BEEF CATTLE RESEARCH UPDATE

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Effect of Cow Body Size on Calf Weaning Weight

Profitability of cow/calf operations is dependent on cow efficiency. One method of measuring cow performance efficiency is to look at the ratio of additional lb of calf weaning body weight (BW) to each 100 lb additional mature cow BW. Recent Auburn University research examined the influence cow BW on 205-day weaning weights of calves using two lines of cows: small to medium frame (SM) and medium to large frame (ML).[1] These lines were established based on mature cow size (weight, height and age of cow) from a base population of Angus cows. Data on 373 calves weaned during 2006-2012 and BW of their respective dams selected for frame size (SM: 225 head and ML: 148 head) were analyzed. Cow BW was adjusted for age of the cows. The weaning weights of the calves expressed as a percentage of cow BW were 40.5% for SM cows and 39.7% for ML cows. An increase in cow BW of 100 lb only increased calf weaning BW by 4.9 lb. Similar responses have been observed in research reported by Oklahoma State University in 2010 and 2011.[2,3]

In the 2010 Oklahoma study, data was collected on 737 cow/calf pairs over 6 years from a commercial Angus and Angus x Hereford commercial cowherd.[2] These cows calved in spring or fall seasons and grazed native tallgrass prairie or bermudagrass pasture year around with supplemental protein during winter and supplemental grass hay when ice or snow covered standing forage. The calves were weaned at 212 days of age and cow BW was adjusted to a constant body condition score (5.0) and age (5.0 years) prior to analysis. Calf weaning BW expressed as a percentage of cow BW was 42%. It was noted that an increase in cow BW of 100 lb increased calf weaning BW by 10 lb ($P < 0.05$).

In the 2011 Oklahoma study, data was collected on 1,111 calves in a Brangus cow/calf operation over an 8 year period at the USDA Grazinglands Research Laboratory in El Reno, OK.[3] In this study, cows grazed abundant native rangeland and were supplemented with hay during inclement winter weather and were provided a protein supplement during winter. Calves were weaned at 202 days of age and cow BW was adjusted to a constant body condition score (5.0) and age (5.0 years) prior to analysis. The weaning weight of the calves expressed as a percentage of cow BW was 40.3%. These researchers reported that an increase in cow BW of 100 lb tended to increase calf weaning BW by 2.34 lb ($P = 0.07$).

Production data from North Dakota State University, the University of Florida, and the University of Georgia all suggest that larger cows wean lighter calves than smaller cows when expressed as a percentage of mature cow BW.[4,5,6] The North Dakota data was collected at the Dickinson Research Extension Center in Dickinson, ND where cow/calf pairs were sorted into two groups based on BW in the late fall or early winter.[4] The first group of 52 cows averaged 1,216 pounds (856 to 1,395 pounds) and the second group of 50 cows averaged 1,571 pounds (1,350 to 1,935 pounds). The cows in the lighter group weighed 1272 lb at weaning and weaned 602 lb calves (47% of cow BW). The cows in the heavier group weighed 1463 lb at weaning and weaned 603 lb calves (42% of cow BW). This author also noted that the larger cows would require approximately 113 more acres of pasture (assumed normal forage production for southwestern North Dakota) and approximately 23 more tons of feed in drylot for 4.5 months. In this situation, the output of the larger cows did not justify the greater feed needs.

In additional analysis, this data trend was further examined by finding the percentage of cow BW weaned in all mature cows in the center's herd data system (Table 1). In this dataset the lightest cows (≤ 1300 lb) weaned 50% of their BW (1242 lb) with 617 lb calves. Whereas, the heaviest cows

(> 1600. lb) only weaned 34% of their BW (1698 lb) with 572 lb calves. As cow BW increased, calf weaning BW (% of cow BW) decreased.

Table 1. Percentage of cow weight weaned.

Weight Range (lb)	Number of Records	Avg. Cow BW at Weaning	Avg. Calf Weaning BW	% of Cow BW Weaned
≤ 1300	37	1242	617	50
1301 – 1400	39	1357	611	45
1401 – 1500	38	1456	589	41
1501- 1600	33	1549	598	39
>1600	22	1698	572	34

Based on performance records when 5 to 9 years of age for the Dickinson Research Extension Center cows enrolled in the North Dakota Beef Cattle Improvement Association's CHAPS programs.

Data from three University of Florida beef cow research herds also shows that as cow BW increases that calf weaning BW expressed as a percentage of cow BW decreases (Table 2).[5] This author noted that this trend was consistent across the three herds even though the herds had different breed composition, sires, sire types, and overall breeding programs.

Table 2. Relationship of calf weaning BW (% of cow BW) to cow BW of three University of Florida research herds.

	Calf Weaning BW, % of cow BW				
Location	Avg. Cow (cow BW, lb)	Lightest Cow (cow BW, lb)	Heaviest Cow (cow BW, lb)	Greatest % (cow BW, lb)	Lowest % (cow BW, lb)
A	46 (1,233)	51 (808)	33 (1,750)	72 (901)	18 (1,518)
B	51 (1,215)	48 (902)	27 (1,650)	65 (1,110)	27 (1,650)
C	55 (1,053)	56 (806)	45 (1,380)	64 (892)	27 (964)

Adapted from Hersom, 2009.

Data from the University of Georgia at the Northwest Georgia Research and Education Center in Calhoun on 438 crossbred cows (average BW = 1352 lb) also illustrates that heavier cows are less efficient than lighter cows (Table 3).[6] In this dataset, the average weaning BW of the calves was 44.4% of cow BW. Cows weighing less than 1300 lb (155 cows) weaned calves that weighed more than 45% of their BW (average of 48.9%). Whereas, cows weighing 1300 lb or greater (283 cows) weaned calves weighing an average of 41.8% of their BW.

Table 3. Summary of production of 438 mature cows.

Cow BW, lb	Number of Cows	Calf Weaning BW, % of Cow BW
900	4	53.0
1000	42	51.5
1100	53	49.0
1200	56	46.5
1300	94	45.0
1400	94	42.0
1500	68	39.0
1600	23	37.0
1700	4	34.0

Source: Northwest Georgia Research and Education Center, Calhoun, GA

All of these studies suggest that larger cows wean lighter calves than smaller cows when expressed as a percentage of mature cow BW and are thus, less efficient than smaller cows. Larger cows may wean heavier calves but the unit of increase observed in the Auburn and Oklahoma studies may not be economically efficient (average of 5.75 lb per 100 lb increase in cow BW). Assuming that a 600 lb weaned calf sells for ~$1.75/lb, this 5.75 lb additional weaning weight is only worth about $10. Will this increased income offset the additional cost of running larger cows?

Obviously, as cow size increases nutrient requirements and feed intake increase. Based on models from the 2000 Beef NRC[7], in Figure 1 the effect of cow BW on the NEm requirements (Mcal/day) of the cow during her yearly production cycle is plotted. These data suggest that over a cow's yearly production cycle that her daily energy requirements increase approximately 5.9% with each 100 lb increase in cow BW. However, as illustrated in the figure, as cows get heavier the rate of increase slows (1000 to 1100 lb: 6.6% vs. 1300 to 1400 lb: 5.2%). These models also suggest that a cow's daily crude protein requirements increase by approximately 5.5% with each 100 lb increase in cow BW (data not shown). The percent increase in nutrient requirements (both energy and crude protein) with each 100 lb increase in cow BW ranges from about 4% in early lactation to about 7% in late pregnancy. If one assumes that the cow is fed a diet containing 55% TDN (0.52 Mcal NEm/lb) on a dry matter (DM) basis, her yearly feed requirement (DM basis) would increase by about 474 lb with each 100 lb increase in cow BW (about 526 lb/year of actual feed if the feed contains 90% DM). Data from Doye and Lalman, 2011 suggest that the annual cost per cow increases by about $42 for each 100 lb of additional cow BW.[8]

These data clearly suggest that running larger cows as compared to smaller or moderate sized cow may not be economically efficient. However, the relationship of cow BW to calf weaning BW may differ in divergent environments and therefore should be determined on an individual ranch basis.

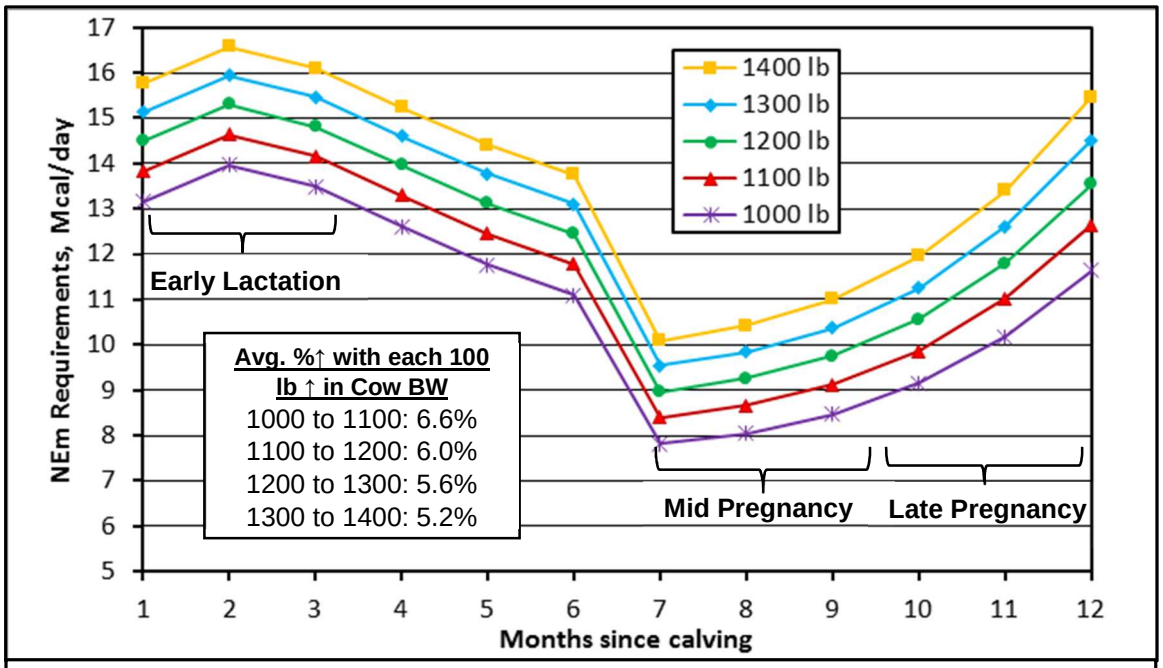

Figure 1. Effect of cow BW and stage of production on energy requirements. Assumptions: calf birth BW is approximately 6.7% of the cow's BW and peak milk production during lactation is 15 lb/day.

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[5] Hersom, M. 2009. Relationship of cow size, cow requirements, and production issues. In: 58th Annual Florida Beef Cattle Short Course, Gainesville, FL. University of Florida/IFAS. p. 23-32.
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