancy Rates

From what can go wrong with the bull to semen mishandling to heat detection, ARSBC speakers shine the spotlight on factors that can undermine pregnancy rates.

by *Kasey Brown*, associate editor; *Lynsey Meharg*, intern; & *Troy Smith*, field editor

**M**any factors come into play in determining whether a cow will become pregnant to natural service or artificial insemination (AI). Tuesday afternoon's speakers at the 2013 Applied Reproductive Strategies in Beef Cattle (ARSBC) Symposium focused in on those factors that affect pregnancy rates, looking at

- ▶ insemination-related factors affecting fertilization,
- ▶ effects of semen handling on sperm viability,
- ▶ factors affecting fertilization to synchronized estrus in a natural-service setting; and
- ▶ critical factors for getting cows and heifers pregnant.

## Insemination-related factors affecting fertilization

Virginia Tech animal scientist Richard "Dick" Saacke said he expects more breakthroughs in knowledge that will improve results from synchronized artificial insemination (AI). While there remains much to learn, there are a number of things we know now that can be used to improve pregnancy rates in beef cattle breeding programs. Saacke explained some of what is already known about insemination-related factors that can and do affect results of AI.

He urged consideration of some less-talked-about influences to what happens after cows and heifers are inseminated, including semen quality, timing of insemination and inseminator competence.

Starting with the "bull factor," Saacke said not all bulls are created equal. Semen quality is highly variable among bulls. Explaining that a minimum number of sperm are required to reach maximum fertility for a given bull, some bulls may be deficient (see Fig. 1).

Seminal deficiencies that are compensable would be those affecting pregnancy rates when numbers of sperm in the dosage are below threshold levels, he explained. These compensable seminal deficiencies can be minimized or eliminated simply by raising sperm numbers per AI dose.

Seminal deficiencies that are uncompensable would be those that result in subfertility to AI or natural service



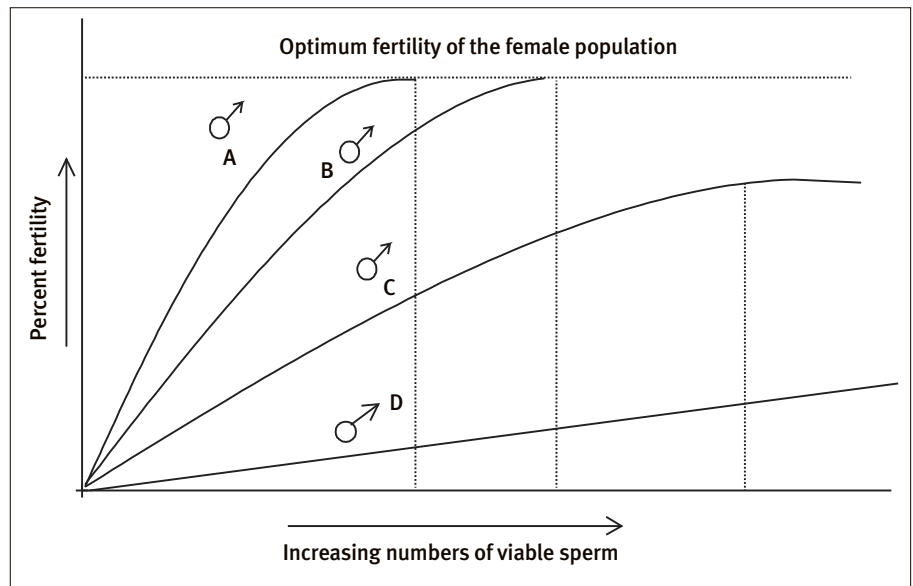
fertilize, but not sustain an embryo.

"Bulls having uncompensable deficiencies in their semen should be eliminated from use," stated Saacke. "Such bulls are best avoided by using AI bulls from

regardless of sperm dosage and are represented by incompetent sperm that can

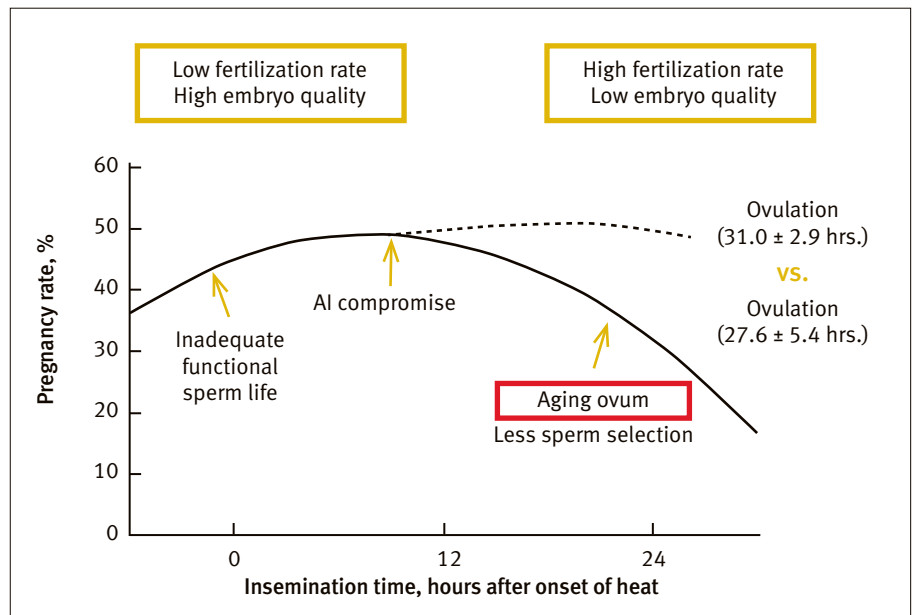
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**Fig. 1: Relationship of semen quality and quantity to fertility**



Source: Richard Saacke, ARSBC presentation, Staunton, Va., Oct. 15, 2013.

**Fig. 2: Effect of insemination time on pregnancy rate**



Source: Richard Saacke, ARSBC presentation, Staunton, Va., Oct. 15, 2013.



► “Bulls having uncompensable deficiencies in their semen should be eliminated from use,” stated Virginia Tech’s Dick Saacke. Evaluate sperm morphology of bulls used for AI or natural service to find bulls with such deficiencies.

reliable sources where sperm morphology is a routine part of the evaluation process or, in the case of natural bulls, where sperm morphology is a strong part of the breeding soundness exam.”

Saacke said timing of insemination relative to the onset of estrus is another critical factor for success. Sperm require 4-6 hours to travel

**From timing to crooked tails and abnormal heads, a lot of factors can influence fertility.**

through the oviduct, during which time they undergo capacitation, to reach the egg at ovulation. Inseminating too early means sperm quality can deteriorate, resulting in lower fertilization rates. When breeding too late, fertilization

rate may be good but embryo quality suffers because the ovum (egg) has aged prior to fertilization.

“Inseminating at the intermediate time of 12 hours post heat onset would prove optimal when using a precise method for determining heat onset,” advised Saacke.

Noting that inseminator skill is another important consideration, Saacke advised care in thawing and handling semen, and proper placement of semen through the cervix. He said the necessity of correct insemination technique cannot be overemphasized.

— by Troy Smith

**Consequences of mishandling frozen semen and embryos**

When an inseminator does everything right and there are still pregnancy failures, it is frustrating. This frustration led to more research into managing cells that have been

frozen, said Brad Stroud, veterinary specialist with BioTech Productions.

A large issue is that no curriculum in animal science or veterinary programs includes frozen-cell management rather than simply how to freeze cells. He explained that when frozen cells are below -130° C, exposed to temperatures higher than -130° C, then re-exposed to the temperatures below -130° C, the ice crystals rearrange. Often, these ice crystals form together into larger crystals, which invade very delicate cell membranes and cellular organelles.

Damaged membranes equate to enzyme leakage, which equates to fertilization failure.

Stroud noted that it takes only 55 seconds in ambient air to dissolve all the ice crystals in a standard 0.5-milliliter (mL) straw of frozen semen. For sperm motility to visibly decrease, it takes only 30 seconds in ambient air before being re-entered in the liquid nitrogen. In some conditions, it can take only 10-15 seconds of exposure to decrease fertilization.

“It can only take 10 seconds in the neck of a half-filled Dewar (semen tank) for the internal temperature of a frozen semen straw to reach -100° C,” he said.

There are many opportunities when improper semen handling can cause damage — receiving a shipment, searching for samples to thaw, thawing samples, preparing a dry shipper, taking inventory, breaking a cane, Dewar-to-Dewar transfer, sale of semen at a cattle sale and improper storage conditions.

Stroud suggested making a liquid-nitrogen bath to use when handling straws of semen. It only requires towel clamps, forceps, hemostats, a liquid-nitrogen bath (which can be made from cutting the top part off of a



► Technicians and producers can damage sperm cells and reduce fertility while trying to select the right straw of semen out of a jug, said Brad Stroud, who presented a very entertaining look at flawed cowboy logic in handling semen and embryos.

Styrofoam cooler) and eye protection. Taking inventory, splitting canes, reading straws and organizing straws into canes can be done in the liquid-nitrogen bath with less likelihood of damaging the semen.

It is imperative to keep the internal temperature of straws below -130° C at all times, he emphasized.

Stroud offered a laundry list of tips for semen-tank maintenance:

- Keep Dewars at least three-quarters full.
- Keep an extra Dewar full of liquid nitrogen for topping off the main Dewar between scheduled fillings.
- The extra Dewar should be an exact replica of the main Dewar in case it needs to be used to replace the main tank.
- Use a nitrogen bath routinely for receiving and sending shipments and documenting the identification of sires.
- Consider the use of alarms that can warn you if something goes wrong with the tank.
- Always try to work below the frost line.
- Be disciplined in obeying the 8-second rule: Cans and canisters should not be exposed any longer than 8 seconds in the neck of the semen tank.

Stroud said one of the biggest obstacles to correcting semen-handling mistakes is educating people who don’t think they need educating, but a lot of common mistakes leading to reduced fertility of the semen result from flawed cowboy logic.

He introduced an in-depth training DVD, which can be accessed at [www.frozendvd.com](http://www.frozendvd.com), which can be downloaded from the Newsroom at [www.appliedreprostrategies.com/](http://www.appliedreprostrategies.com/) 2013 along with his proceedings paper and PowerPoint, and the audio of Stroud’s presentation.

— by Kasey Brown

**Control of estrus with natural service**

“Bull breeding dominates the U.S. beef industry,” Carl Dahlen, North Dakota State University (NDSU)—Fargo, told attendees, noting that a vast majority of producers use bulls to do the breeding. Dahlen discussed how to improve pregnancy rates in a synchronized natural-breeding program. He considered three main components — the bulls, the cows and the protocols.

Bull factors affecting pregnancy rate, said Dahlen, include age, breeding soundness, libido and stocking rate.

Dahlen shared research showing that while yearling bulls mount and service cows more often, older bulls service a greater percentage of the cows in heat and attain a higher pregnancy rate (see Table 1, page 118). The

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end result is a higher pregnancy rate.

Dahlen recommended breeding soundness exams be performed yearly for certain attributes, including physical traits, as well as semen motility and morphology. Breeding soundness exams are an indicator of fertility, he said, sharing research that showed bulls rated satisfactory achieved a 45.6% pregnancy rate, while those rated questionable achieved a 36.5% pregnancy rate — significantly lower.

“With the breeding soundness exam you might get an indication that he’s maybe fertile, but it tells you nothing about libido,” said Dahlen. “Libido is certainly something that plays a big role in a bull’s ability to go out and service 20 to 30 cows within a three-day period.”

Though Dahlen said he has found no difference in pregnancy rates between bulls with high libido and bulls with lower libido, the trait is certainly a factor to consider when evaluating bulls before breeding season.

“There were no differences between a bull with a high libido and bull with medium libido, so these are not an indicator of fertility,” said Dahlen, “but a bull certainly has to have the sex drive to get out and breed those cows.”

Dahlen shared research indicating that stocking rates of 1:16 resulted in significantly



► When choosing bulls to breed synchronized females by natural service, Carl Dahlen of NDSU recommended using bulls 2 years old or older that have had previous experience, ensuring they have a satisfactory breeding soundness exam as well as high libido, and stocking at a rate of 1:25.

higher pregnancy rates by Day 28 when cows were synchronized (see Table 2). However, using a 1:25 stocking rate achieved the most cost-effective pregnancy rate.

When choosing bulls to breed synchronized females, Dahlen recommended using bulls 2 years old or older that have had

previous experience, ensuring they have a satisfactory breeding soundness exam as well as high libido, and stocking at a rate of 1:25.

Though the bull is part of the equation, cows need to be in proper breeding condition, as well. Breeding females should have a body condition score (BCS) of 5 or higher (see [www.cowbcs.info](http://www.cowbcs.info) for more information), be 40 days postpartum at the start of synchronization protocol and have a low incidence of calving difficulty.

At the end of the day, evaluating the protocols recommended by the Beef Reproduction Task Force (see pages 107-108), Dahlen found no difference in pregnancy rate based on which protocol was used, but there was a difference in the date of conception for those cattle treated with a CIDR® as compared to cattle on another controlled treatment. The questions producers need to ask themselves, according to Dahlen, is whether the three-day gain in calving date is worth the extra effort for their particular operation.

— by Lynsey Meharg

## Get the most cows and heifers pregnant

Fertility plays a major role in the success of any breeding program, whether it involves AI or natural service. South Dakota State University (SDSU) animal scientist George Perry talked about factors influencing fertility of beef cows and heifers to be bred by AI. Perry’s comments focused on what he considers critical issues, including the percentage of animals detected in standing estrus and inseminated, inseminator efficiency, fertility level of the herd, and fertility level of the semen.

With natural service, detection of females in standing estrus, or heat, is the bull’s job. With AI, this critical duty falls to the cattle manager, said Perry. It is common for visual observation to take place in the early morning and again at night.

“To determine the best time to inseminate an animal, visual heat detection really needs to be done more than twice per day,” advised Perry.

He cited studies showing that heat detection could be increased by 10% when females were observed three times each day, adding one more observation at mid-day. Heat detection was improved by 19% when performed four times per day, or every six hours.

Admittedly, heat detection by visual observation is a time-consuming chore. Perry said heat-detection aids, such as marker animals or heat-detection patches, can help. However, increased visual observation, in

**Table 1: Impact of bull age on breeding success in natural service**

Item	Bull age		
	1	2	3+
Mounts, n	207 <sup>x</sup>	120 <sup>y</sup>	85.8 <sup>y</sup>
Services, n	54.5	37.6	40.5
Estrous females serviced, %	69.4	73.8	72.0
Pregnant of serviced, %	39.6 <sup>x</sup>	59.4 <sup>y</sup>	62.2 <sup>y</sup>
Pregnant overall, %	30.9 <sup>x</sup>	41.5 <sup>y</sup>	49.9 <sup>y</sup>

<sup>x,y</sup> Means differ P < 0.05.

Source: Carl Dahlen, ARSBC presentation, Staunton, Va., Oct. 15, 2013.

**Table 2: Impact of stocking rate on breeding success in natural service**

Item	Bull:heifer ratio			
	1:50 Non-synch	Synchronized		
		1:50	1:25	1:16
Bulls per 100 heifers, n	2	2	4	6
Pregnant by Day 6, %	40	38	41	53
Pregnant by Day 28, %	82	77 <sup>a</sup>	83	84 <sup>b</sup>
Day of conception	10 <sup>a</sup>	10 <sup>a</sup>	11 <sup>a</sup>	8 <sup>b</sup>
Pregnant overall, %	30.9 <sup>x</sup>	41.5 <sup>y</sup>	49.9 <sup>y</sup>	

<sup>a,b</sup> Means within row differ P < 0.05.

Source: Healy et al., 1993, per Carl Dahlen, ARSBC presentation, Staunton, Va., Oct. 15, 2013.

addition to the use of heat-detection aids, could improve fertility by determining the most appropriate time for insemination.

**Heat detection, inseminator efficiency, and fertility of the herd and semen are critical factors.**

during the first few days of the breeding season and more opportunities to conceive during the breeding season.

Perry also discussed fixed-time AI (FTAI), involving synchronization protocols that allow for all females to be inseminated at a predetermined time, thus eliminating the need for heat detection.

“Fixed-time AI is a practical alternative to heat detection,” stated Perry. “If you are not doing a good job of heat detection, using fixed-time AI may actually improve your conception rates.”

To address the question of whether synchronization protocols can decrease or increase fertility, Perry said studies indicate no reduction in fertility and some protocols can result in an increased chance to become pregnant



► “We don’t want to stress animals right after AI,” emphasized George Perry of SDSU. “It’s a horrible time for females to experience stress from vaccination, shipping or nutrient deficiency.”

Discussing inseminator proficiency, Perry reminded managers to observe proper semen-handling practices, follow recommended thawing procedures, use proper hygiene and deposit semen correctly and within 15 minutes of thaw.

Perry said herd fertility level may be the hardest factor to evaluate, but includes cycling status, compliance with protocols, embryonic mortality, body condition (nutrition level), and disease status. Though often overlooked, various stress factors can influence fertility. These include changes in diet. Stress experienced soon after insemination can also jeopardize embryo survival.

“We don’t want to stress animals right after AI,” emphasized Perry. “It’s a horrible time for females to experience stress from vaccination, shipping or nutrient deficiency.”

— by Troy Smith



**Editor’s Note:** Saacke, Stroud, Dahlen and Perry spoke during the ARSBC session focused on managing factors to improve pregnancy rates. For more information, visit the Newsroom at [www.appliedreprostrategies.com/2013](http://www.appliedreprostrategies.com/2013) to listen to their presentations and to view their PowerPoint slides and proceedings papers. Comprehensive coverage of the symposium is available online at [www.appliedreprostrategies.com](http://www.appliedreprostrategies.com). Compiled by the Angus Journal editorial team, the site is made possible through sponsorship by the Beef Reproduction Task Force.