

Managing the AM (Curly Calf) Genetic Defect

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Reprinted from *Cattle Call*, 2009, Vol 14, Iss 1

Arthrogryposis Multiplex (AM), commonly known as Curly Calf syndrome, is a lethal genetic defect that was recently confirmed within the Angus breed. Other breeds with Angus in their pedigree may also be affected. An AM-affected calf is born dead, appears thin, and most notably, has a bent or twisted spine (Figure 1).

AM is caused by a mutation in which a significant section of DNA is missing. The deletion of this genetic information affects 3 genes - one involved in immune function, one involved in nervous system-muscle connection, and one with unknown function. AM is a simple recessive genetic condition.



Figure 1. Calf with Arthrogryposis Multiplex (Photo courtesy of the American Angus Assoc.)

This means that a calf requires two copies of the AM mutation (one from the sire and one from the dam) to

suffer from the condition, and is referred to as AM-affected (AMA). Animals that have only one copy of the mutation are considered an AM-carrier (AMC) and can pass the defect to his or her offspring. Animals with no copies of the mutation are denoted AM-free (AMF). The probability of producing different genotypes with various breeding scenarios is shown in Table 1. AM has been traced to the bull, Rito 9J9 of B156 7T26. This bull appears in many pedigrees, including a popular and widely used maternal grandson, G A R Precision 1680, which is also an AM carrier.

Table 1. Probability of producing AM genotypes

Resulting offspring genotypes	Parent genotype matings		
	AMF x AMF	AMF x AMC	AMC x AMC
AMA (affected)	0%	0%	25%
AMC (carrier)	0%	50%	50%
AMF (free or normal)	100%	50%	25%

You cannot look at an animal and tell if it is an AM carrier. Dr. Jonathan Beever, Univ. of Illinois, developed a diagnostic test, which can accurately determine if the mutation is present in DNA from samples of blood, hair, or semen. Thousands of animals have already been tested. Additionally, the testing has confirmed that many animals are AMF, by simple elimination of the possibility of AM inheritance from their pedigree. American Angus

Assoc. registration numbers are given a suffix of AMC or AMF when a DNA test result is confirmed, and a list of free and carrier animals is also maintained on the association website. Cattle not confirmed as AMF from their pedigrees can be tested by an American Angus Assoc. approved laboratory (listed at www.angus.org/ccs_info.html). The DNA test generally costs \$20 to \$30.

The American Angus Assoc. has set policy to proactively remove this defect from the cattle population. Breeders of registered Angus cattle should know that no registrations will be revoked; however, progeny of known carriers must be tested before they can be registered in 2009, and progeny of carriers, confirmed as carriers themselves, will not be eligible for registration beginning in 2010. Complete policy details are available on the association website.

Management considerations

Angus and hybrid seedstock operators should familiarize themselves with their respective breed association guidelines for AM testing and registration of animals.

In general, commercial producers that have used untested Angus sires with Rito 9J9 of B156 7T26 in their pedigree and kept replacement heifers from them, should strongly consider any new bull purchases or semen be tested AMF. This information should be available from the semen provider, breeder, or association. Note that Rito 9J9 of B156 7T26 could be several generations back in the pedigree and still pass on carrier status. To rapidly eliminate this genetic defect from the herd, replacement heifers should ideally only

be kept from bulls that have been tested AMF. Carrier bulls can be used as a terminal (all offspring harvested) sire on AMF Angus or non-Angus cows with little chance of a problem. If producers have cows that have AM carriers in their pedigree, carrier status has not been tested, and culling is not practical, the safest option would be to breed them to AMF bulls and not retain replacements. This practice will eliminate the risk of producing an AM-affected calf; however it does not eliminate the risk of producing carrier animals. Only genetic testing can definitively rule out whether an animal with carriers in its pedigree is AMF.

Today's DNA testing allows rapid identification and removal of genetic mutations from the cattle population. The rapid development (approximately four months elapsed from the time the defect was recognized, until the test was commercially available) of the AM DNA test was made possible by the availability of the bovine genome sequence, and demonstrates one of the most compelling examples, to date, of the utility of this information for the cattle industry.