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INTRODUCTION

- Matching cow size to their environment plays a key role in the long-term sustainability of the cow-calf operation
- Over recent decades producers have made selection decisions on growth traits in an effort to maximize revenue, which has led to an increase in mature cow size (Johnson et al., 2010). However this may be hampering the economic and environmental sustainability of the operations (Doye and Lalman, 2011).
- Recommendations are therefore required for producers to make informed decisions on suitable cow sizes for their specific environment.

OBJECTIVES

- The objective of this study was to model the relationship between cow body size (**DBW**) and age on calf weaning weight (**WW**), yearling performance, cow longevity, and economic returns of a Northern Michigan cow herd.
- We hypothesized that weaning weight efficiency and economic returns would decrease with increasing cow body size.

METHODS

- Data for this study was collected from the Red Angus cow herd located at the Lake City AgBioResearch Center in Lake City, MI from 2011 to 2018 (N = 1038).
- Biological Analysis
 - DBW was adjusted to a BCS of 5 and WW adjusted to 205-d WW
 - Data analyzed using lmer package in R (R Core Team, V. 3.6.1) with individual cow and year as random terms.
 - Natural log of DBW, sex, and Age² were used as fixed effects
- Economic Analysis:
 - Enterprise budgeting techniques were used to calculate expected net returns from 2011 to 2018 after classifying cows into 11 BW tiers at 22.67 kg intervals beginning at 430.83 kg.
 - Forward looking net present value (**NPV**) was calculated using the same tier system, for a 10-year production cycle with the baseline being a 200-d grazing season.

RESULTS

- For each 1% increase in DBW, WW increased 0.37kg ($P < 0.01$), but percentage of DBW weaned declined 0.38% over that same range ($P < 0.01$). This led to cows weaning 26.38 kg/ha more with every 100 kg drop in DBW.
- Yearling weight did not significantly differ as DBW increased ($P = 0.26$), but similar to WW yearling weight did significantly increase as a % of DBW as DBW decreased and resulted in a depression in yearling weight efficiency by 0.58% for each additional 1% in body weight ($P < 0.001$),
- Expected net returns from 2011-2018 did not differ by DBW tier on a per cow basis but did on a per ha basis with a decrease in \$10.27/ha with each increase in DBW tier ($P < 0.01$).

Table 1: NPV at increasing DBW

Dam (kg)	Grazing D ^a										
	175	180	185	190	195	Baseline	205	210	215	220	225
430.84	-\$585.56	-\$561.44	-\$537.32	-\$513.20	-\$489.08	-\$537.44	-\$443.04	-\$421.11	-\$399.18	-\$377.26	-\$355.33
453.51	-\$618.96	-\$594.85	-\$570.75	-\$546.64	-\$522.54	-\$496.63	-\$476.45	-\$454.46	-\$432.47	-\$410.48	-\$388.49
476.19	-\$654.92	-\$630.83	-\$606.74	-\$582.65	-\$558.56	-\$534.46	-\$512.42	-\$490.37	-\$468.33	-\$446.28	-\$424.23
498.87	-\$670.98	-\$646.90	-\$622.82	-\$598.74	-\$574.67	-\$550.59	-\$528.49	-\$506.39	-\$484.29	-\$462.19	-\$440.09
521.54	-\$687.17	-\$663.10	-\$639.03	-\$614.97	-\$590.90	-\$566.84	-\$544.69	-\$522.54	-\$500.39	-\$478.25	-\$456.10
544.22	-\$722.34	-\$698.29	-\$674.23	-\$650.18	-\$626.12	-\$602.07	-\$579.87	-\$557.68	-\$535.49	-\$513.29	-\$491.10
566.89	-\$739.43	-\$715.39	-\$691.34	-\$667.30	-\$643.25	-\$619.21	-\$596.97	-\$574.73	-\$552.50	-\$530.26	-\$508.03
589.57	-\$756.81	-\$732.78	-\$708.74	-\$684.71	-\$660.67	-\$636.64	-\$614.36	-\$592.08	-\$569.81	-\$547.53	-\$525.26
612.24	-\$774.59	-\$750.56	-\$726.53	-\$702.51	-\$678.48	-\$654.45	-\$632.14	-\$609.83	-\$587.51	-\$565.20	-\$542.89
634.92	-\$792.81	-\$768.80	-\$744.78	-\$720.76	-\$696.74	-\$672.72	-\$650.37	-\$628.03	-\$605.68	-\$583.33	-\$560.98

^aBaseline= 200 d grazing

CONCLUSIONS

- These results indicate that in the Upper Midwest utilization of lighter weight cows increases the weaning weight efficiency of the herd, requires less land and hay per cow, and increased expected net returns on a per ha basis.
- The net present value of light weight cows increased as the number of grazing days decreased, as they require less hay compared to their heavier counterparts. This may provide protection for producers against adverse weather events and climatic variability that is predicted to increase in frequency in Michigan (Melillo et al., 2014).

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