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Genetic Improvement Made Through DNA Testing and Artificial Insemination to High- Growth, High Carcass Value Angus Sires

Abstract

The beef industry has improved the recording of pedigrees and performance data through the use of breed associations and herd health databases. Constant evaluation of genetics and performance has allowed producers to make more informed breeding decisions that help improve herd productivity. As a result of recent droughts and elevated feed and grain prices, however, the American beef cowherd is at a record-low 29 million head. For the United States to continue to be the leading producer of beef in the world, the industry must adopt technologies that improve efficiency of the cowherd and the quality of beef being produced. There are two sizable pools of relatively low-grading, low-value carcass genetics in the U.S. beef industry: (1) southern cattle with significant *Bos indicus* influence, and (2) cattle with a relatively high percentage of Continental breeding. The objective of this research project was to demonstrate the improvement in marbling and grid premium potential that can be made in a cow base with average to below-average genetic potential in just one generation through the use of genomics and artificial insemination.

Keywords

Angus, genomics, marbling, artificial insemination

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Genetic Improvement Made Through DNA Testing and Artificial Insemination to High-Growth, High Carcass Value Angus Sires

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Introduction

The beef industry has improved the recording of pedigrees and performance data through the use of breed associations and herd health databases. Constant evaluation of genetics and performance has allowed producers to make more informed breeding decisions that help improve herd productivity. As a result of recent droughts and elevated feed and grain prices, however, the American beef cowherd is at a record-low 29 million head. For the United States to continue to be the leading producer of beef in the world, the industry must adopt technologies that improve efficiency of the cowherd and the quality of beef being produced. There are two sizable pools of relatively low-grading, low-value carcass genetics in the U.S. beef industry: (1) southern cattle with significant *Bos indicus* influence, and (2) cattle with a relatively high percentage of Continental breeding. The objective of this research project was to demonstrate the improvement in marbling and grid premium potential that can be made in a cow base with average to below-average genetic potential in just one generation through the use of genomics and artificial insemination.

Experimental Procedures

In April 2012, 104 yearling heifers of predominantly Charolais and Charolais-cross breeding were obtained from a single ranch source in Texas. Heifers were expected to have a low genetic potential for marbling. Heifers and subsequent progeny were individually identified with an on-farm tag and electronic identification tag. Heifers were genotyped for predicted marbling, yield grade, and tenderness potential. All heifers had below-average GeneMax (Zoetis, Florham, NJ) DNA marker-predicted marbling values. Heifers in the bottom third for marbling potential were culled and fed to harvest. The predicted marbling values were -4.69 and -52.17 ($P < 0.01$; SEM = 3.67) units below the population average for retained and culled heifers, respectively. Retained females were bred by artificial insemination to one of two Angus sires selected for high growth potential and increased carcass quality. Reference sires ranked in the top 6% of the breed for calving ease and the top 1% for \$B (beef value, the expected average difference in future progeny performance for postweaning and carcass value compared with

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the progeny of other sires). Replacements were artificially inseminated up to two times, followed by natural service to bulls of similar quality. Resulting calves ($n = 35$) were managed traditionally, DNA-tested, fed in a southwest Kansas feedyard, and harvested in June 2014.

Results and Discussion

Progeny DNA showed predicted marbling scores 54.5 units higher ($P < 0.01$) than that of their respective dams (Table 1). On the rail, progeny recorded an average hot carcass weight of 823.2 lb and a 2.91 average yield grade. Dams of these progeny had an average hot carcass weight of 820.5 lb and average yield grade of 1.66. Only 22.9% of dams received a USDA Choice quality grade, and none qualified for the Certified Angus Beef (CAB) brand. Meanwhile, progeny graded 94.6% USDA Choice or higher. Of those, 5.8% graded USDA Prime, and 35% qualified for CAB. There were no differences in quality grade, yield grade, or price per 100 lb between sires ($P \geq .19$). With no carcasses taking weight discounts and an average dressing percentage of 64.92%, there was a \$113.10 grid premium per head. The results from this study demonstrate that significant improvement can be made in one generation by using DNA technology and proven sires simultaneously.

Implications

Genomic testing and artificial insemination can result in a significant improvement in the carcass quality of progeny and in increased financial returns for producers in just one generation.

Table 1. Results of using DNA technology and proven sires

Item	Dams	Progeny	SEM	<i>P</i> -value
Marbling score	414	532	13.0	<0.01
Hot carcass weight, lb	820.5	823.2	29.9	<0.01
12th-rib fat, in.	0.32	0.54	0.02	<0.01
Ribeye area, sq. in.	14.7	12.9	0.21	<0.01
Kidney, pelvic, and heart fat, %	2.5	2.5	0.00	>0.05
Yield grade	1.66	2.91	0.12	<0.01
Price/animal	\$1,482.11	\$1,948.81	31.72	<0.01
Price/100 lb	\$181.08	\$237.27	2.18	<0.01