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Arkansas Purebred E-News

In This Newsletter

Inbreeding and Linebreeding

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The concept of inbreeding and linebreeding are often misunderstood by cattle producers. Inbreeding usually has a negative connotation due to the fact that humans are encouraged to avoid inbreeding. Inbreeding in livestock species is, however, quite common.

Inbreeding is the mating of individuals that are related. In the broad sense, all members of a breed are related. As a result, any seed stock producer is practicing some level of inbreeding. Therefore, we generally reserve the term inbreeding for the mating of animals that are more closely related than the average of the breed.

Linebreeding does not have the same negative reputation as inbreeding, but it is a mild form of inbreeding. Linebreeding is the mating of individuals within a particular line. It is a mating system designed to maintain a substantial degree of relationship to a highly regarded ancestor without causing high levels of inbreeding.

Animals that are related have a certain percentage of their genes in common. For example, brothers and sisters will have 50% of their genes in common due to their relation. Inbreeding is a measure of how many genes are identical by descent, which is the opposite of crossbreeding.

The main benefit of inbreeding is increased uniformity in offspring. Since inbreeding increases the number of genes in common, these animals will have more similar performance numbers. Most breeds have used inbreeding to fix such traits as coat color or horn status.

There are some negative aspects of inbreeding as well. As the amount of inbreeding increases, so does the occurrence of genetic defects (see Curly Calf Syndrome in this issue). Also evident in inbred populations is an issue called inbreeding depression, which is a decrease in performance of inbred animals – most noticeable in traits like fertility. Inbreeding depression is the opposite of heterosis or hybrid vigor that is accomplished by crossbreeding.

Linebreeding has the advantage of maintaining genes from outstanding individuals that are no longer available for breeding purposes. Also, it helps in recognition, since the breeder can use the name of the ancestor at the center of linebreeding. This is fine if this ancestor is truly outstanding.

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Curly Calf Syndrome

The American Angus Association is asking for reports of any calf born with abnormalities that resemble curly calf syndrome. Curly calf syndrome is a genetic defect that is lethal and has been linked to one of the most heavily used sires in the Angus breed, GAR Precision 1680.

Curly calf syndrome is a genetic defect that is lethal, and has been linked to one of the most heavily used sires in the Angus breed, GAR Precision 1680.

It appears that this genetic defect is a simple recessive (similar to the red and black genes that control coat color); so once a genetic test for it is developed, it should be relatively easy to minimize any additional ill effects. Only half of the animals out of Precision 1680 will be carriers and even a smaller percentage of grandsons and granddaughters. It would require the mating of two carriers before the lethal outcome will be realized, and even then only one-fourth of the resulting offspring would be affected.

Here is a picture of a calf that exhibits curly calf syndrome. The calf will be stillborn and be very light, the hind legs extended and stiff and the front feet will be curled up and stiff. There will be very little muscle mass present on the calf.

If a producer encounters a calf that exhibits these characteristics, he or she should contact the American Angus Association immediately.

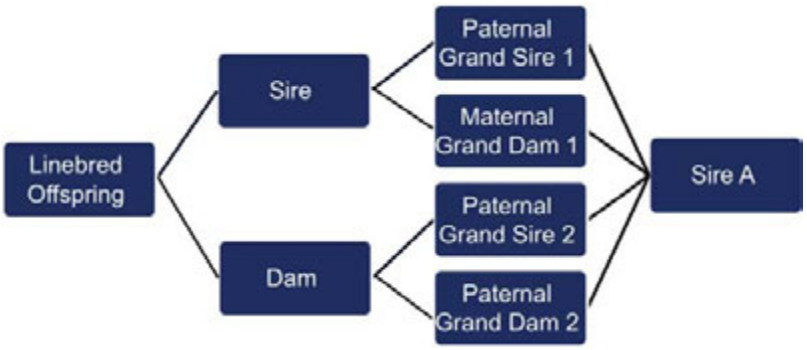
This defect has gotten a lot of publicity because it is out of one of the more heavily used sires within the Angus breed, but we have seen similar defects discovered in the Red Angus, Maine-Anjou, Shorthorn, Holstein and Quarter Horse breeds recently. While molecular genetics has made it possible for the industry to manage these genetic defects vastly better than in the past, it also points out the disadvantage of inbreeding. Improved genetic tools have allowed us to select animals that excel in a particular trait, but it has also resulted in less genetic diversity, more inbreeding and more potential problems like this because of the lack of genetic diversity. The goal is to have the genetic test available before the upcoming spring bull sale season gets in full swing.

If a producer encounters a calf that exhibits these characteristics, they should contact the American Angus Association immediately.

The only way to eliminate all possibility of this syndrome is to not breed two animals that are descendents of GAR Precision 1680 to each other. This solution can be problematic for some since Precision is one of the most popular sires in the Angus breed and has a great number of descendents.

Inbreeding and Linebreeding *(cont. from page 1)*

Let's look at an example of linebreeding:



In this example, the linebred offspring is 47% related to sire A, but is only moderately inbred. This level of relationship is almost that of full siblings. This type of breeding can be beneficial to purebred breeders who are trying to produce calves that are similar within year and between years. It does take some study to minimize any issues that may be present due to inbreeding. If you have any questions or would like to have a more in-depth discussion on inbreeding and linebreeding, please feel free to contact me.

Sex-Sorted Semen for Purebred Beef Producers

In the past few years, sex-sorted semen has made its way from the lab and field trials to use in beef cattle production. Shifting the sex ratio for a calf crop has been tried several different ways, but the idea of sorting or selecting semen to favor male or female offspring has been researched since the advent of artificial insemination. The fact that makes this concept possible is that the fertilizing sperm cell determines the gender of the calf. Due to the genetic makeup of the cells, sperm that produce female offspring are referred to as X-bearing sperm while those that produce male offspring are referred to as Y-bearing sperm.

Sex-Sorting Technology

There have been several attempts to develop a method that efficiently separates bovine semen into fractions containing higher concentrations of X- or Y-bearing sperm. These technologies have utilized sex-specific antibodies, centrifugation and flow cytometry. Of these attempts, the only one that has proven to be commercially viable is flow cytometry. This type of sorting was first researched in the 1980s but yielded very low conception rates when the semen was used fresh after processing. Work in the laboratory and field has improved the results, and the first gender-selected calf using frozen semen was produced in 1999. Eventually, sexed semen became commercially available on a large scale in the U.S. in 2004.

The inefficiency of flow cytometry comes from its complexity and slow pace. The principle of this method relies on the fact that X-bearing (female) sperm contain 3.8% more DNA than Y-bearing (male) sperm. Before sorting, the sperm cells are stained with a fluorescent dye and then passed through the flow cytometer as drops of liquid containing a single sperm cell per droplet. Because of the difference in amount of DNA, the X-bearing sperm shine brighter than the Y-bearing sperm when exposed to light. This allows the cytometer's laser and detector to determine the gender of the sperm cell based on the amount of light it emits. A positive or negative charge is then applied to the droplet containing the single sperm cell.

For producers who rely on bull sales and require fewer replacement heifers (or purchase bred replacements), breeding with Y-bearing (male) sorted semen could be a practical management decision.

Positively charged drops are deflected one way, negatively charged drops deflected the other and uncharged droplets pass straight through. The uncharged drops may contain multiple sperm, damaged material or cells that were not aligned in the proper direction.

Disadvantages

The sperm cells pass through the machine at about 60 miles per hour. This seems fast but, considering that they pass in single file and one ejaculate can contain more than 7 billion sperm, it takes about three to four times longer to process sex-sorted semen than conventionally processed semen. Therefore, this technique yields fewer straws of frozen semen per ejaculate at an increased cost and results in lower conception rates. Current research shows that, in an ideal situation, pregnancy rates will be about 70 to 90% of that for cows or heifers bred with non-sorted semen. This sorting method is not perfect, but it does shift the ratio to about 85 to 90% of the desired sex. As with any other market-driven technology, it is reasonable to consider that sex sorting will evolve to become more efficient and less costly. In the meantime, the benefit from shifting the sex ratio of a calf crop has to be weighed against the increased cost and lower fertility.

Advantages

In some regards, sex-sorted semen is more applicable to the dairy industry. Milking herds are almost always more interested in producing replacement heifers while bull calves are drastically less valuable. For purebred beef cattle producers, bull sales to commercial cattlemen are often the most significant source of revenue, while heifers are also important for genetic improvement as replacements. For producers who rely on bull sales and require fewer replacement heifers (or purchase bred replacements), breeding with Y-bearing (male) sorted semen could be a practical management decision.

Breeding Strategies

Use of sex-sorted semen should be reserved for herds where reproductive efficiency has been optimized through intense reproductive management. Pregnancy rates to sexed semen will be highest in virgin heifers that are bred 12 hours after the beginning of standing heat, and mass insemination or timed breeding is not an acceptable method. Semen handling is similar to traditionally processed semen, even though it will likely be packaged in a ¼ cc straw as opposed the usual ½ cc straw. Keep in mind that semen handling during storage and just prior to insemination is equally critical for success as proper insemination technique. Most

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Purebred Producers Are COOL Also

It would be hard to find a producer who has not heard about Country of Origin Labeling (COOL) in some way or another. No matter your opinion of the program, COOL will become mandatory on Sept. 20, 2008. This law is really aimed at the retail level but affects ALL cattle producers – even purebred producers. While most cattle that are sold off your farm may not be headed straight to slaughter, a high percentage of them will make it there eventually. Once they do, they will be subject to COOL just the same as a slaughter steer. The exact rules of COOL are still under debate, including what form of documentation is needed to certify the country of origin. Purebred breeders should have an easier time than most cattle producers in meeting the requirements of COOL since detailed records are kept for registration purposes. Some records that are recommended to be kept are:

Birth records (calving book, registration certificates, etc.)

Inventory records that reconcile

Purchase and sales receipts

Other supporting documents identified by USDA

These documents should be kept at least **two** years after the sale of an animal in case of an audit. At this time, the consensus in the beef cattle sector is to use an affidavit that certifies these animals' origin. There is not an "official" affidavit that must be used, but here is an example of one that has been recommended by several beef cattle trade groups.

Document 3

Origin Declaration Language for Seller/Buyer Invoices and Other Sales Documents with a Continuous Declaration on Record or as a Stand-Alone Declaration of Origin

(Document 3 is intended for use by cow-calf and stocker operators making an individual transaction.)

I attest that all livestock referenced by this document and transferred are of _____ (country) origin.

_____	_____	_____
Signature	Date	Business/Farm/Ranch Names
_____		_____
Printed Name		Locations (Address, City, State, Zip)

Round Table Discussion

I am planning several discussion sessions this fall and winter to take the time to visit with purebred producers across the state. These discussion sessions do not have an agenda, a topic or a PowerPoint presentation. It is my opportunity to visit with you and talk about purebred production in Arkansas. I'm looking to get a better idea on the issues of concern for purebred producers across the state. Once these sessions are planned, I will send out more information on the times and locations. As always, please feel free to contact me anytime to discuss any issues that you might be facing.

Sex-Sorted Semen *(cont. from page 3)*

of the research to this point indicates that the number of transferable embryos produced by using sex-sorted semen in superovulated cows will be half that of conventionally packaged semen.

With new technologies that have some potential for controversy, it is important to understand the underlying science before making a judgment on its ethical implications. Sex-sorted semen is not genetically engineered or modified. It is a natural product that is simply separated into fractions that contain a higher percentage of sperm cells that will produce either male or female offspring.

Calves from these matings do not have an increased risk for death or abnormalities compared to calves from conventional artificial insemination or natural breeding.

Source: Justin Rhinehart, MSU Extension Beef Cattle Specialist