Use of Parentage Testing in the ISU McNay Angus Beef Cattle Herd

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Introduction

The ISU McNay research herd consists of approximately 400 head of registered purebred Angus cows and is located at the ISU McNay Farm, Lucas County, Chariton, Iowa. The herd has been selected since 1996 for increased marbling and has been a valuable data resource for use in both short- and long-term research. Previous research with the herd has involved ultrasound technology to select for marbling, the inheritance of pinkeye resistance, genetic variation in response to vaccination, as well as the genetic basis of mineral and fatty acid concentrations in beef.

Materials and Methods

The cows are split into a fall and spring herd resulting in both a fall and spring calving season. There are approximately 300 cows in the spring herd and 100 cows in the fall herd. Breeding season for the fall herd typically begins in November and ends in January. Calving season for the fall herd typically runs from August to October. Breeding season for the spring herd typically begins in June and ends in August. Calving season for the spring herd typically begins in March and ends in May.

An estrous synchronization protocol is used on both the spring and fall cow herds to allow the herd to benefit from the use of artificial insemination (AI). All cows are synchronized and exposed to AI for the first round. The cows then are pasture exposed to a group of 3 to 4 bulls. Therefore, a large number of cows conceive via AI, but a proportion does not. Ideally most of the cows not conceiving via AI are bred by the pasture bulls. The exact sire of each of the calves resulting from a pasture mating is difficult to determine, because it could be any of the 3 or 4 bulls from the pasture setting. This is where parentage testing is a very useful tool.

Parentage testing compares DNA markers from bulls or cows with calves to verify a calf's parentage. This method often is used when multiple bulls are mixed with a group of cows. The most common markers currently used are single-nucleotide polymorphisms (SNP) for which special SNP chips have been developed and used by various genotyping vendors. In order to be successful, parentage testing requires genotype of the individual calf of interest, the genotype of all sires used in the herd, and the genotype of all dams in the herd. Some 5,000 individual animals from the ISU McNay research herd have been genotyped to date. Entire calf crops in recent years have been high density genotyped at either GeneSeek in the United States or Weatherbys in Ireland so the parentage of each calf can be verified.

Results and Discussion

The GenSel program developed by Iowa State University was used to perform parentage testing of the herd. A summary of the errors and multiple sire issues resolved with parentage testing for each year-season of calving is displayed in Table 1. The calf crop has increased steadily in numbers from 2013 to the present, and with this comes a larger percentage of errors discovered and then

resolved. The percentage of errors identified ranged from 2.0-4.2 percent, with the largest percentage of errors occurring in the 2016 spring calf crop (Table 1). Parentage errors identified and corrected often were due to a mistake in recording of the dam at calving. This type of mistake can be easy to make when multiple cows are dropping calves on the same day and in very close proximity to one another.

The multiple sire issues resolved with parentage testing ranged from 37.6-68.0 percent, with the largest percentage of multiple sire issues occurring in the 2014 fall calf crop (Table 1). Overall conception rates for the spring herd have ranged from 75 to 90 percent with about half of the cows conceiving by AI and half conceiving by natural service. For the fall herd, there usually is a larger percentage conceiving by natural service. Therefore, each spring about half of the calf crop will have a multiple sire issue to be resolved. Correcting these errors and resolving these multiple sire issues makes it possible to have a correct pedigree to produce a more accurate Expected Progeny Differences (EPD), which can be used to make the best selection decisions for the genetic improvement of the herd. In addition, known parentage of the entire herd allows us to register each animal retained with the American Angus Association.

Table1. Summary of errors and multiple sire issues resolved with parentage testing by year/season of calving for the McNay research herd, Chariton, IA.

Year/season of calving	No. calves born	Percentage of errors (%)	Percentage of multiple sire issues resolved (%)
2013-spring	189	2.1	53.9
2014-fall	100	2.0	68.0
2015-spring	246	3.7	41.9
2016-spring	287	4.2	37.6
2017-spring	278	2.9	47.1