Progress in the purebred cattle industry demands that breeders understand their cattle thoroughly—the bad points as well as the good.

This is the first in a series of articles designed to acquaint Angus breeders with genetic defects, problems which occur in every breed of every species. The better we understand genetic defects, the better we can control them.

Inherited defects are minimal in the Angus breed today. If Angus breeders understand these disorders, cooperate with the American Angus Assn.'s control program, are open and honest in their dealings with genetic problems, we can keep defects at an insignificant level and continue to produce the quality seed stock Angus are noted for.

Much of the information for this series was provided by Dr. Horst Leipold, D.V.M., professor of pathology and assistant head of the Dept. of Pathology at Kansas State University, Manhattan.

GENETIC DEFECTS

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Genetic defects occur in all breeds of all species. Inherited defects are, in fact, a natural part of cattle breeding. Genetic change is the tool of purebred breeders striving to improve their cattle. Good genetic changes benefit the entire industry—and outweigh the undesirable changes, such as genetic defects, by far. But any business that makes such rapid progress and change as the Angus business does should expect to face some adversities along the way.

Although occurrence of genetic defects in the Angus breed is minimal, it's impossible to avoid undesirable genes. They're in all living things. Studies indicate that every bull may carry a certain number of bad genes, maybe five or six lethal ones. Studies also indicate that man may carry a mutational load of eight or more hidden recessives than cattle.

Genetic defects affect only a minute number of Angus cattle and an even smaller number of breeders. But they shouldn't be taken lightly. They can cause severe economic losses and setbacks in breeding programs. They can spread insidiously through a breed if not monitored and controlled. And they can hit anyone.

Comparative Losses

Calf losses due to infectious disease and environmental problems are much more common than losses due to inherited defects. But modern science and technology enable breeders to control environmentally caused losses more effectively every day. This means genetic defects could increase in proportion and importance in the future if not carefully controlled now.

We can't eliminate genetic defects, but those found in Angus cattle can be easily controlled and bred around. The responsibility lies with the seed stock producer, the purebred Angus breeder.

Genetic defects are results of mutations. Mutations are changes in genetic material —more specifically, changes in the code transmitted by a gene that gives instructions to build a specific protein. Mutations have played an important role in shaping all living creatures. In fact, the genetic part of the variation among individuals of a species in type, size, color, behavior, etc., is due to accumulation of mutations. An example of a desirable mutation is the change from horned cattle to polled. These "changed" genes then are transmitted from generation to generation.

Monitors Defects

The American Angus Assn. monitors five Class I genetic defects and one Class II defect that have been reported in Angus cattle. Class I defects are lethal, seriously disabling or seriously affect reproductive performance. Dwarfism, osteopetrosis (marble bone disease), double muscling, syndactyly (mule foot) and congenital reproductive abnormalities (including, but not limited to, retained testicles) fit into this category. The single Class II defect is red color. Although red color isn't lethal and doesn't affect structure or function, it is economically important because red calves can't be registered with the American Angus Assn.

These six defects are thought to be transmitted by simple recessive genes. This means they're caused by a single pair of genes and only show up when both genes of the pair are recessives.

Simple recessive traits are the easiest to select against or control. Other traits such as small pelvic areas, leg problems, lack of mothering ability, prolapses and many others of economic importance are much harder to breed out or handle with minimal losses because they're controlled by many pairs of genes.

The Mechanics

A calf inherits one gene in a pair from its sire and one from its dam. If both parents carry a recessive and pass it on to the offspring, the calf will be affected with the defect.

A calf also could inherit one recessive gene and one normal gene. This type of animal is called a carrier and, although it appears normal, can pass the defective gene on to its offspring. Usually there's no way to detect a carrier unless it's mated to another carrier or to an affected animal and a defective calf is produced.

Genetic defects are passed along from generation to generation. When two normal animals (with no recessives for the defect) are mated, all of the offspring will be normal.

If a normal bull is mated to carrier cows, statistically one-half of the offspring would be carriers. (Remember, carriers appear normal.)

If a carrier bull is mated to carrier cows, the problem usually becomes obvious. One-fourth of the calves would be affected, one-fourth would be normal and one-half would be carriers. In order for a calf to be affected, both parents must carry the recessive and pass it to the offspring.

Least Likely Program

The least likely event would be to use affected cattle in a breeding program. Marble bone and mule foot cattle usually die before they reach puberty, but it could happen with red color, double muscling or congenital reproductive abnormalities.

An affected bull mated to clean cows would produce all carriers. An affected bull mated to carrier cows would produce one-half carriers and one-half affected calves. And an affected bull mated to affected cows would produce all affected calves.

The American Angus Assn. has the most comprehensive and open genetic defect control program in the industry. Some breed associations deal with genetic problems secretly, others have no program at all, and others simply refuse to admit that genetic defects do exist in their breed. But policies that cover up defective cattle certainly do more harm than good. Those breeds can only go backward in the long run.

As one Angus breeder who discovered a genetic problem in his herd says, "If we have to have a problem, it is to our long-term advantage to learn of it now so we can correct it. If we are to be truly successful in improving our cattle, we need to know all of their hidden problems along with all of the obvious beneficial economic advantages. This will make us even more aware of the tremendous responsibility, burdens and problems a purebred breeder faces."

Requires Report

The Angus association requires members to report any abnormalities found in Angus cattle. Failure to comply could result in suspension or expulsion from the association.

The association strives to keep its members informed of bloodlines that carry defective genes so they can avoid introducing them into their herds. A list of all animals reported by their owners as having sired or produced one or more of the six genetic defects monitored is published regularly in ANGUS JOURNAL. It currently includes 29 bulls and nine cows as carriers of specific Class I defects. This list, however, is not a list of all Angus that are carriers of genetic defects. Only cases reported to the association by the owner or owners of the animal (or verified by a veterinarian) are included.

A list of animals that have been progeny tested also is published. Five bulls have tested free of all defects, and 22 have tested free of specific defects.

In addition, a code is printed on registration papers issued after Jan. 30, 1979, which designates reported carrier animals. (Congenital reproductive abnormalities are not included.) The following codes are used to indicate carriers of the respective defects: Syndactyly "s", double muscling (muscular hypertrophy) "h", dwarfism "d", osteopetrosis "m" and red "r". The code for bulls possessing multiple genetic defects is "x", and breeders can check the association's list to determine which defects the animal carries.

Tested Clean

Animals tested free of a specific genetic defect in accordance with association rules are indicated by adding an "f" to the code letter for that defect. For example, "sf" means that the animal has tested free of syndactyly. Animals that are carriers of one defect but have tested free of another also are indicted. For example, "r-sf" means the animal transmits the red gene but tested free of syndactyly.

Bulls that have tested free of all genetic defects by mating to 35 or more daughters under association guidelines are designated "gdf", genetic defect free. Females that have tested free of defects under association guidelines also can be labeled "gdf". (Progeny testing will be discussed in a later article.)

These codes, however, don't mean that an animal doesn't carry a genetic defect that hasn't been discovered or hasn't been reported to the association.

Another important part of the association's policy involves A.I. service certificates. A registered Angus bull confirmed as a carrier of any of the six defects is indicated as a carrier on all A.I. certificates issued for that bull.

Calves sired artificially by non-owned bulls that transmit dwarfism, marble bone, mule foot or double muscling aren't eligible for registration if conceived 60 days or more after first notification in the ANGUS JOURNAL list. The breeder who sold semen from the carrier bull is responsible for informing semen buyers.

The association also supports studies by contributing financially to breeders who follow set guidelines to determine whether an abnormal calf is afflicted with a genetic disease. (Contact the office for details.)

Need Effective Reporting System

The association's control program can be only as effective as its reporting system—the purebred Angus breeders. Angus

seed stock producers are charged with the responsibility of keeping our breed as free from undesirable genes as possible. This requires breeders not only to understand genetic defects but to report defective calves, cull carriers and be honest in dealing with customers.

"A breeder should have the insight, education and foresight to handle it (reporting genetic defects) on his own," Dr. Leipold says. "It's really his responsibility. It's his material. It's his baby."

Purebred breeders are the only ones who can effectively monitor genetic defects. Animal identity is often lost in commercial herds and, when a defective calf is discovered, the sire often can't be traced. As a result, introducing defective animals into commercial herds can lead to serious economic problems.

Few Losses

Genetic defects should cause few, if any, calf losses in a registered herd. If no genetic defect problems are present in a herd, the breeder has only to avoid using carrier bulls and females sired by known carriers. This can be done by checking pedigrees to determine which animals could be carriers and which should be clean. (There is a rare possibility that a mutation will create a new genetic defect in the herd no matter how cautious a breeder is.)

On the other hand, what should be done if a defective calf is discovered? First of all, only a small fraction of dead or aborted calves are afflicted with genetic problems. Most calf losses are caused by nutritional problems or infectious diseases.

The suspected calf should be thoroughly inspected by a veterinarian. Breeders should aid in the postmortem by providing as much information about the calf, its ancestors and its environment as possible. Speed in calling the vet is important if the suspected calf is dead, because tissue degenerates quickly, especially in hot weather.

If the diagnosis confirms a genetic problem, the occurrence must be reported to the association.

Recommendations

Most geneticists recommend eliminating the offending bull from the herd. Breeders also may want to eliminate the dam or breed her only to clean bulls because she is a confirmed carrier. The breeder must then decide what to do with offspring of the sire because, statistically, one-half of his calves will be carriers.

If a breeder decides to keep the bull's daughters, they should be bred only to clean bulls. This way, the frequency of carrier offspring would be halved each generation. (Fifty percent of the daughters are carriers. When mated to clean bulls, 25% of the bull's granddaughters would be carriers. The next generation, only 12.5% would be carriers, etc.) Elimination of the problem this way is a slow process, however, and some breeders prefer to eliminate all daughters of the carrier bull and replace them with clean females.

If the carrier bull has produced an outstanding son, he should be progeny tested before extensive use as a sire. Good genetic material shouldn't be thrown away unnecessarily, but caution must be used to avoid undesirable genes.

Keep Postitive Attitude

Ethics in dealing with carrier cattle is an area which can't be stressed strongly enough. Breeders who sell carriers or descendants of carriers owe their customers complete honesty. A breeder who informs his buyers that an animal has, for example, a 25% chance of transmitting a certain defective gene can only inspire the customer's trust and respect. And that's what the purebred business is all about.

Breeder perspective and attitude is perhaps the most important part of dealing with genetic defect problems. One Angus breeder hit the nail on the head when he stressed, "Think positive! We all know the vast majority of our cattle are clean. This can only turn into a 'monster' by breeder neglect and attitude."

Editor's Note: This is the first in a series of nine articles. The next six will discuss hydrocephalus, osteopetrosis, syndactyly, mannosidosis, dwarfism and double muscling. The eighth article will include descriptions of rarer genetic defects. The last will feature progeny testing and outline the association's progeny testing guidelines.