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Brachygnathia in Simmental Cattle

Neal E. Woollen¹

Introduction

Brachygnathia is a deficit in mandibular length causing the incisor teeth to meet the upper dental pad behind its anterior angle. It is a problem to breeders of both red and black Simmental cattle, as well as other breeds. The condition has been considered inherited as a simple autosomal recessive trait. It has also been observed as one part of a lethal, multiple-defect syndrome in Simmentals caused by the calf being born with an extra chromosome (Trisomy 17). Intrauterine infection with bovine viral diarrhoea-mucosal disease virus (BVD-MD) also can cause the defect, but usually in this case the calf is also born with a variety of additional problems. In Angus cattle, the defect has also been observed accompanying osteopetrosis, an inherited bone defect.

Selective culling and breeding practices designed to remove an undesirable genetic trait have been unsuccessful for a number of producers of both red and black Simmentals. For that reason, we have been studying the inheritance of this condition in more detail.

Procedure

An affected and distantly related red bull and heifer were selected as the foundation for this project. Following superovulation and embryo transfer, 14 calves were produced from this mating. One affected heifer was selected to mate back with her sire. Eleven calves have been produced from this mating. The same bull was mated to an affected Angus cow. Six calves have been produced from this mating. Semen has been collected from a black Simmental bull. To evaluate the source of deleterious genes in black Simmental cattle, he will be mated to the same females.

Results

The initial mating produced three (21%) affected calves. The father-daughter mating produced two (18%) affected calves. The Angus-Simmental mating has produced no affected calves. Affected calves have had no additional significant defects, and have been of both sexes.

In a recessive mode of inheritance, two affected cattle should produce 100% affected calves if penetrance is complete. It is clear that there are significant factors affecting penetrance, or that the condition is not due to recessive gene action.

There is no significant difference in the percentage of affected calves produced from either Simmental mating. It is reasonable to assume that if enough calves were produced, the affected percentage would be roughly 25%. This pattern of inheritance is compatible with overdominance at two gene loci (locations) involving four genes. In overdominant inheritance, the heterozygote (Aa) is different from either the homozygous dominant (AA) or recessive (aa). Overdominance at one locus would produce 50% affected calves, and overdominance at two loci would produce 25% affected calves.

The fact that no affected calves have been produced from the Simmental-Angus mating suggests that inheritance of the condition is different between the two breeds. However, with only six calves produced to date, this is only an assumption. If this pattern continues, we also can assume the condition in black Simmentals is of either Simmental or Angus origin and not combined genetic action. Identical matings using the black Simmental bull should clarify this matter.

¹Woollen is a veterinary medical officer, Animal Health Systems Research Unit, MARC.