Spreading Genetic Wealth

Artificial insemination is one of the keys to rapid genetic improvement.

by T.S. Gatz

Artificial insemination, or AI, has been called one of the most effective tools or innovations available to enhance the productivity and profitability of the beef cattle industry. Yet, less than 5% of the nation's beef cows are bred using AI.

Research indicates the two main groups taking advantage of AI are seedstock producers and club-calf producers. An online check of calves registered by the American Angus Association shows more than 50% of Angus calves registered are sired by AI.

Semen companies report that Angus is the breed of choice when it comes to semen sales. Some AI companies note that 50% or more of their sales are from Angus semen.

Based on the percentage of available females being AIed today, Todd Sears, beef sales director for ABS Global, says AI is undergoing "modest growth." A majority of interest is coming from commercial producers.

Willie Altenburg, associate vice president of beef marketing for Genex Cooperative, points out several advantages to AI, among them:

► AI gives cow-calf and seedstock producers access to sires of superior genetic merit — the best bulls of the breed;

► AI is an avenue to improving production traits;

Artificial insemination timeline

1677: Using the newly discovered microscope, scientist Antony van Leeuwenhoek was the first person to see spermatozoa, which he and his assistant Hamm called "animalcules."

1784: Italian Lazzaro Spallanzani performs the first successful insemination in a dog.

1899: Russian Ilya Ivanovich Ivanov developed practical techniques for the artificial insemination (AI) of farm animals, revolutionizing livestock breeding practices throughout the world. (Interesting note: Unlike previous researchers and breeders who had used AI to circumvent certain anatomical barriers to fertilization, Ivanov began using AI to propagate thoroughbred horses more effectively.)

1907: A dairy calf was born from AI by L.L. Lewis at the Oklahoma Experimental Station.

1938: First AI cooperative in the United States is started by an extension dairyman from New Jersey.

1939: Paul Phillips and Henry Lardy, both of the University of Wisconsin, discovered that egg yolk would protect sperm cells from temperature shock upon cooling. Sperm survival at 5°C permitted use of the fresh semen for up to three days.

1940s: Fresh semen stored in glass ampules is shipped from dairy AI cooperatives to AI technicians across the country, leading to phenomenal growth of AI in the U.S. dairy industry. Because fresh semen could only be stored for up to three days, semen was shipped via bus every other day.

1949: A pivotal discovery of the cryoprotective properties of glycerol is discovered by Chris Polge and his co-workers, opening the doors for the later widespread commercial use of frozen semen in farm animals.

1956: The Linde Division of Union Carbide worked with American Breeders Service (ABS) to develop a small thermos-type container that had a two-week holding time and could be transported from farm to farm as the local inseminator made his rounds.

1960: Liquid nitrogen became the refrigerant of choice for preserving bull semen.

1964: AI straws or pipettes started to replace glass ampules. (Interesting note: The idea for using a straw originated from Robert Cassou while watching children sip punch via cellophane straws.)

Early 1970s: Producers within the beef industry start to embrace AI.

1980s: Estrus synchronization introduced to the beef industry.

2006: Sexed semen commercially available.

Table 1: A look at beef semen sales and custom-frozen beef semen

	Domestic beef semen sales*	Custom-frozen beef semen**
2013	1,811,133 units	2,560,074 units
2003	1,025,116 units	2,232,998 units
1993	1,117,798 units	1,747,424 units
1983	885,938 units	1,757,284 units
1979	1,086,339 units	1,119,802 units

*Domestic beef semen sales do not include the sale of semen by individual producers. These figures only cover the sale of semen by National Association of Animal Breeders (NAAB) members.

**Not all custom-frozen beef semen is used every year. Some breeders collect bulls and keep their semen as an insurance policy.

Source: National Association of Animal Breeders.

▶ AI reduces the number of herd bulls needed;

▶ AI can increase reproductive performance; and

▶ AI allows cowmen to mate specific sires to individual cows.

"If you're not AIing in the seedstock business, are you really in the seedstock business?" Altenburg questions. "I don't mean to sound smug, but are you really making genetic progress if you're not AIing?

"AI lets you have a calf out of a genetically superior bull that might cost $50,000 or upwards that you can't afford to buy outright," he continues.

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So what's stopping the approximate 95% of those in the beef industry from embracing AI?

Of the three reasons identified as why most cattle producers do not adopt AI — costs or perceived costs, increased risk of poor pregnancy rates and increased management demands — Altenburg contends the No. 1 reason most seedstock producers shy away from AI is management restrictions.

"It's the inability to get the process done — the labor or their labor expertise to get the job done," Altenburg states. "Seedstock businesses that don't AI typically lack the people power in their operation to get it done.

"AI requires good management practice and paying attention to the details. Some seedstock operations simply don't have the people-power to get the job done right."

Don Trimmer Jr., director of beef programs with Accelerated Genetics, agrees. Trimmer says a successful AI program requires that a beef enterprise zero in on herd health and good nutrition and have acceptable facilities that reduce stress on cattle and people. Additionally, it must have a good AI technician and heat-detection program in place. (See related article on getting cows and heifers pregnant on page 160.)

Mass breeding

A boost to AI and AI programs occurred when another beef industry innovation — estrus synchronization — became available, facilitating the mass breeding of numerous animals at a predetermined time rather than depending on heat detection. Trimmer calls the introduction of synchronized breeding products for the beef industry "a big game changer."

"Synchronized breeding is the biggest advancement in the use of AI," Trimmer states. "Synchronization allows you to breed cows by appointment."

Trimmer says synchronization means 50%-60% of a herd's females can get bred on the first day of a breeding season. He estimates that, with a good breeding barn, good help getting the animals in place and having the AI gun loaded and ready, an AI technician can service 150 to 200 cows per day.

"Most people AI their heifers because that is where they can get their greatest gain," Altenburg explains. "Heifers are easy to synchronize and have the greatest reproductive response. They are also a cattleman's greatest or freshest genetics. Plus, when a program is set up right, you can repeat-AI your heifers and still have calves born in a tight calving season.

Viewing the progress of AI over time

Warren Gatz of Hiawatha, Kan., learned to artificially inseminate (AI) in 1947 at the age of 21 and started breeding cows for the Brown County (Kansas) Co-op Breeding Association on Jan. 1, 1948. During his career as an AI technician, he serviced "more cows than I can count," he says.

In the beginning years, bull semen was delivered to him via bus three times a week: Monday, Wednesday and Friday, he recalls.

"It was the late 1950s when we first started using beef semen, and it was used mainly in dairy cows," Gatz says. "Dairy producers would pick out their poorest cows and breed them to Angus. They would then feed out these calves for beef. The beef semen dairies wanted was definitely Angus."

Now 88 years old, Gatz recalls the day when AI inseminating tubes were glass, noting that "you broke a few." He adds that he was glad when inseminating tubes switched to plastic in the 1950s.

Gatz says it was the 1960s when a few beef herds in his assigned American Breeders Service (ABS) territory of Kansas, Nebraska and Missouri started taking advantage of AI.

"The herds that used AI were primarily the smaller herds that didn't have enough cows to warrant the purchase of a good beef bull," he elaborates.

In the late 1960s, beef producers showed an interest in learning how to AI rather than hiring an AI technician. Gatz answered their call and began training cattlemen and women to AI. While the first AI schools had only three or four people, he says class size increased to 20 or more in the 1970s.

"AI in the beef industry has never taken off like it did in the dairy industry," Gatz states. "I'm not surprised.

"Dairy farmers have a management system that makes heat detection more convenient for them than for beef producers. For an AI program to be successful, you have to have a top-notch heat-detection program in place."

Gatz also points out that dairy cows calve year-round, with AIing a daily activity on most dairies. In the beef industry, however, beef producers want a small calving window. If a cow doesn't settle AI the first time, she's another 21 days into the calving season. If she doesn't settle the second time, she's 42 days or so into the calving season. He says sometimes it's not the cow's fault she didn't settle; the blame might lie with factors such as heat detection or the AI technician.

Calling AI "one of the best innovations in the beef industry," Gatz says he wholeheartedly agrees with the 2013 *BEEF* magazine survey in which respondents put AI as the No. 1 "most important innovation in genetics" — ahead of expected progeny differences (EPDs), crossbreeding, carcass data collection tied to sires, embryo transfer and other innovations.

"AI lets you have access to some of the best bulls in a breed," he summarizes. "And a really great sire can have thousands of offspring rather than just 40 to 50 a year."

"When it comes to cows, most producers typically just AI their cows one time then turn out a powerful cleanup bull."

Sears notes that a majority of producers turning to AI for the first time have a synchronization program in place.

Trimmer adds that timed-breeding programs help large herds keep the calving season tight. They are also a way for seedstock or commercial cow-calf producers who have herds of 50 cows or fewer and hold a job off the farm to use AI and superior genetics.

Research conducted by Purdue University shows that determining the best-suited timed-AI program for a given beef operation hinges on the proportion of animals that are anestrus prior to breeding, the amount of time and labor available, and various management practices.

"No single timed-AI program is perfect for every producer, and each program has both advantages and disadvantages," states Allen Bridges, Purdue Beef Team, Purdue University.

"The variety of timed-AI programs available, however, allows producers the flexibility to incorporate estrus synchronization and AI into their herds, as well as the opportunity to take advantage of both the genetic improvements and economic benefits that can be realized from estrus synchronization and AI."

An estrus synchronization planner is as close as your fingertips — and it's free, compliments of the Beef Reproduction Task Force. Located on the Iowa Beef Center website, *www.iowabeefcenter.org/estrus_synch.html,* this online tool offers tips and recommended protocols for estrus-synchronization program users, covers a number of preferred timed-breeding systems for heifers and for cows and provides analysis and comparison of input costs of several synchronization systems.

Editor's Note: *T.S. Gatz is a freelancer from Windsor, Colo. She has been writing about the beef industry for more than 40 years.*