ECONOMIC AND GREENHOUSE GAS IMPACTS OF CHANGING HERD SIRES FOR ARKANSAS COW-CALF OPERATIONS

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Abstract

Concern over GHG emissions has producers analyzing cattle production alternatives. One way producers can modify emissions is by changing herd sire genetics. The 'Bull Estimator', part of a recently developed cow-calf profitability and GHG spreadsheet tool, shows that genetic change can enhance returns while decreasing emissions at the same time.

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INTRODUCTION

- **Cow-calf operators can modify herd genetics by changing bulls. Bull EPD factors for birth and weaning weight and price effects should be considered in bull purchase price**
- **With increasing concern over climate change, producers are expected to add environmental impact via greenhouse gas (GHG) emissions to their genetics decision. Cattle emissions are comprised of carbon dioxide (CO_2) via respiration, methane (CH_4) from enteric fermentation and nitrous oxide (N_20) from manure and urine**
- **Cow-calf farmers thus need a tool that answers:**
  - What is the profit and GHG impact of changing bull genetics?
  - What can the farmer afford to pay for a new bull?

OBJECTIVES

- **Decision support software (DSS) designed by the authors allows an Arkansas cow-calf operator to understand how their operation's economic and environmental performance changes when:**
  - input and cattle prices, fertilizer use, pasture rotation, forage species mix, cattle weights, calving season, farm size, cow replacement age, stocking rate, and cattle genetics are changed, where
  - genetic changes lead to breed-specific modifications to prices received for weaned calves along with changes in both birth and weaning weights that affect input use
- **The Bull Estimator, a tab in this DSS, allows user input for a bench mark operation and the user's operation and:**
  - summarizes changes in profit and GHG impact
  - allows calculation of breakeven prices for changing bull genetics from a baseline cattle operation such that:
    - profitability with initial genetics, sale prices, and input use of cattle with initial birth and weaning weights

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    - profitability with modified genetics, new sale prices, and input use of cattle with new birth and weaning weights

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DATA

- **The most recent Across-Breed EPD values (Table 1) adjusted to the Angus breed were used to determine impact of genetic change in birth and weaning weights across 17 different bull breeds (Kuehn and Thallman)**
- **2011 average monthly prices for calves sold in Arkansas (Cheney) were used along with 2011 input costs for fertilizer and hay and a recent five year average for fencing and veterinary charges**
- **Cattle price adjustment factors for breed, crossbreed, and hide color reported for 2010 (Troxel et al., 2012) were used to adjust calf sale prices (Table 2).**
- **Cattle GHG emissions were calculated for CO_2, CH_4, and N_2O using CO_2 equations by Kirchgessner et al. and IPCC Tier II estimates for CH_4 and N_2O**
- **Baseline herd characteristics:**
  - Small farm (zero hay acres and 120 pasture acres)
  - ½ ton of poultry litter per acre and lime as needed
  - Continuous grazing method on 30% Bermuda, 60% Fescue and 10% Clover
  - Year-round calving with 8% breeding failure, 1% cow loss and 5% calf losses
  - 1,100 lb mature cows, 7 month weaning age, and 6 calves per cow over useful life
  - Herd size of 40 cows or 3 acres per cow
  - Baseline genetics are Angus bulls and Angus dams with breed average EPD's used across all genetics changes
  - Marketing, supplemental feed, veterinary, equipment, and building default parameters
  - See original bull purchase price, useful life and cows per bull assumptions in Figure 1, below

PROCEDURES

- **Figure 1 shows the 'Bull Estimator' tab of the DSS. Of particular interest are:**
  1. The application of breed effects. In the case below a comparison of Angus x Angus to Angus x Brahman for the benchmark operation vs. Angus x Angus at state average vs. Angus prices in the user-specified operation.
  2. The new bull cost to equate before and after profits/cow. In this case the new bull can be bought at a premium over the $2,000 base price assumption as a Brahman bull has higher calf birth and weaning weights (Table 1) and a higher price factor than Angus x Angus (Table 2) but a lower new steer sale price because of the heavier weight category.
  3. Side by side comparison of new and original genetics for prices and weights with profitability and GHG emissions of new genetics recalculated and compared to old genetics.

RESULTS

- **A comparison of economic returns and GHG emissions of all breeds relative to Angus is shown in Figure 2 and pertains to the herd characteristics specified herein**
- **Of the 17 breed alternatives to Angus:**
  - 4 breeds had a positive profitability impact
  - 6 breeds had essentially no impact, and
  - 7 breeds impacted profitability negatively
- **The baseline GHG emissions were 12.92 lbs. of CO_2 per lb. of live weight of beef sold**
- **All of the four breeds that were profitable also were among the nine breeds that decreased GHG emissions**
- **GHG emissions reductions as a result of genetic changes were quite small**
- **Breakeven price premiums and discounts relative to the $2,000 baseline price by breed are shown in the right most column of Table 1 and mirror the above results**

Table 1. 2012 Across-Breed EPD Table for Birth (BW) and Weaning (WW) Weight with Angus as the Base Breed Adapted from Kuehn and Thallman, 2012 along with Breakeven Bull Prices for Angus Dams for Baseline Herd Characteristics with $2,000 Angus Bulls.

Breed	BW (+/- lbs. relative to Angus)	WW	Price Premium or Discount (+/ - relative to $2,000 Angus Bull Base Price)
Angus	0.0	0.0	$0
Beefmaster	6.7	35.3	$125
Brahman	11.1	42.5	$946
Brangus	3.7	13.0	-$597
Braunvieh	1.2	-19.2	-$1,294
Charolais	8.6	40.1	$102
Chiangus	3.3	-14.9	-$1,042
Gelbvieh	4.0	5.7	-$6
Hereford	2.7	-2.8	$17
Limousin	3.8	-0.9	-$311
Maine Anjou	4.1	-13.0	-$941
Red Angus	2.4	-0.6	-$293
Salers	1.8	-3.1	-$440
Santa Gertrudis	7.4	37.7	$263
Shorthorn	6.0	15.7	$500
Simmental	5.2	24.9	$1,434
South Devon	4.2	3.2	-$153
Tarentaise	1.7	33.1	$4

Table 2. 2010 Price Factors for Reported Breeds, Crosses, and Hide Colors Relative to State Average Prices as Adapted from Troxel et al. (2012).

Breed	Price Factor	Breed	Price Factor
		Charolais X 1/4 Brahman	0.973
Angus	**1.026**	Charolais X Limousin	0.999
Brahman	0.869	Hereford X 1/4 Brahman	0.959
Charolais	1.001	Hereford X Charolais	1.017
Hereford	1.011	Hereford X Limousin	0.992
Limousin	0.995	Black	1.015
Simmental	0.920	Black White Faced	1.029
1/2 Brahman Cross	0.970	Gray	0.984
1/4 Brahman Cross	0.969	Gray White Faced	0.958
Angus X 1/4 Brahman	0.987	Red	0.956
Angus X Brahman	**1.030**	Red White Faced	0.962
Angus X Charolais	1.006	Spotted/Striped	0.757
Angus X Hereford	1.029	White	0.963
Angus X Hereford X 1/4 Brahman	1.015	Yellow	1.014
Angus X Hereford X Brahman	1.003	Yellow White Faced	1.011

Figure 1. Bull Estimator Tab Allows Economic and Environmental Impact Analysis Associated with Changing Beef Herd Genetics Specific to Initial Baseline Herd Characteristics That are User Specified. *(Bench Mark = Your Farm in all aspects except application of breed effects below)*.

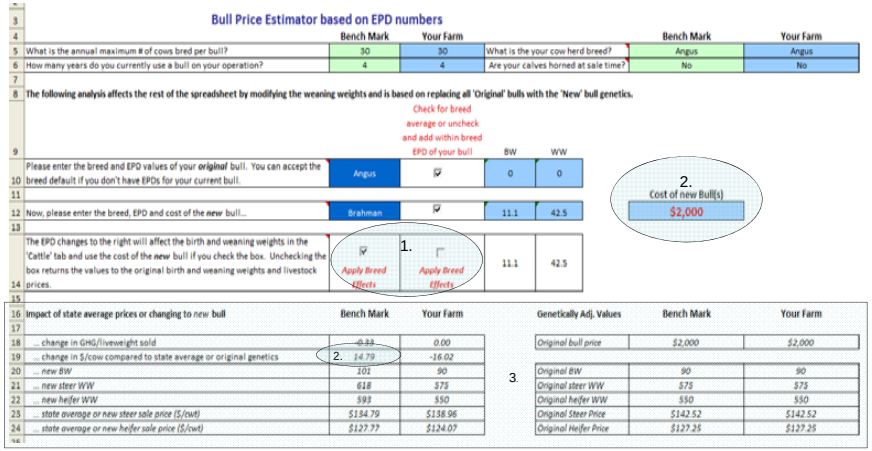
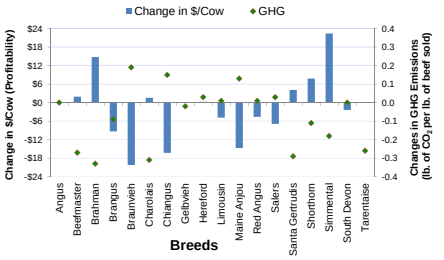


Figure 2. Profitability and GHG Emissions Changes from an Angus Baseline Breed for Specified Herd Characteristics.



CONCLUSIONS

- **Changing from an Angus bull to a Simmental bull looked to be the most likely genetic change, given the base scenario, as it had the highest profit change and one of the greatest decreases in emissions**
- **A myriad of different initial herd characteristics are expected to lead to different outcomes**
- **Feedlot performance is not part of the tool and would also affect producer decisions**