Improving Reproc

Symposium features ways to improve reproductive efficiency in beef herds.

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Photos by ***Shauna Rose Hermel & Troy Smith***

Nearly 200 producers, veterinarians, researchers, artificial insemination (AI) technicians and Extension specialists met in Fort Collins, Colo., Dec. 2-3 to discuss ways to control and improve reproductive success in beef cattle. Presentations at the "Robert E. Taylor Memorial Symposium: Applied Reproductive Strategies in Beef Cattle" (ARSBC) ranged from improving pregnancy rates in natural-service programs to opportunities for using DNA technology to improve reproductive efficiency.

Tuesday morning workshops were designed to improve understanding of the physiological processes of the estrous cycle, currently available procedures to synchronize estrus and ovulation, and the proper application of these systems. Tuesday afternoon's presenters explored the role of management and nutrition on reproductive rates.

Highlighting Tuesday's sessions were a keynote address by Ivan Rush, professor emeritus with the University of Nebraska, on why commercial cattlemen have been slow to adopt AI as a management tool and a producer panel describing the benefits and limitations of AI in three real-world settings.

Presenters Wednesday addressed male fertility, procedural and health-related factors affecting reproductive rates, as well as the value of using improved genetics and a futuristic look at potential advancements in assessing reproductive traits in beef cattle.

What follows here are brief summaries of some of the Tuesday presentations. Full coverage of the conference is available online at *www.appliedreprostrategies.com.* Visit the site's newsroom for summaries of all the presentations, along with accompanying PowerPoint and audio files. Symposium proceedings are available as a printed copy ($25) or on CD ($10) by contacting Nancy Weiss, Colorado State University, at nancy.weiss@colostate.edu or 970-491-7604.

The Robert E. Taylor Memorial Symposium is conducted by Colorado State University every other year to provide current, research-based information for improving profitability in the beef cattle industry. The ARSBC program was developed by the Beef Cattle Reproduction Task Force to improve understanding and application of reproductive technologies, including AI, estrus synchronization and factors affecting male fertility. In 2008, CSU and the Task Force collaborated to provide the Dec. 2-3 symposium in Fort Collins.

Nearly 200 people gathered in Fort Collins to discuss ways to improve reproductive success.

Consider nutritional influences on reproduction

Environment and nutrition play an important role in reproductive success in a beef female, Rick Funston, University of Nebraska Extension reproductive physiologist, reminded symposium participants. Funston discussed the importance of selecting for a balance of traits, but he emphasized that producers must also select traits that match animals to their environment.

Crossbreeding can be a valuable tool in achieving herd longevity, calf weight per cow exposed and net profit per cow exposed, he noted. But, he also cautioned that it's not as simple as putting two breeds together. Instead, he stressed that producers must be attuned to a cow's nutrient requirements in order to achieve reproductive success within the herd.

►Reproduction is the most important factor affecting profitable beef production, said Rick Funston, University of Nebraska Extension reproductive physiologist. Funston discussed how nutrition is a key influence on reproduction.

Most importantly regarding nutrition and reproduction, Funston said that research indicates, "It is better to have cows and heifers in good condition before calving than to play catch up after calving." He recommended that cows be in a body condition score (BCS) of 5 to 6 prior to calving (see *www.cowbcs.info*).

To that end, he said, "Balanced nutrition is the key to optimizing production." On his list of nutrients to consider were protein, energy, minerals, vitamins and water. Some tips that he highlighted to achieve this balance:

- Minerals and vitamins must be balanced in the diet to optimize reproductive performance. Funston said mineral supplementation is critical 45 days prior to calving, through the breeding season and prior to weaning.
- Consider water quantity and quality when balancing diets.
- Be cautious about overfeeding nutrients as it has been shown to delay puberty, lower ovulation and lower conception. Funston acknowledged that there is a misconception that feeding cows protein too extensively prior to calving increases dystocia. Research has proven otherwise, he said. "It may increase the birth weight slightly, but there is no impact on calving difficulty." To avoid overfeeding, he reiterated that the rule of thumb for a herd should be a BCS of 5-6 prior to calving.
- Consider feeding fat as a prepartum supplement. Funston reported on multiple research studies that indicate feeding fat — from sources such as sunflowers to ethanol

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byproducts — about 60 days before calving can improve pregnancy rates in beef cow herds.

There is no quick fix for reproduction challenges brought on by poor nutrition, Funston emphasized. "There is no magic feed ingredient that exists to compensate for a diet deficient in any of the mentioned nutrients or poor BCS."

— by Tosha Powell & Kindra Gordon

The little things matter

Why can beef herd pregnancy rates vary so much? What causes the variation? The answer lies in management, said George Perry, assistant professor in beef reproductive management at South Dakota State University.

"Management can affect the outcome of artificial insemination or natural-service breeding," Perry commented. "Little mistakes can add up to a big impact on fertility."

Specifically, Perry said the reproduction equation includes the key areas of:

- animals detected in heat and inseminated;
- inseminator efficiency;
- fertility level of the herd; and
- semen fertility level.

Perry said if producers were perfect in each of those four areas (achieving 100% in each area) they could have 100% fertility. However, if they only achieve 70% success in each of those areas, herd fertility can be significantly reduced to a 24% pregnancy rate.

In reviewing the four key areas that he outlined, Perry reminded producers that success is in the details. For instance, he said, "Successful insemination requires animals be detected in standing estrus and inseminated at the correct time." This is true whether you are using natural service or a synchronization protocol.

Heat detection aids and synchronization protocols can be useful in the breeding process — even with natural service, Perry said. But, he cited several studies that have used these tools and still had large variations in fertility. Likewise, when using a bull, libido or sex drive can vary, which can compromise the herd's reproductive performance. Perry emphasized the importance of watching a bull when he is turned out with the cows to make sure he has ample libido.

►George Perry, assistant professor in beef reproductive management at South Dakota State University, discussed how management factors influence fertility in both AI and natural-service breeding programs using estrus synchronization.

Even with the tools and synchronization protocols available, estrus detection is essential, Perry acknowledged. It takes a great deal of time and labor, particularly because there are often variations in how cattle display signs of heat, and even animals that may stand but do not ovulate.

Regarding the second key component, inseminator efficiency, Perry explained semen must be deposited in the correct location at the correct time. If this is done, studies show fertilization occurs 95% of the time, he said.

The correct place for semen to be deposited is in the uterine body, Perry explained. Studies have shown there is typically a 10% reduction in fertility when semen is deposited in the cervix.

Producers may think they do not need to be concerned with this point if employing bulls for natural service, but Perry said it still should be considered. Just because a bull has passed a breeding soundness exam does not mean he is physically able to breed cows. In fact, one study showed that 4% of bulls that pass a breeding soundness exam were not physically able to breed a cow.

Perry emphasized again that bulls should be monitored after being turned out with the cow herd for breeding. Producers should consider the appropriate male-to-female ratio. Recommendations range from 1:10 to 1:60, but Perry advised producers keep in mind these guidelines:

- Yearling bulls have a lower serving capacity than older bulls.
- Synchronization places greater pressure on bulls and lowers serving capacity. He recommends about a 1:20 or 1:25 ratio in these instances.
- Multiple-sire pastures decrease serving capacity since multiple sires will mate an individual cow.

As a third point, Perry said cow-calf producers must consider the fertility level of their herd, which can be influenced by many factors, such as herd health, nutrition, body condition and stress.

Perry acknowledged that some embryonic death is unavoidable and is a means of eliminating unfit genotypes. But he cautioned that stress due to shipping, heat or even running cattle through chutes can delay embryo development and is avoidable.

Lastly, Perry said producers must be aware that there can also be differences in fertility levels of semen. This too can reduce fertility rates. To maximize chances for fertilization, he recommended watching the details, such as heat detection and correct placement of the semen within the female at ovulation.

"All of the management decisions that are made through the year add up to what occurs during the breeding season," Perry concluded. "Producers must think about everything they do that can affect their herd's reproductive performance."

– by Kindra Gordon

Why don't more commercial beef producers use AI?

"While many commercial producers are using AI successfully, a whole lot more of them are not," said University of Nebraska Professor Emeritus Ivan Rush. "Producers cite a lot of different reasons, but it mostly comes down to economics. They don't believe it pays."

The biggest factor limiting adoption of AI in commercial operations may be labor, Rush said. Producer surveys indicate both quantity and quality of labor is lacking. A goal of many large ranching operations is to reduce their number of employees, with some

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striving to employ one person per 800 cows, and AI is considered too labor intensive and impractical. Quality of labor is an issue as well, as employees with cattle handling and heat-detecting skills are in short supply.

For large expansive operations managing cattle in multiple locations, confining cattle to implement synchronization protocols and perform AI is challenging, Rush explained. Many do not have adequate facilities. Really large range operations may only handle cows once or twice a year, and additional handling represents considerable added cost.

►**Left:** Ivan Rush, University of Nebraska professor emeritus, explained reasons for slow adoption of AI technology in the commercial beef industry. Among the reasons he gave was the availability of high-quality natural-service bulls.

At the other end of the scale, some operators believe their 20- to 25-head herds are too small for efficient implementation of AI, he added.

After hearing stories of AI programs gone wrong, some producers are afraid of having a "wreck" themselves, Rush noted. Others say the intensive management required for AI doesn't fit their goals for quality of life on the ranch.

"A trend toward calving later in the spring (or early summer), on green grass, also increases the challenge of using AI," Rush said. "And this is still too much of a

commodity business to provide enough market incentive for a 'superior product' produced through AI."

To achieve greater adoption by commercial producers, Rush said implementation of AI must be simpler, with lower labor requirements and higher success rates.

"Make it economical and it will be used," Rush concluded.

— by Troy Smith

Producer perspective

A panel representing three diverse Colorado cow-calf operations discussed strategies for implementing AI programs with symposium attendees. The panelists shared their respective evaluation of benefits, whether applied to the breeding of replacement heifers or mature cows.

Lara Teague described her family's operation, Teague Diversified Inc., headquartered near Fort Morgan, Colo. Approximately 2,500 cows are managed in Nebraska on two leased ranches, while another 500 head are maintained in Colorado. Also at the Fort Morgan site, Teague Diversified develops and breeds close to 2,500 heifers, both for its own use and for other producers. Teague personnel also provide AI breeding services for up to 5,000 heifers on ranches in Wyoming, Utah and Montana.

Teague said selection of AI sires for breeding heifers emphasizes calving ease and maternal characteristics, including fleshing ability and stayability. "Free" family labor, supplemented with labor provided by graduate students and interns, helps keep labor costs low. A synchronization protocol requiring the least time and labor is used. Strategies are chosen to enhance reproductive performance without jeopardizing efficient use of grazing resources.

Kevin Miller said proven AI sires are used in his family's seedstock operation, Croissant Red Angus, located near Briggsdale, Colo. The operation currently manages about 250 females on its 10,000-acre operation.

"I don't mind spending $1 as long as I get $1.20 back," said Miller, explaining how AI allows incorporation of superior genetics to produce seedstock and fed cattle with added value.

Miller called heifers much easier to handle when implementing AI, since they are more easily held in confinement, near working facilities. Cows, on the other hand, have a calf at side, which must be sorted and

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penned separately while synchronization injections are administered.

Commercial cattleman Carl Hansen, of Livermore, Colo., said his family first adopted AI for breeding replacement heifers. Hansen Ranches is now in its fifth year of breeding about half of the mature cows by AI, targeting a shorter calving season and increased weaning weights.

Hansen buys higher-quality bulls to collect for AI use and turn with cows for natural service as well.

"We are getting more calves born early in the calving season and heavier calves at weaning, but we're also raising better females," Hansen explained. "According to our calculations, it costs us about the same to produce a calf through AI as with natural service."

— by Troy Smith

Physiological principles of estrus synchronization

Technologies to increase reproductive efficiency and improve genetic merit have developed at a rapid pace to include embryo transfer (ET), ultrasonography, transgenics and cloning. But of all available reproductive technologies, University of Missouri animal scientist Michael Smith ranks estrus synchronization and AI among the most powerful and applicable.

Successful application, however, depends on the understanding of physiological and hormonal mechanisms controlling the estrous cycle, Smith told symposium attendees.

"While synchronization products and protocols have changed over time, the basic principles explaining why they work have not changed," Smith said. "Understanding the biology helps us choose the best protocol for heifers or for cows. It can help us determine what went wrong if results are less than expected, and how to correct it."

Three general approaches to estrus synchronization involve inhibiting ovulation with long-term progestin treatment, regressing the corpus luteum with prostaglandin ($PGF_{2\alpha}$) treatment, or a combination of both, Smith said. Most protocols utilized today involve the "combination" approach. And with the ability to induce ovulation and synchronize follicular waves with hormonal (GnRH) injection, a new and important dimension was added, making fixed-time AI a viable option.

►Michael Smith of the University of Missouri emphasized the role of follicular waves and various reproductive hormones on estrus synchronization programs.

Smith cautioned producers to consider

certain factors before implementing a synchronization protocol. With heifers, he recommended consideration of the previous heifer pregnancy rate. If that rate ranged from 85% to 90%, the operation is likely a good candidate for implementation of synchronized AI.

Producers should also consider whether heifers received growth-promoting implants. Implants administered before 30 days of age may be detrimental to reproductive development, he said. Producers should also select an appropriate breeding weight target (65% of mature weight) and have heifers in appropriate body condition (preferably BCS 5) by time of breeding.

When implementing synchronization programs for cows, Smith advised producers to be aware of their previous pregnancy rate, decide on an appropriate breeding season length, and have a good estimate of the percentage of cows already cycling at the start of the season. Again, adequate body condition is a factor. Allow a reasonable length of time postpartum before starting synchronization treatments, with 40 to 45 days being recommended.

Smith advised producers to consider how much time they can devote to heat detection before choosing a synchronization protocol. If time and labor for heat detection are limited, a protocol for fixed-time AI may be the best choice.

— by Troy Smith

Postpartum anestrus and puberty

Anestrus is the primary factor reducing reproductive efficiency in beef cow-calf operations, said Jack Whittier, Extension beef specialist at Colorado State University. Fortunately, it is a contributor to infertility that producers can potentially manipulate through management.

►Anestrus is the primary factor reducing reproductive efficiency in beef cow-calf operations, said Jack Whittier, Extension beef specialist at Colorado State University.

Whittier discussed factors contributing to infertility and puberty in beef cattle herds during Tuesday morning's opening session.

Anestrus is the absence of estrus, or those coordinated physiological events necessary for conception and the establishment of pregnancy, Whittier explained. Anestrus among yearling heifers and postpartum cows often contributes to reduced reproductive efficiency in beef breeding herds.

The goal when developing replacement heifers, he said, should be to ensure that a majority of heifers attain puberty at least one estrous cycle length prior to breeding season. Research indicates that maturation of the reproductive system in heifers is heavily dependent on nutrition, including nutrient intake between 4 and 6.5 months of age.

There is mounting evidence that the dam's nutritional status during gestation also has a fetal programming effect on her heifer calf's fertility, Whittier noted. Progesterone therapy and biostimulation by the male also show promise for hastening puberty in heifers.

Whittier called postpartum anestrus the single most important reason mature cows fail to rebreed during defined breeding seasons. Postpartum anestrus in cows also is heavily influenced by nutritional status. To minimize the length of the anestrus period, cows should exhibit a BCS of 5 or greater.

While it is not fully understood, the presence of a suckling calf may also inhibit a cow's return to normal cycling behavior, Whittier noted. Removal of the calf for 48 hours has been relatively effective in prompting a return to estrus.

The presence of a bull or androgen-treated cow and the associated pheromone effect can also aid in shortening the period of anestrus, he said. This "biostimulation" has also been used successfully, when introduced at least 45 days postcalving, to reduce the length of the anestrus period.

"This raises the question of whether putting a bull with cows at the start of the breeding season can have the same effect," Whittier added. "There is no definitive proof, but I believe it does."

— by Troy Smith

Synchronization can offer boost for heifers

Estrus synchronization protocols offer many opportunities for beef cattle operations, particularly among heifers, said David Patterson, professor on the animal science faculty at the University of Missouri. Patterson told attendees effective estrus synchronization programs can help:

- facilitate AI and embryo transfer (ET);
- reduce time required to detect estrus;
- help cycling females conceive earlier in the breeding period; and
- induce cyclicity in peripubertal heifers and anestrous postpartum cows.

"Improvements in methods to synchronize estrus create the opportunity to significantly expand the use of AI in the U.S. cow herd," Patterson said. For producers, that can mean more access to better genetics, as well as the opportunity to maintain a shorter breeding and calving season, resulting in a more uniform calf crop and added profitability.

Patterson acknowledged that although hormonal treatment of heifers and cows to group estrous cycles has been a commercial reality for more than 30 years, beef producers have been slow to adopt this management practice. He suggested this is due to past failures, which happened when females were placed on estrus synchronization programs but failed to reach puberty or resume normal estrous cycles following calving.

However, Patterson said, research during the past two decades has helped develop more-effective and economical estrus synchronization protocols. He cited the use of MGA and CIDR® inserts as being highly effective for heifer breeding programs.

There are numerous protocols for utilizing these products, Patterson said. "The choice of which system to use depends greatly on a producer's goal." As one example, Patterson said the decision to use the MGA Select and 7-11 Synch methods in heifers should be based on careful consideration of the age, weight and pubertal status of the heifers involved.

Patterson recommended producers work with a beef cattle reproductive specialist to design a synchronization program suitable to their individual herd needs.

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Proceedings available

Copies of the various synchronization and artificial insemination (AI) protocols recommended by the Beef Reproduction Task Force for breeding cows and heifers are available in the symposium proceedings. The proceedings are available as a printed copy ($25) or on CD ($10). For more information, contact Nancy Weiss, Colorado State University, at nancy.weiss@colostate.edu or 970-491-7604.

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He emphasized that the feeding of MGA is specifically approved for estrus synchronization in heifers only. Producers who have used MGA to synchronize cows in the past should transition to the CIDR to comply with FDA regulations concerning extra-label use of medicated feeds.

To listen to Patterson's presentation and hear an in-depth summary of the research available using MGA and CIDRs, to view the accompanying PowerPoint, or to view other presentations from the symposium, visit the newsroom at *www.appliedreprostrategies.com.*

— by Tosha Powell & Kindra Gordon

Synchronization protocols for cows

The latest generation of estrus synchronization protocols employs two strategies that are key to the more widespread adoption of synchronized AI in beef herds, said reproductive physiologist Cliff Lamb.

"These strategies include minimizing the number of times cattle must be put through a cattle-handling facility and they eliminate detection of estrus by employing timed AI," explained Lamb, who is director of the University of Florida's North Florida Research and Education Center. "High priority needs to be placed on transferring these current reproductive management tools and technology to producers, veterinarians and industry personnel to ensure they are adopted at the producer level and to provide the necessary technical support to achieve optimum results."

Lamb attributed the increased success of modern estrus synchronization protocols to incorporation of the CIDR — an intravaginal progesterone insert used in conjunction with other hormones. Upon insertion, blood progesterone levels rise rapidly, reaching maximum concentrations within an hour after insertion. Concentrations are maintained while the insert is in place, but progesterone levels are quickly eliminated after removal.

Inclusion of the CIDR in the CO-Synch procedure is the most researched alternative and the primary timed-AI protocol recommended by the Beef Reproduction Task Force for use in beef cows.

University of Florida Extension Beef Cattle Specialist Cliff Lamb discussed estrus synchronization protocols for cows while University of Missouri Extension Educator David Patterson discussed synchronization protocols for heifers.

"Results of the most recent CIDR-based studies indicated that, for a timed-AI protocol, the five- or seven-day CO-Synch + CIDR protocols yield the most impressive pregnancy rates, whereas the Select Synch + CIDR and timed-AI treatment yields the best overall pregnancy rates," Lamb said.

He said research has been conducted to determine whether the CIDR could be utilized to enhance reproductive performance in herds employing natural service. Insertion of a CIDR occurred seven days prior to the

Table 1: Task-force recommended synchronization protocols for heifers and cows, by level of heat detection

Level of heat detection	Heifers	Cows
Heat detection	one-shot prostaglandin (PG) CIDR®-PG MGA-PG	Select Synch Select Synch + CIDR
Fixed-time AI	CO-Synch + CIDR MGA-PG CIDR Select	Co-Synch + CIDR
Heat detection and fixed-time AI	Select Synch + CIDR and fixed-time AI; MGA-PG and fixed-time AI	Select Synch and fixed-time AI Select Synch + CIDR and fixed-time AI

Source: Beef Reproduction Task Force.

breeding season, with removal on the day bulls were introduced to the herd. Results showed no increase in overall pregnancy rates, but more cows conceived during the first 10 days of the breeding season.

— by Troy Smith

Narrow the selection process

Choosing the right estrus synchronization protocol can be a daunting task for producers, said Sandy Johnson. The Kansas State University Extension livestock specialist presented two tools to help guide producers through the decision-making process.

1. Protocol short list. The Beef Cattle Reproduction Leadership Team has compiled a short list of protocols recommended for heifers or cows based on various levels of heat detection the producer is willing to employ.

"When in doubt, use something off these sheets," she advised, explaining that the leadership team had considered available research to establish the recommendations. "If someone suggests you use something else, ask them what data they have to support it."

►Sandy Johnson, Kansas State University Extension livestock specialist, presented Task Force-recommended synchronization protocols for cows and heifers and walked attendees through the Estrus Synchronization Planner available through the Iowa Beef Center.

Johnson described recommended protocols for cows and for heifers, each broken out by desired level of heat detection (see Table 1).

The protocols are detailed in the symposium proceedings and in the PowerPoint accompanying Johnson's presentation, which is available in the newsroom at *www.appliedreprostrategies.com.*

In all cases, Johnson said, be sure to use the correct synchronization product at the recommended time and follow Beef Quality Assurance (BQA) practices when administering products.

2. Synchronization planner. Another helpful tool is available through the Iowa Beef Center, Johnson explained. The Estrus Synchronization Planner is an Excel spreadsheet-based tool intended to help producers apply synchronization protocols more effectively.

The web module available at *www.iowabeefcenter.org* allows producers to insert preferences such as the day they want to start breeding or the desired number of trips they are willing to put cattle through the chute, along with cost considerations. The result, Johnson explained, is a calendar for administering the protocols and a cost breakout including the estimated cost per AI pregnancy.

To listen to Johnson's presentation, review her PowerPoint or view other presentations from the symposium, visit the newsroom at *www.appliedreprostrategies.com.*

— by Shauna Rose Hermel