The Environmental and Economic Impact of Calving Rate Within U.S. Beef Production

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OBJECTIVE

To quantify the effects of calving rate within U.S. beef production upon environmental and economic sustainability metrics

INTRODUCTION

- The cow-calf industry is the foundation upon which U.S. beef industry productivity depends
- Industry concern currently exists regarding the declining size of the national herd, due to drought and external influences
- Long-term reductions in the national herd size may be disadvantageous to industry survival, yet previous research demonstrated that maintaining beef supply from a smaller total herd improves both environmental and economic sustainability through greater resource use efficiency
- Improved reproductive performance has long been cited as a mechanism to improve the economic viability of beef production, yet the impact of this productivity metric upon resource use and greenhouse gas (GHG) emissions has not yet been quantified

MATERIALS & METHODS

- A deterministic, environmental impact model based on the nutrition and metabolism of beef cattle (Capper, 2012) was used to quantify resource use and greenhouse gas (GHG) emissions from producing 363 kg hot-carcass weight beef
- Model system boundaries extended from manufacture of cropping inputs to animal arrival at the slaughterhouse door
- Beef production was modeled using characteristic U.S. production data, management practices and population dynamics; and included four animal sub-systems: cow-calf, stocker, feedlot plus inputs (calves and cull cows) from dairy production
- The impact of altering calving rate within the cow-calf sector was investigated at 5% intervals, with a U.S. baseline of 90% calving rate (NAHMS, 1991) compared to the ideal of 100%, and extending out to 40%, characteristic of very extensive systems
- A 60% calving rate (characteristic of extensive systems in South America and South Africa was also used as a comparison point
- Economic impact was calculated based on feed usage for beef production at national market prices

ACKNOWLEDGMENTS

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RESULTS

Table 1. Resource use, GHG emissions and economic impact per 363 kg hot-carcass weight beef at three different calving rates within U.S. beef production (percentage difference from ideal expressed in parentheses)

	Calving Rate (%)		
	100% (Ideal)	90% (U.S.)	60% (Global Extensive)
Total animals (supporting plus slaughter population)	2.35	2.51 (+6.8%)	3.38 (+43.8%)
Land use (ha)	2.36	2.55 (+8.1%)	3.61 (+53.0%)
Water use (liters)	508,242	534,742 (+5.2%)	681,712 (+34.1%)
Fossil fuels (MJ)	2,434	2,502 (+2.8%)	2,878 (+18.2%)
GHG emissions (kg CO_2e)	5,458	5,837 (+6.9%)	7,943 (+45.5%)
Feed cost ($)	1,412	1,491 (+5.6%)	1,924 (+36.3%)

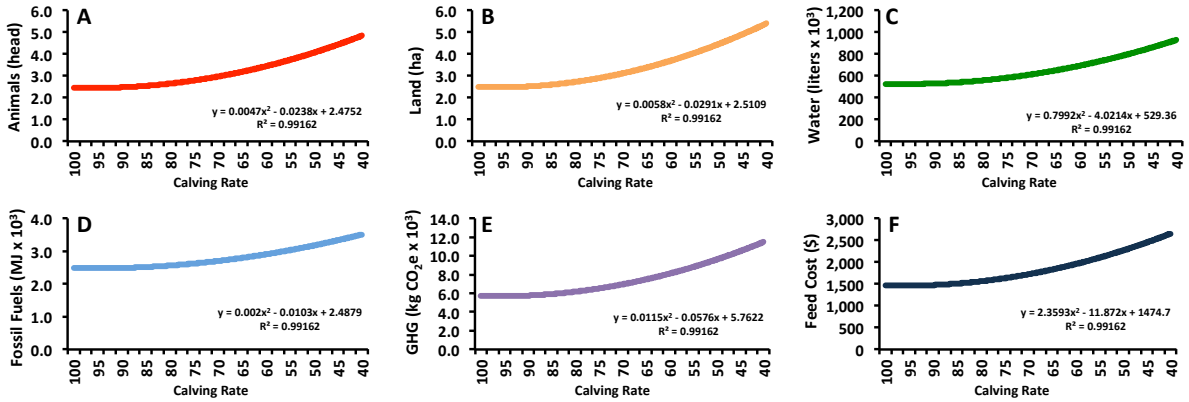

Figure 1. Impact of variation in calving rate on resource use (A: animals, B: land, C: water, D: fossil fuel energy), GHG emissions (E) and economic impact (G: feed cost) per 363 kg hot-carcass weight beef produced by the U.S. beef industry

CONCLUSIONS

- Opportunities clearly exist to reduce environmental and economic impact per unit of beef by improving calving rate, with the greatest returns per unit increase occurring at lower calving rates
- Further research should focus on quantifying the proportional contribution of other management practices, including calf mortality and weaning weight

REFERENCES

- Capper, J. L. 2012. Is the grass always greener? Comparing resource use and carbon footprints of conventional, natural and grass-fed beef production systems. Animals 2:127-143.
- USDA. 2009b. Beef 2007–08 Part II: Reference of Beef Cow-Calf Management Practices in the United States, 2007–08. USDA-APHIS-VS, Fort Collins, CO.