

## Relationships Among Terminal Traits and Sale Prices of Red Angus Bulls Sold at Auction From 2017 Through 2019

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### Abstract

The objective of this study was to evaluate the influence of terminal traits in the form of selection indices and expected progeny differences on the sale price of Red Angus bulls sold at auction from 2017 through 2019 across the United States. Various factors were discovered to be of significance through statistical models. Through the construction of descriptive figures, sale price was found to be positively associated with several terminal traits. However, relatively low  $R^2$  values across both models indicated that only a small amount of price variation was accounted for with these factors. Other factors likely affecting sale price were breeder reputation and visual aspects of bull quality.

### Introduction

The selection of a beef bull is an important choice, as a herd sire provides more than 80% of genetic merit and change to a herd (Ishmael, 2017). In an industry with rapid change in producer priorities and preferences, the utilization of various management strategies and selection tools has been crucial in ensuring a continued level of economic productivity (Hersom et al., 2011). Numerous categories of information are provided to potential buyers through various auction channels. Information includes values concerning expected progeny differences, selection indices, and phenotypic data and characteristics. Different information provided to buyers during the time of sale may have the potential to alter the price a buyer may be willing to offer for the bull depending on the goals and priorities of the specific producer (Dhuyvetter et al., 1996).

### Experimental Procedures

Information describing various factors about Red Angus bulls marketed and sold nationwide through auctions were obtained from the Red Angus Association of America (Commerce City, CO) in an electronic format. These data were available for Red Angus bulls offered for sale in auctions during the spring and fall of 2017 and 2018, and the spring of 2019 sale seasons. Quantifiable factors came in the form of two selection indices and fourteen expected progeny differences, encompassing a variety of maternal and terminal traits.

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Two separate multiple regression models were developed using backward selection procedures to examine the effect of genetic factors in the form of selection indices and expected progeny differences on the sale price of Red Angus bulls. Terminal traits included with the selection index model came in the form of the GridMaster Index. Terminal traits in the form of expected progeny differences included birth weight expected progeny difference, weaning weight expected progeny difference, yearling weight expected progeny difference, yield grade expected progeny difference, marbling score expected progeny difference, carcass weight expected progeny difference, ribeye area expected progeny difference, and 12th rib fat thickness expected progeny difference. Relationships between sale price and these genetic parameters were further examined by evaluating the trends in selection indices and expected progeny differences across sale price categories. Red Angus bulls were categorized into eight groups by respective sale price. The unadjusted, average values of these selection indices and expected progeny differences were then calculated across price categories to investigate the trend of these various genetic factors relative to sale price.

## Results and Discussion

Data were collected for 21,362 Red Angus bulls offered for sale in auctions from 2017 through 2019. Within the selection index model, GridMaster Index ( $P < 0.05$ ) was found to be a significant factor positively influencing bull sale price. Regression coefficients from the model indicate that a single unit increase in GridMaster Index increased auction price by \$331.00 (Table 1).

Correlations among expected progeny differences were examined to minimize the occurrence of multicollinearity. The following parameters were excluded from the regression model due to high correlations across traits: weaning weight expected progeny difference, yearling weight expected progeny difference, and yield grade expected progeny difference. Within the expected progeny difference model, various terminal traits significantly influenced bull sale price. Those factors were: birth weight expected progeny difference ( $P < 0.05$ ), marbling score expected progeny difference ( $P < 0.05$ ), carcass weight expected progeny difference ( $P < 0.05$ ), ribeye area expected progeny difference ( $P < 0.05$ ), and 12th rib fat thickness expected progeny difference ( $P < 0.05$ ) (Table 2). Positive relationships with sale price were discovered for the variables of marbling score expected progeny difference, carcass weight expected progeny difference, ribeye area expected progeny difference, and 12th rib fat thickness expected progeny difference, while birth weight expected progeny difference was found to be inversely associated with bull sale price. While selection indices and expected progeny differences were found to be significant through statistical models, relatively low  $R^2$  values were found across both models (Table 1 and Table 2), indicating a small amount of variation in auction price was explained by the associated genetic parameters. This may suggest that producers are relying on other factors not captured within the data when making purchasing decisions.

When summarizing descriptive data for terminal traits across bull sale price groups, positive trends were discovered for GridMaster Index (Figure 1), weaning weight expected progeny difference (Figure 2), yearling weight expected progeny difference (Figure 3), marbling score expected progeny difference (Figure 4), carcass weight expected progeny difference (Figure 5), ribeye area expected progeny difference

(Figure 6), and 12th rib fat thickness expected progeny difference (Figure 7). An inverse relationship was discovered between sale price and birth weight expected progeny difference (Figure 8). A relatively flat trend was observed for yield grade expected progeny difference (Figure 9).

## Implications

Relatively low  $R^2$  values suggest that bull buyers are utilizing other informational components not captured within these data when making purchasing decisions. Knowledge of physical attributes, marketing strategies, and breeder reputation is likely influencing buyers, and may explain additional variation in the sale price of Red Angus bulls. Continued research on terminal traits influencing the sale price of beef bulls across the United States may prove advantageous to producers.

## References

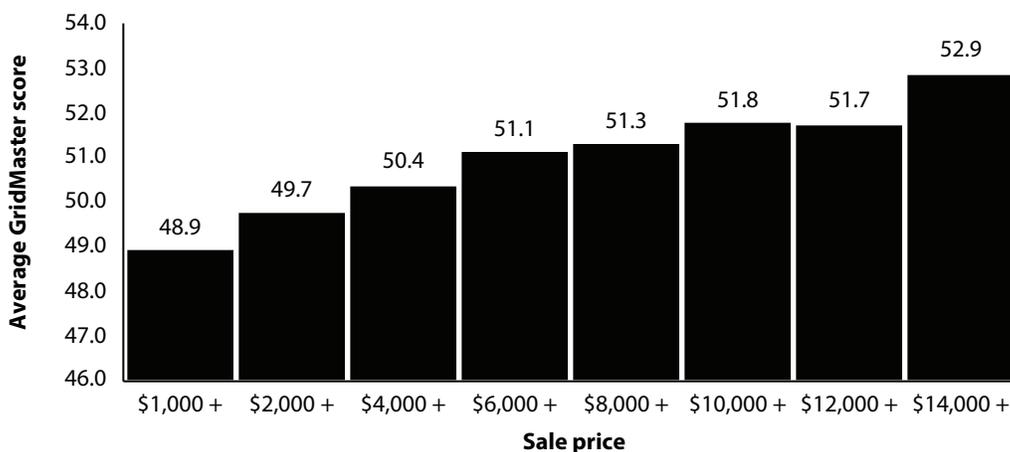
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**Table 1. Terminal traits in the form of selection indices affecting the sale price of Red Angus bulls sold at auction from 2017 through 2019**

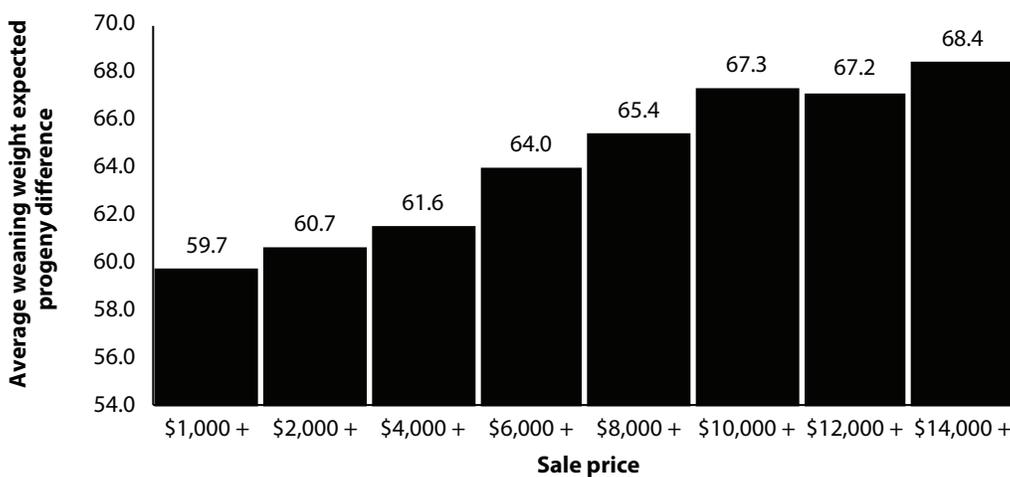
Factor	Estimate	Standard error	T-value of factor	P-value
Intercept	-12,800.00	521.30	-24.55	<0.0001
GridMaster index	331.00	10.53	31.44	<0.0001
Number of observations	21,362			
$R^2$	0.05			
Adjusted $R^2$	0.05			

**Table 2. Terminal traits in the form of expected progeny differences affecting the sale price of Red Angus bulls sold at auction from 2017 through 2019**

Factor expected progeny difference	Estimate	Standard error	T-value of factor	P-value of factor
Birth weight	-276.40	18.32	-15.09	<0.0001
Marbling score	567.15	114.16	4.97	<0.0001
Carcass weight	69.47	2.78	24.96	<0.0001
Ribeye area	1,125.72	115.62	9.74	<0.0001
12th Rib fat thickness	3,114.31	1,016.32	3.06	<0.01
Number of observations	21,362			
R <sup>2</sup>	0.07			
Adjusted R <sup>2</sup>	0.07			



**Figure 1. GridMaster score by sale price category.**



**Figure 2. Weaning weight expected progeny difference by sale price category.**

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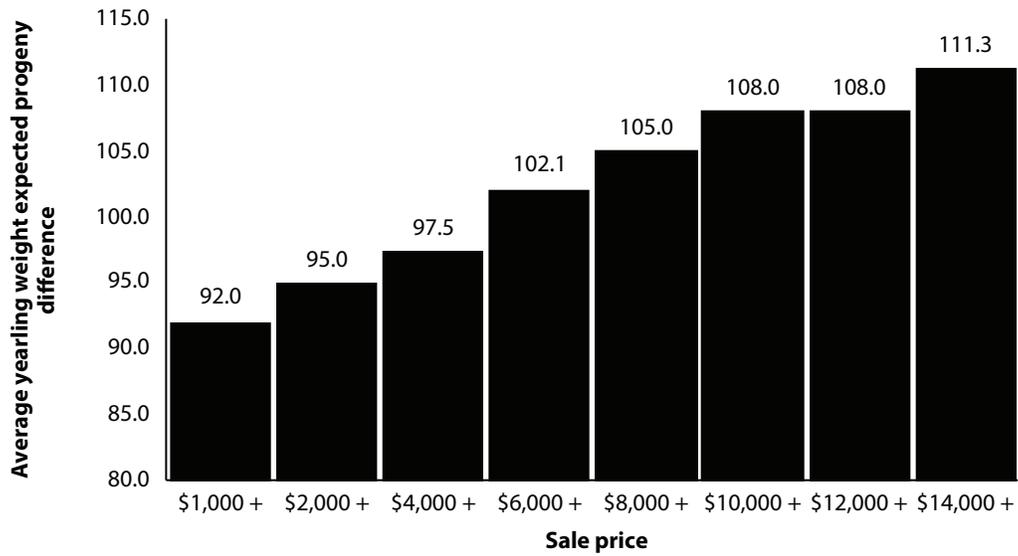


Figure 3. Yearling weight expected progeny difference by sale price category.

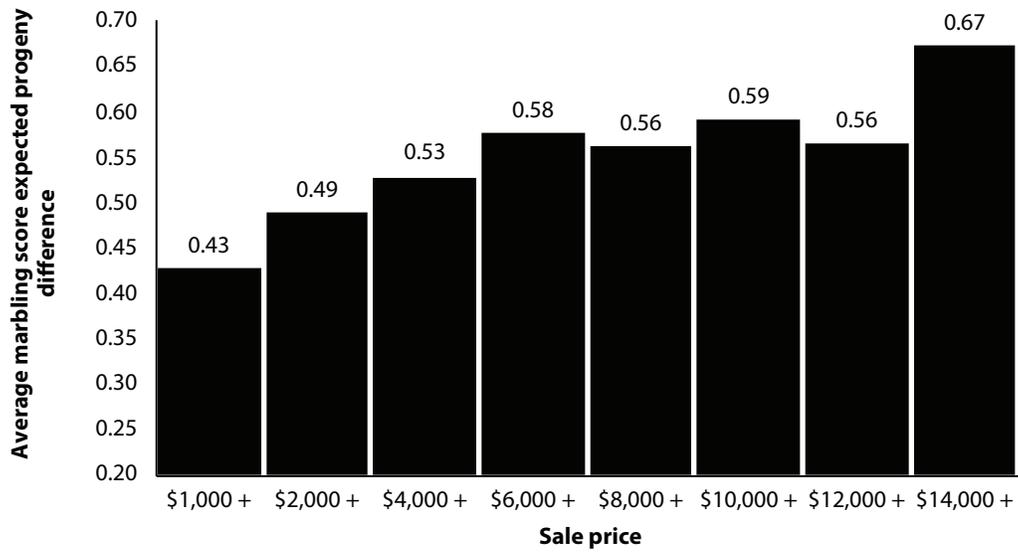


Figure 4. Marbling score expected progeny difference by sale price category.

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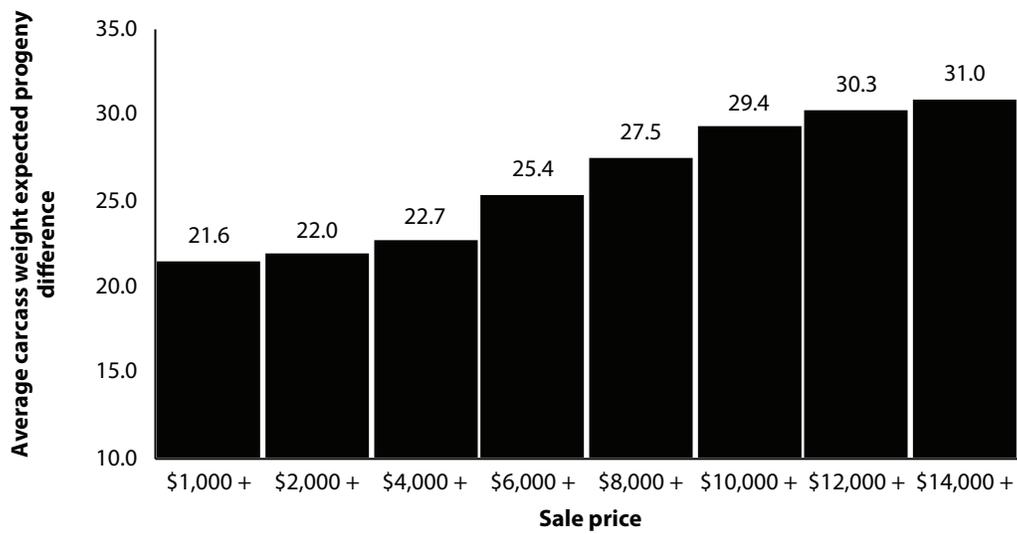


Figure 5. Carcass weight expected progeny difference by sale price category.

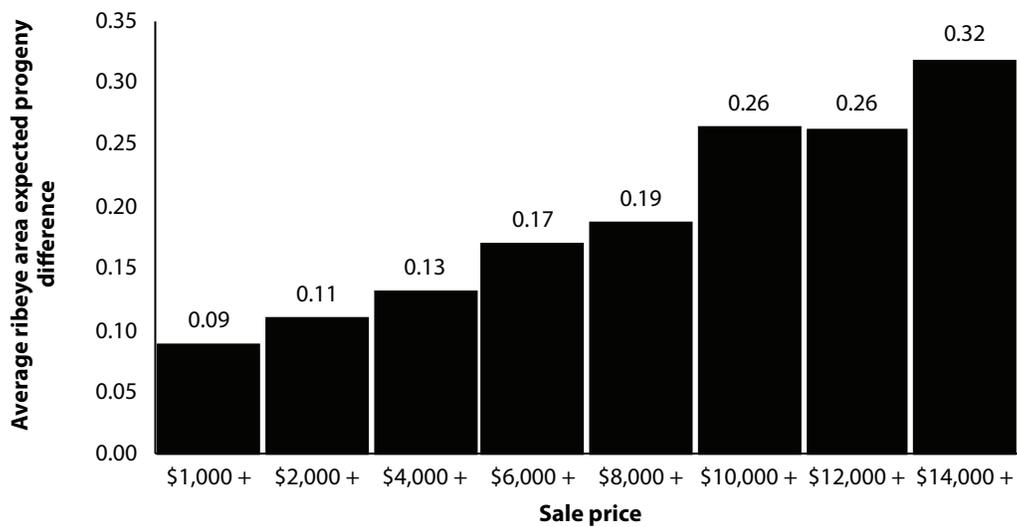


Figure 6. Ribeye area expected progeny difference by sale price category.

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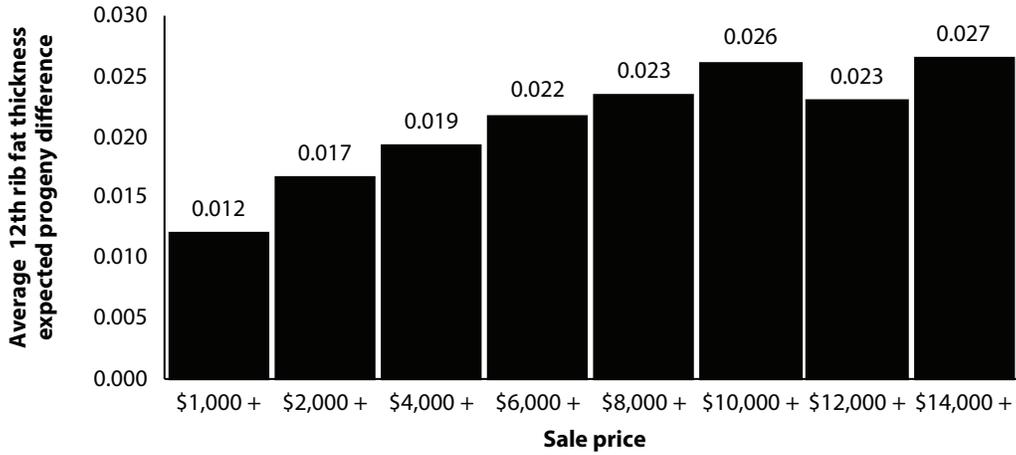


Figure 7. 12th Rib fat thickness expected progeny difference by sale price category.

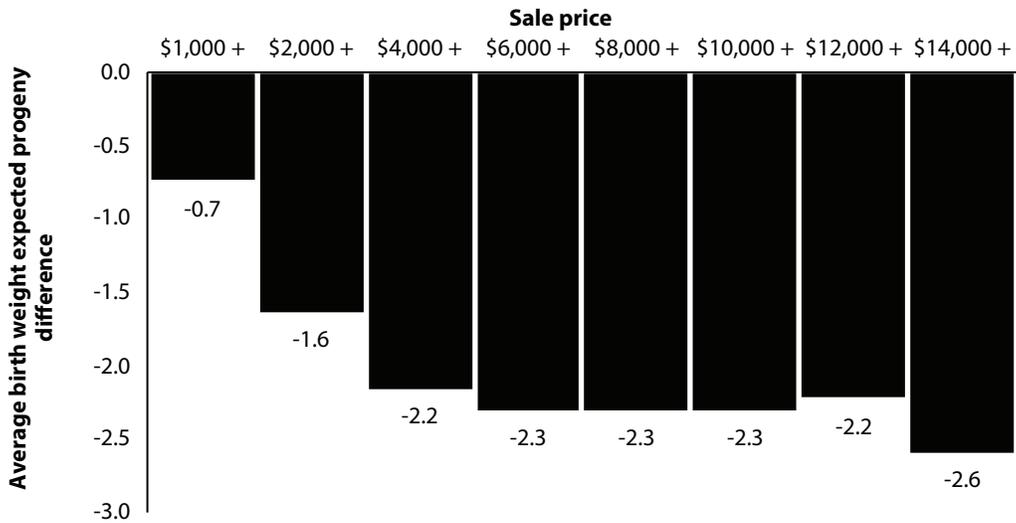


Figure 8. Birth weight expected progeny difference by sale price category.

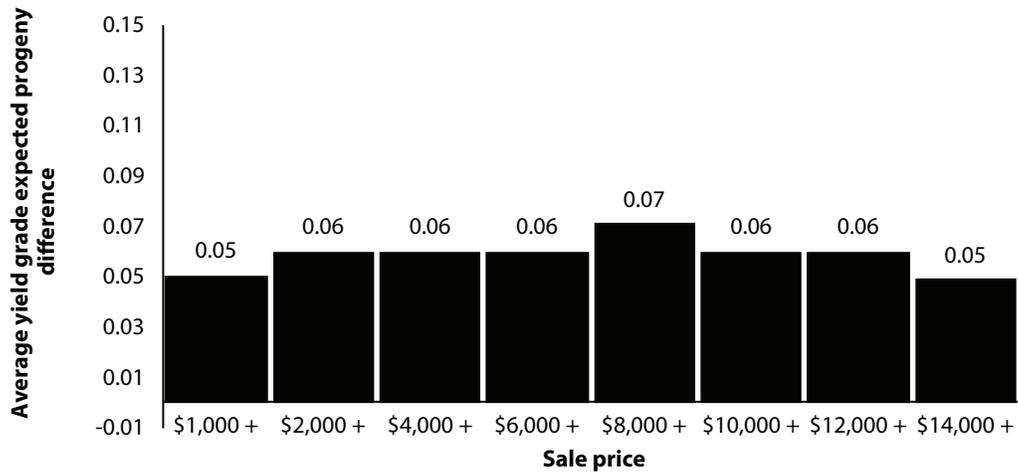


Figure 9. Yield grade expected progeny difference by sale price category.