

# Apply Strategy

Experts share cutting-edge reproductive strategies with producers seeking improved herd productivity.

by Troy Smith & Barb Baylor Anderson

**G**iven the magnitude of increased expenses, producers are intently focused on the bottom line while seeking both economic and production efficiencies. In response, the University of Tennessee and the Beef Reproduction Task Force sponsored the 2010 Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium Aug. 5-6 in Nashville, Tenn.

The symposium informed producers of cutting-edge reproductive strategies. Speakers provided the knowledge needed to improve herd productivity and decrease input costs by shortening the calving and breeding season and helped producers understand how to improve overall reproductive management through enhancement of both male and female reproduction, as well as innovations in protocols such as estrous synchronization.

Provided here are some of the highlights of the event. Angus Productions Inc. (API) provides comprehensive coverage of the event — including summaries, PowerPoints, proceedings papers and audio, when available — at [www.appliedreprostrategies.com](http://www.appliedreprostrategies.com).

## The Making of a Calf

Just about every cow-calf producer has had cause to wonder why some of his or her cows failed to become pregnant. According to University of Tennessee (UT) Reproductive Physiologist Lannett Edwards, there are plenty of possible reasons. Edwards said management may contribute to the fact that, in many herds, only 76%-80% of cows wean calves each year. Consequently, she added, a basic understanding of the process of making a calf is important to achieving a calf crop of 90% or better.

“Reproduction is a complex process dependent upon a multitude of factors,” Edwards stated, adding that producers need not feel overwhelmed by the complexity. “It’s important, though, to be aware of the many factors.”

During her presentation, Edwards highlighted the challenges related to the “pilgrimage” both egg and sperm make to

the site of fertilization and the production of an embryo competent to develop into a healthy calf. For example, a heifer has about a million oocytes at birth. But during a heifer’s lifetime, a relative few oocytes will undergo the dynamic process of follicle growth and development to a size capable of ovulating. Why certain oocytes are destined to develop while others do not is unknown.

Edwards said the complexity of changes occurring during the maturation of a chosen one make the oocyte very susceptible to environmental stressors, especially elevated body temperature due to heat stress or illness. Consequently, severe stress can reduce female fertility due to direct effects on the oocyte.

Compared to the oocyte, Edwards explained, sperm cells make an epic journey from testes to epididymis, where they are held until released through ejaculation. During ejaculation, sperm are mixed with seminal fluid from accessory glands. But the greatest



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challenges are faced after deposition in a cow. Of the billions ejaculated, as few as 100 sperm actually reach the site of fertilization. Once a single sperm cell fertilizes the oocyte, a reaction occurs immediately to prevent other sperm from entering.

The fertilized oocyte, or zygote, then begins a series of cell divisions to become an embryo. During this time — up to 14 days after fertilization — the embryo is particularly fragile. This is believed to be the reason, Edwards said, why some females conceive but do not have successful pregnancies. Research suggests that while conception among a group of heifers may be 90%-95% successful, calving rate to a single breeding may be only 70%-75%. The majority of loss, said Edwards, occurs before Day 14. This may be due to genetic abnormalities or poor semen quality and other factors, but also because of environmental stress.

“At 15 to 17 days after fertilization, the embryo secretes hormones, which help prevent its destruction,” Edwards explained. “But during the first two weeks after fertilization, anything managers can do to minimize stress will help improve the outcome of reproduction.”

— by Troy Smith

## Understanding Postpartum Anestrus

Anestrus may be the most challenging factor reducing reproductive efficiency in beef cow-calf operations, but University of Kentucky (UK) Animal Scientist Les Anderson offered some explanations and solutions for its management.

“Unfortunately, anestrus occurs annually in productive females. Heifers are anestrus prior to puberty, and cows undergo a period of anestrus after each calving,” he said. “The length of the anestrus period in both is governed by many factors, including the presence of a calf, nutritional status of the cow, the cow’s age and degree of calving difficulty.”

Anestrus ranges from 14 to 180 days in

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postpartum cows. Anderson said the normal range for mature cows is 30 to 90 days. For young cows, the normal range is 60 to 120 days.

“Producers need to get cows cycling at the beginning of the breeding season,” he said, adding that can help with conception rates at the right time of the year. “The presence of a calf, for example, can affect that. Having the calf establishes estrogen negative feedback and a low LH pulse frequency, but short-term calf removal of about 48 hours has been shown to be effective in inducing estrus.”

Body condition score (BCS), parity, and days postpartum are also associated with the incidence of anestrus and pregnancy failure. Anderson compared the cow to a water tank. As nutrients pour in, the energy level rises so the cow’s length of the anestrus period is reduced. Cows that calve with a body condition score less than 5 generally

► **Right:** “At today’s current market price, a rancher loses \$3.17 per calf for every day later in the season it is born,” Les Anderson, UK animal scientist, says.

have longer postpartum intervals than cows calving with a higher BCS. To minimize the length of the anestrus period, cows must calve at BCS 5 or greater.

With parity, Anderson has found that 2-year-old cows need 20-30 days longer to resume estrous cycles than older cows. He recommends first-parity cows then calve 20-30 days before the mature cow herd. Additionally, the longer the time that has passed since calving occurred, the more likely a cow is to cycle. The percentage of cows cycling peaks at 70% at 81-90 days postpartum.

“Early calving appears critical and has

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a tremendous impact on profitability,” Anderson said. “At today’s current market price (500- to 550-lb. feeder steers at \$1.27 per lb.), a rancher loses \$3.17 per calf for every day later in the season it is born (assuming 2.5 lb. of gain per day growth).”

So, in order to successfully induce estrus in anestrus cows, he said producers must use protocols that increase progesterone before ovulation and enhance pulsatile LH secretion and follicle growth.

“Administration of a progestin to anestrus cows for a short time period (five to nine days) can successfully induce estrus in many anestrus cows and is the core treatment used to induce resumption of estrous cycles in most protocols to synchronize estrus,” he said. “The most effective method to induce puberty in heifers involves administration of a progestin.”

Anderson continued, “Effectiveness of progestin treatment appears to be dependent upon the progestin used. Treatment of cows with progesterone from CIDR® appears to be more effective than the orally active synthetic progestin melengestrol acetate (MGA). Use of gonadotropin releasing hormone (GnRH) has been shown to increase estrus and ovulation rate in anestrus cows. The induction rate appears to be highest when cows receive a combination of progestin and GnRH.”

Several different protocols and combinations of strategies have been shown to effectively synchronize a fertile estrus in anestrus cows. Anderson outlined a number of the possibilities, along with the accompanying research, which can all be found in the conference proceedings.

“Whether prepubertal or postpartum, protocols are available to effectively induce a fertile estrus in anestrus females and help producers maximize reproductive potential,” Anderson reiterated. “Induction is essential for producers to maintain a high reproduction rate in their herds.”

— by Barb Baylor Anderson

### Insemination-Related Factors Affecting Fertilization in Estrous-Synchronized Cattle

Beef producers may have the tendency to focus on the female side of reproduction, but Richard Saacke, professor emeritus with the Virginia Tech’s Department of Dairy Science, said the male side of the equation may be just as complex. He outlined four major factors that producers should

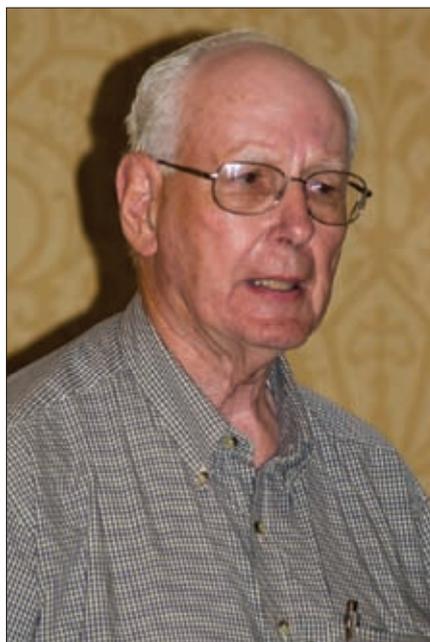
consider when it comes to fertilization in estrous-synchronized cattle.

Those factors include sperm transport in the cow, reproductive history and source of preserved semen of the bull; placement and semen handling by the inseminator; and insemination timing.

“In most breeding strategies, whether estrous synchronization is employed or not, the semen quality, placement and timing of insemination are critical to successful pregnancy,” he said.

For beef cattle, Saacke said six to 16 hours are needed for sperm to travel and colonize in the female egg reservoir. Various studies of embryos and other research seem to confirm that the motile and better-shaped sperm appear to be the most viable. While millions of sperm may be placed by an inseminator, only thousands reach the reservoir, which Saacke says is how nature intended. The female’s system affects what sperm may reach the egg.

“We now know success or failure of an AI (artificial insemination) dose due to the male or inseminate resides in whether or not the egg was fertilized or whether or not the embryo developed normally and hatched in time to signal pregnancy to the dam. Both scenarios are embraced by semen quality and quantity, and they must be considered together to address pregnancy rate,” he said. “Fertility increases with increasing numbers of viable sperm delivered to the cow up to



► Virginia Tech’s Richard Saacke outlined four major factors that producers should consider when it comes to fertilization in estrous-synchronized cattle.

a threshold, after which limiting factors in the female population become important and further increases in sperm are without effect on fertility. The minimum number of motile sperm required for maximum fertility differs among bulls. Bulls also differ in the maximum fertility at any dosage.”

Saacke said clearly while producers should pay attention to semen dosage, the bull selected, natural service or the timing of AI, most emphasis should be placed on the male selection and AI timing together.

“Some bulls can be compensated for with more sperm added. Others cannot, and those are the bulls that need to be removed from the beef cattle population,” he said.

In problem bulls, abnormal sperm may be just the tip of the iceberg, Saacke added. Fat deposition in bulls can affect testicular temperature, and elevated testicular temperature results in the production of abnormal sperm and vulnerability of sperm DNA to acid denaturation. The result can be abnormally-shaped sperm and normal-shaped sperm in abnormal samples.

Saacke said major AI stations and veterinarians usually understand the sperm morphology, and can make adjustments in the AI process to help compensate. AI technicians may need greater training to do a more consistent job in increasing the success rate.

“The shift from ampule to straw has given technicians better thermal control of semen,” he said. “And while technicians may know where the sperm goes, they need proper training to be sure of accurate placement. Bottom line, inseminators can act like bulls — one may require more sperm than another during the process to get it right.”

Additionally, Saacke said, AI timing generally needs to be closer to ovulation while more sperm needs to get to the egg. He explained that the fertilization rate may go up with accessory sperm, but the number of excellent to good embryos goes down.

“AI is a compromise, and if you breed late, you increase the fertility rate and decrease the embryo quality,” he said. “Producers should ovulate early and breed earlier to allow the 6-10 hours it takes for the sperm to get there. Use a high-fertility bull, and you can inseminate over a period of time and still get good results and work with better sperm.”

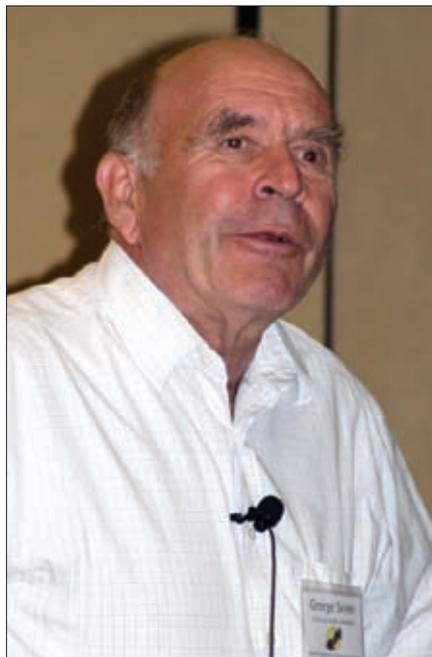
— by Barb Baylor Anderson

## Use of Gender-Sorted Semen

It can be argued that the most important genetic trait is gender. Depending on the specific mating and the target market, the sex of a calf can make a significant difference in its value. So it's not surprising that producers would be interested in a reproductive technology allowing them to choose whether the result of a mating will be male or female.

During the ARSBC symposium, Colorado State University Animal Scientist George Seidel Jr. discussed the development and application of sexed semen for AI. He called it appropriate for some situations — but not without its limitations.

Seidel said the current method of sorting sperm according to gender is its greatest limitation. He explained how sperm are sorted one at a time, in series, and there are limits as to how fast this is accomplished. Sorted by flow cytometry, X-chromosome-bearing sperm (which produce females) can be distinguished from Y-chromosome-bearing sperm (which produce males) due to differences in DNA content. Actually, said Seidel, it can be accomplished at the rate of



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more than 20,000 sperm per second. The procedure is about 90% accurate.

However, more than half of those evaluated are undetermined. That results in fewer than 5,000 sperm of each sex sorted per second. That's just one or two standard AI doses. And since a semen sorter costs around half a million dollars, sexed semen is more expensive, costing roughly \$20 per dose more than conventional frozen semen.

According to Seidel, another limitation is that semen from some bulls does not sort well, so sexed semen is not available for all AI sires. Additionally, sperm viability is compromised if semen is frozen, thawed for sexing and then refrozen. Consequently, bulls must be kept near the sorting laboratory so fresh semen can be sorted prior to freezing.

The fertility of sexed semen is lower than that of conventional semen, added Seidel, partly due to fewer sperm per dose but also because the sperm undergoes greater stress. Still, under ideal circumstances, pregnancy rates are only slightly depressed.

“With excellent management, pregnancy rates are 70% to 90% of that achieved with

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conventional semen,” said Seidel. “It works best with heat detection. When used with estrous synchronization, it works best when inseminating 12 to 24 hours after the onset of heat. It does not work well with timed AI.”

When used with superovulation, the number of good embryos produced is roughly half the number achieved with conventional semen. However, Seidel says, when sexed semen is used with in vitro fertilization it offers the advantage of fertilizing many oocytes with one dose of semen.

Due to the higher cost of purchasing sexed semen and even higher cost of lower fertility, most sexed semen is currently used by seedstock producers wanting to produce bulls or bull mothers from specific matings, or females to sell.

Seidel said one of the most practical applications for commercial producers might be to decrease dystocia by breeding first-calf heifers to have heifer calves. Another would be to increase herd biosecurity during herd expansion by targeting replacement-quality females and avoiding purchased females.

“Commercial producers may find sexed semen to be profitable under some circumstances. In my own herd, over the years, steer calves have been worth an average of about \$50 more than heifers at weaning. This probably isn’t enough to justify sexed semen at current costs and success rates,” said Seidel. “The difference in value would probably have to be greater than \$200 to make it work economically.”

In time, added Seidel, costs of sexed semen will decline and fertility may improve. New products, like the now available 75% accuracy sexed semen, will become available at lower cost. It’s also likely that sexed semen from more bulls will become available.

— by Troy Smith

### AI Benefits, Challenges in the Southeast

The percentage of beef producers using AI remains relatively low. Dee Whittier, Extension cattle veterinarian in Virginia, encouraged Southeastern beef producers to consider the benefits of AI and weigh them against the challenges.

“USDA (the U.S. Department of Agriculture) estimated in 2002 that 92% of dairy operations used AI to some extent and that 45% of U.S. dairy operations used AI

exclusively to get cows pregnant,” he said. “USDA reported in 1998 that 13.3% of beef cattle operations had used AI. However, the percentage of all beef cows that were being inseminated was reported to be less than 5%.”

Whittier cites another USDA study where beef cow-calf operators were asked why they had not used reproductive technologies. Top responses included perception that the technology did not return good results; excessive amount of time and labor required to apply the technology; insufficient facilities to apply the technology; cost; and perception that AI is too complicated.

“To increase AI in the Southeast, we must deal effectively with the ‘too complicated’ reason,” he said. “We also must change the perception that time and labor constraints outweigh the cost. AI time per cow decreases as herd size increases, and we have a lot of smaller herds.”

In the nine states that make up the region, 24.1% of farms reported beef cows in 2007. Only 19.3% of the U.S. beef herd is in the Southeast with an average 32.2 cows per herd. Only Florida exceeds the average U.S. herd size and has 22% of cows in herds greater than 199 head.



► Top responses why Southeastern producers did not use AI included the perception that the technology did not return good results; excessive amount of time and labor required to apply the technology; insufficient facilities to apply the technology; cost; and perception that AI is too complicated, shared Dee Whittier, Virginia Extension cattle veterinarian.

“We know that as herd size increases, along with the associated financial and time commitment, the likelihood that there is a major profit motive in the ownership of cattle increases. Although it would seem that making a profit would be the major incentive to own a beef herd, that is not true in many cases (in the Southeast),” Whittier said. “Producers own cattle for recreation, for esthetic reasons, for tax purposes, for historical and traditional reasons and more.”

Regardless of herd size or reasons for owning cattle, if producers were to better understand the benefits AI can offer vs. natural service, the current trend might change. Whittier noted some of the non-genetic reasons to consider are greater control over reproduction in the herd, some enhancement of reproductive outcomes, some safety from disease and a decrease in bull costs.

“The biggest justification for AI is the superior genetics that can be obtained through AI,” he stressed. “You have the ability to mate each cow to a selected bull and match the characteristics of a cow with a particular sire. But it also extends to use of other breeds without the significant commitment of creating entire breeding pastures where different sire breeds can be utilized.”

There are, however, some challenges to the improved genetics. Producers may want to receive higher returns for AI-sired offspring. That may not always be the case. Bulls have been identified that sire offspring more likely to grade Choice, but decreasing additional value has been assigned to carcasses that grade Choice compared to ones that grade Select. He said the decline in enhanced Choice carcass value has been disappointing for many producers.

“Once genetic traits with potential economic value are identified and propagated, the tendency is for animals with those traits to begin to lose their economic edge,” he said. “Alliances have been formed to market increased value, but without the long-term progress of these alliances, there is insufficient incentive for producers to develop long-standing AI programs.”

Whittier said the goal for greater AI use should be to become routine, especially in larger operations.

“The technology has never been utilized to its full potential in the beef industry, particularly in commercial operations,” he summarized. “In order to achieve greater use, the perception of excessive time and

labor must be overcome. As cow-calf operations become larger, they may have more resources and be able to utilize economies of scale to increase AI programs.”

— by Barb Baylor Anderson

### Managing Bulls for Natural Service

When maintaining one herd sire or a large battery of bulls for natural service, a manager's goals are much the same as the producer making extensive use of AI. The herd manager wants females bred early in the breeding season and high pregnancy rates. He or she wants the highest possible number of offspring from bulls with the greatest genetic value. And the manager wants to achieve all of that as economically as possible.

But University of Georgia Veterinarian Roger Ellis fears many managers do not capture the full potential and breeding power of their bulls. Ellis discussed management considerations that could help producers optimize return on their investments in breeding bulls.



► “We can evaluate bull fertility, but we don't have the ability to adequately predict breeding performance or libido,” said University of Georgia Veterinarian Roger Ellis. “That has to be observed.”

“All bulls do not perform equally,” warned Ellis. “There can be significant variability in fertility and reproductive performance among bulls. And the same bull's performance can vary year to year or even between one breeding cycle and the next.”

According to Ellis, 25% to 40% of bulls do not perform optimally, either because of subfertility or because they are inefficient breeders. There are many reasons, with the leading causes being physical faults or injury. Other reasons range from disease, nutritional and environmental effects to hindering social or sexual behavior. Bulls won't perform up to expectations, added Ellis, unless they possess essential attributes, including the capacity to produce functionally normal sperm, the physical capability and a willingness to breed cows.

“Additionally, bulls must be adaptable to survive environmental challenges and social hierarchy. They also need some luck, to remain injury free,” said Ellis.

Offering tips for prebreeding management, Ellis advised producers to acquire new bulls at least 60 days prior to

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breeding season to allow adequate time for them to adapt to the new environment. He recommended testing for persistent infection with bovine viral diarrhoea virus (BVDV), trichomoniasis (trich) and Johne's disease. All bulls, he added, should be subjected to a complete breeding soundness examination prior to turnout. With regard to body condition, Ellis recommended having yearling bulls in BCS 6, while mature bulls can be in BCS 5 or 6.

Calling proper bull-to-cow ratio very important, Ellis said the recommendation for yearling bulls is no more than 20 cows, and 40 cows for mature bulls. For multi-sire breeding pastures, he advised producers to group bulls together by similarity in size and age. Ellis warned against managing yearlings together with older bulls.

"Watch what's going on in the pasture after putting bulls with cows," urged Ellis. "We can evaluate bull fertility, but we don't have the ability to adequately predict breeding performance or libido. That has to be observed."

Ellis noted that estrous synchronization can also be used successfully with natural service, to get more cows bred early in the breeding season. However, producers should make sure they have adequate bull power. He also recommended that bulls be turned out with cows prior to the onset of maximum estrous activity. Nor is it wise to have synchrony overly tight, or a bull's performance may wane before he gets his job done.

— by Troy Smith

### Management Factors Influence Fertility

The cost of reproductive failure in the U.S. beef and dairy industry tops \$1 billion annually. But George Perry, South Dakota State University (SDSU) animal scientist, said by maximizing the equation of reproduction, producers can achieve greater pregnancy rates.

"The majority of loss occurs because cows do not become pregnant during a defined breeding season. Therefore, the goal of any breeding program, AI or natural service, synchronized or not, is to maximize the number of females that become pregnant," he said. "That means fertility plays a major role in the success of any breeding program."

Perry explained that beef cow fertility can be influenced by many factors. He recommended looking at four major factors



► By maximizing the equation of reproduction, producers can achieve greater pregnancy rates, said SDSU's George Perry, sharing practical ways to do just that.

through an "equation of reproduction." The equation includes percentage of animals detected in standing estrus and inseminated, percentage of inseminator efficiency, percentage of fertility level of the herd, and percentage of fertility level of the semen.

"In a perfect world, these should total a 100% pregnancy rate," he said. "But what if each factor is only 70%? The pregnancy rate would only be 24% for single service."

Perry broke down the equation, looking first at animals detected in standing estrus — a necessity for successful insemination. But AI conception rates may be lower, even if producers are detecting heat. Natural service is a similar problem. You need to watch the libido in bulls.

"This is why fixed-time AI has become important and we have aids to help with that," he said. "Some animals may not show estrus while others may not ovulate."

Since the timing of estrus can be spread throughout the day, Perry said synchronizing can shift distribution of estrus timing. Fixed-time AI eliminates the need for estrus detection and sets up for better conception. In this instance, producers may achieve 90% success.

"Inseminator efficiency is the second factor. You have to be in the right place at the right time," he said, adding that mistakes can occur. "Sexed semen must be handled even more carefully. With natural service,

some bulls are not physically able to service the herd."

In both instances, though, Perry said he sees no difference in pregnancy rates. He estimated for his example a 95% success rate with inseminator efficiency.

The third area is the fertility level of the herd, which Perry says is the most complicated.

"The fertility level of the herd is affected by cycle status, compliance with protocols, body condition scores, disease control, embryonic mortality and stress," he said.

For example, in the case of embryonic mortality, management decisions can affect the incidence of its occurrence. Shipping stress in heifers, especially heat stress and nutrition restriction, can also affect embryonic mortality rates. Perry assigns a 90% success rate to the factor.

The final factor is fertility level of the semen. "If you do the best you can, you may get about 95% success in this area," Perry said. "Combining the four factors into our equation, 90%, 95%, 90% and 95%, you end up with a 73% pregnancy rate for single service.

"It is clear reproduction is complicated," he continued. "Everything must be lined up. Recordkeeping becomes even more important. You have to be a perfectionist."

— by Barb Baylor Anderson

### Nutritional Influences: Energy and Protein

Research suggests that only 75% to 85% of all U.S. beef cows deliver a calf each year. It is estimated that three-quarters of those cows that fail to reproduce simply do not become pregnant during the breeding season. The remainder conceive but do not carry their calves to term — usually due to embryonic loss. According to University of Idaho Reproductive Physiologist John Hall, nutrition is the most important driver of reproductive efficiency, and nutritional deficiencies often are the cause of reproductive failures.

"Energy is the primary nutrient for which deficiency can affect reproduction," Hall said. Energy availability and the timing of dietary energy increase or deprivation appear to influence a release of hormones associated with the female's reproductive cycle, as well as the animal's response to those hormones.

Restricted energy intake during late gestation can result in a longer postpartum

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interval — that period of time between calving and resumption of the estrous cycle — and reduce subsequent pregnancy rates. But even if the female does cycle in a timely fashion and breeds back, energy deprivation can jeopardize embryo survival.

“If energy is deficient, we may be compromising the quality of the oocyte (egg),” Hall explained.

Calling cow body condition a good indicator of whether the diet is supplying adequate energy for cows to rebreed readily, Hall recommended calving cows in body condition score (BCS) 5 or 6. For heifers, he recommended BCS 6 or 7.

Hall said heifers raised on low-energy diets typically are delayed in reaching puberty and have lower pregnancy rates during their first breeding season compared to heifers raised on high-energy diets. Heifers developed to approximately 65% of mature weight by 12 to 13 months of age generally reach puberty by breeding time.

Hall noted recent studies indicating heifers could be developed to 50% to 55% of mature weight by breeding time, and thus reduces development costs without

affecting pregnancy rates. However, results also showed the percentage of heifers cycling at the beginning of the breeding season was reduced, as were pregnancy rates for heifers bred through AI.

“So be careful,” warned Hall. For a reduced development program to work effectively, producers must provide sufficient nutrition for heifers after breeding for continued growth. Pregnancy rates to AI will be improved if producers use a progestin-based synchronization system to induce puberty in a maximum number of heifers. Hall said it’s also beneficial to have a ready market for open heifers.

While body condition at calving has the greatest impact on cow reproduction, Hall said maintaining body condition postcalving is important for cows, too. Even cows that calve while in good condition but experience a period of weight loss after calving can be compromised.

“Dietary energy for cows and heifers can come from a variety of sources. It’s calories that matter,” said Hall. “It doesn’t matter what the sources of calories are, as long as

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they get into the animal.”

Hall mentioned that supplementing fat to increase energy density in the diet and improve reproduction has been studied. Some positive effects result from diets containing 5% to 8% fat, but exceeding the 8% level can impair rumen function. Hall said feeding fat during the last 45 days of gestation has been shown to improve pregnancy rates among mature cows.

“The take-home message is this,” said Hall, “If you can feed fat at a reasonable cost, feed it during late gestation and there should be some benefit.”

Hall said protein deficiency also delays return to estrus after calving. When forages provide less than 7% to 10% crude protein, supplementation of pregnant and early-lactation cows is advised to help improve forage digestibility and enhance energy intake.

“In (the southeastern U.S.), crude protein is often adequate in forages, though it does depend on the type of forage available. That’s often not the case west of the Mississippi,” said Hall, referring to protein-deficient dormant western range forages.

Because pasture and other forages contain mostly rumen degradable protein, researchers have studied the potential benefits of feeding undegradable intake protein (rumen bypass protein). Benefits to reproduction, said Hall, are inconsistent.

To manage breeding herds for successful reproduction, Hall advised producers to know their cows, their nutritional needs, and the nutrition that available forages provide.

“Test forages, for goodness sake,” declared Hall. “Supplements are expensive. Don’t waste money.”

— by Troy Smith

### Nutritional Influences: Mineral Supplementation

The cost of beef cattle mineral supplements has climbed dramatically in recent years. Prices of some mineral supplements have nearly doubled. It has caused many producers to wonder what is really needed and what might be cut to save money.

“A lot of producers have shown me a tag torn from a bag and asked, ‘Is this a good mineral?’ Or they bring in a couple of different tags and ask, ‘Which one would you buy?’” said UK Extension Beef Cattle Specialist Jeff Lehmkuhler.

Lehmkuhler said some producers have turned to cheaper products than they had



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been using. Others are feeding less mineral or providing cattle with salt only. There’s nothing wrong with being a smart shopper, but Lehmkuhler warned that blindly removing mineral supplementation from beef herds is not advisable. He talked about the roles key macro- and micro-mineral elements play in reproductive function, for both cows and bulls.

Calcium, said Lehmkuhler, is well-documented in its role in activation of sperm cells. The calcium to phosphorus ratio is important, with the latter element being essential for cellular energy metabolism and skeletal development. Phosphorus is the most prevalent mineral deficiency of grazing livestock and severe deficiencies lower fertility in breeding herds.

Lehmkuhler said adequate levels of trace minerals in cow diets aid in the return to estrus after calving. Selenium serves as an antioxidant and cancer preventative, as well as aiding spermatogenesis. Copper deficiency can delay or depress estrus in cows, and hinder spermatogenesis in bulls. Adequate levels of zinc also appear to enhance male fertility. Manganese deficiencies appear to be less common than other trace elements but can reduce first-service conception rates.

According to Lehmkuhler, producers seeking to lower mineral input costs should first sample and test forage resources. Availability of minerals from forage are

not static and change seasonally as well as varying by location.

Lehmkuhler said mineral supplementation offered at appropriate levels can be critical to optimizing reproductive success. And while they may seem expensive, mineral supplements usually represent a small portion of total feed costs.

“If a cow eats close to 30 pounds of dry matter a day, that’s about five tons of feed annually. At 4 ounces per day, she consumes about two bags of mineral annually,” said Lehmkuhler. “Relatively speaking, the mineral makes up a small component of total feed cost, but can have a significant impact on animal performance and reproduction.”

— by Troy Smith

### Nutritional Influences: Endophyte-Infected Tall Fescue

Getting beef cows pregnant in the Southeast can be an issue for some producers where endophyte-infected tall fescue is present. Neal Schrick, UT animal scientist, told participants that the issue is being explored, but with few specific conclusions.

“These fescue issues may be management issues. We do not know if cattle have been selected over time to be tolerant to fescue, or whether there is uterine adaptation or



► Neal Schrick, UT animal scientist, recommended producers remove cows from endophyte-infected tall fescue pastures for 30 days before and after breeding.

whether adaptation can fade if bulls are sent to test stations and come back to a herd,” Schrick said. “Have animals been selected for adaptation here? I’ll leave that question for the genetic researchers.”

Schrack said endophyte-infected tall fescue can cause poor performance in cattle, including reduced intake, higher respiration rates and excessive salivation. Toxicosis can further cause decreased calving and pregnancy rates to the tune of more than \$600 million annually in the U.S.

“We see problems when weed spraying kills clover, we stockpile fescue and when we bring in cattle from non-fescue-infected areas,” he said. “Less time grazing means lower fertility. But fescue is a good grass, and it needs to be grazed. It fits in with the needs of the cows here.”

Schrack and others have studied possible causes on both the female and male sides of the issue. Potential female issues include how fescue toxicosis may affect either the growing egg or early embryo while still in the oviduct on the female side.

“When you add in the effects of tall fescue on the sperm, we can understand

why fertility is reduced,” he said. “Throw in elevated temperatures during the summer months with little or no clover and we could see a ‘reproductive wreck.’”

Schrack recommended producers remove cows from fescue for 30 days before and after breeding. He has seen no effect on pregnancy rates. A more practical solution, he added, may be to have cows calve early and get them exposed to the bull before hot summer months.

“We intend to perform more studies to determine if we can manage females differently around the time of breeding to improve pregnancy rates when grazing infected tall fescue,” he said.

On the male side, Schrick and colleagues have studied grazing bulls and evaluated the semen. In the work, scrotal circumference and semen motility and morphology were similar between treated and control bulls, but fertilization potential was reduced in treated bulls compared to controls. In addition, testicular core temperatures were reduced in treated bulls even though rectal temperatures were elevated. Additional work will be conducted on males as well.

“Future studies include determining effects of the fescue on reproduction parameters of mature bulls and sperm defects associated with toxicosis and reduced fertilization ability,” he said. “Another study would include evaluation of tall fescue effects on bulls that have been removed from infected pastures for a period of time, then re-introduced during the breeding period.”

— by Barb Baylor Anderson

## Effects of Temperament & Animal Handling

Nearly every cattle producer has experience with animals whose temperament is such that they become excitable when handled. Many producers are inclined to rid their operations of bad actors for safety reasons. According to Oregon State University Animal Scientist Reinaldo Cooke, cattle temperament may also have productive and economic implications.

Cooke talked about the effects cattle temperament may have on fertility. The

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temperamental or “crazy” cow becomes agitated and sometimes aggressive because of fear and inability to cope with a given situation, he says. Her reaction is classified as a stress response.

In addition to altered behavior, Cooke said temperamental cattle may also experience changes in body physiology. Hormones are released during a stress reaction and those hormones influence growth, health and reproduction.

“Cortisol blood levels increase in response to stress, along with epinephrine and others. It’s the body’s way of preparing the animal for flight or fight. Heart, respiratory and metabolic rates go up, and the animal’s nutrient requirements increase as well,” Cooke explained.

Indirect effects, he added, include reduced feed intake and reduced performance. The hormones released also include those that influence the estrous cycle. So poor temperament often leads to poor reproductive performance both as a result of stress related effects on nutritional status and influences to the physiological mechanisms controlling ovulation, conception and

establishment of pregnancy in females.

Cooke cited studies in Florida showing how Brahman-influenced heifers with calm temperament reached puberty sooner than more temperamental heifers. Mature Brahman-influenced cows with excitable temperament were less likely to become pregnant during the breeding season than calm cows. Brahman influence is generally associated with greater variation in temperament, but Cooke says Oregon studies involving Hereford-Angus crossbred females produced similar results.

One strategy to improve temperament and benefit reproduction in beef females is to acclimate or adapt cattle to human handling. Studies have demonstrated positive response to an acclimation process by replacement heifers. However, acclimation to handling by humans is less effective.

“My advice,” Cooke said, “is to include temperament in criteria for selection of replacements. Secondly, try to become more familiar with your heifers. Get them used to human interaction while they are young.”

— *by Troy Smith*



► In addition to altered behavior, Oregon State’s Reinaldo Cooke said temperamental cattle may also experience changes in body physiology, and those changes could affect fertility.

