

# Reproduction's Impact on Beef Cattle Herd Profitability

Andrew P. Griffith, Associate Professor and Extension Specialist, Department of Agricultural and Resource Economics  
Justin D. Rhinehart, Associate Professor and Extension Beef Cattle Specialist, Department of Animal Science

University of Tennessee

Several factors influence beef cattle operation profitability. The three primary categories are input costs, cattle prices and reproduction (i.e., “making something to sell”). Of those three, cattle producers generally have more influence over reproduction than input costs and cattle prices, because reproductive rate can be controlled through management. Even if a cattle producer can purchase inputs at volume discounts and is extremely good at managing cattle price risk, it is still necessary to have something to sell, which comes back to reproduction.

There are benchmarks for reproductive performance that influence profitability and economic sustainability. Pregnancy rate, calving rate and weaning rate are the first three reproduction benchmarks to focus on, with each rate setting the upper level of the next (i.e., if the pregnancy rate is 95 percent, then the calving rate cannot exceed 95 percent). These three values are indicative of the number of calves a producer can market given the number of cows exposed to a bull. Another important reproductive benchmark is the calving distribution of a herd (percent of calves born by day 30, 60 and 90 of a calving season), which influences the production benchmarks of weaning weight and pounds of calf weaned per cow exposed. The older a calf is, the heavier the calf will likely be at time of weaning and at time of sale. Shifting calving distribution improves revenue potential after reaching the upper limits of the other reproductive factors, but it is also influential prior to achieving those benchmarks.

The objective of this publication is to compare how the net return to a beef cow-calf operation is impacted by changes in reproductive success. This publication illustrates how changes in reproductive benchmarks (i.e., weaning percentage and calving distribution) can influence profitability of a cow herd.

## Analysis Assumptions

To calculate profitability, it is necessary to know cost of production and output prices. In this analysis, the 2020 University of Tennessee Cow-Calf budget is used to obtain expected variable costs for a 50-head beef cow operation (Table 1; Griffith and Bowling, 2020). Fixed costs are omitted from this analysis as they vary greatly from one operation to the next. Cattle prices used for the analysis are based on the 10-year average price (2010-2019) in Tennessee for utility cows and 500- to 600-pound steers and heifers (USDA Market News, 2020).

The base reproductive benchmark values assumed in this analysis are a pregnancy rate of 92 percent, calving rate of 90 percent and weaning rate of 88 percent. Weaning rate is also considered the marketing rate (calves sold) per cow exposed to a bull. For simplicity, the weaning rate is the only value analyzed, because it is assumed a change in pregnancy rate will result in a proportional change in calving rate and thus a proportional change in weaning rate, which will result in a change in returns. The base calving distribution is assumed to be 40 percent in the first 30 days of the calving season, 35 percent between day 30 and 60, and 25 percent between day 60 and 90 of the

calving season. The distribution is abbreviated as 40-35-25. This calving distribution is assumed to yield an average weaning weight of 515 pounds for heifers and 545 pounds for steers and bulls at 195 days of age (USDA-APHIS, 2020).

The base weaning weight assumption is compared to scenarios with weaning rates of 92 percent and 82 percent. These alternative scenarios were used to represent rates commonly experienced across Tennessee. Similarly, alternative calving distribution scenarios are compared to the base calving distribution. The calving distribution scenarios evaluated consider a 10 percent increase in the number of cows calving in the first 30 days and a 5 percent decrease in the number of cows calving between day 60 and 90 (50-30-20). Similarly, a 5 percent decrease in the number of cows calving in the first 30 days and between day 30 and 60 is compared to the base scenario (35-30-35). The change in the calving distribution effectively changes the weaning weight and thus the total pounds of cattle marketed.

**Table 1: Return to variable expenses for a 50-head beef cow-calf operation in Tennessee**

Item	Unit	Quantity	Price		\$/Cow	Herd Total
<b>Revenue<sup>1</sup></b>						
Cull cows	lb	1,200	\$ 0.70		\$ 134.40	\$ 6,720.00
Heifer calves	lb	515	\$ 1.40		\$ 187.46	\$ 9,373.00
Steer calves	lb	545	\$ 1.57		\$ 376.49	\$ 18,824.30
Total Revenue					\$ 698.35	\$ 34,917.30
<b>Variable expenses</b>						
Pasture production	acre	2	\$ 119.28		\$ 238.56	\$ 11,928.20
Hay production	acre	0.9	\$ 186.32		\$ 167.69	\$ 8,384.49
Purchased hay per cow	ton	0	\$ 80.00		\$ -	\$ -
Bull (pasture & hay) <sup>2</sup>	\$	1.7	\$ 406.25		\$ 27.63	\$ 1,381.26
Supplemental feed	head	1	\$ 16.45		\$ 16.45	\$ 822.38
Salt & mineral	lb	91.25	\$ 0.35		\$ 31.94	\$ 1,596.88
Vet & med	head	1	\$ 31.90		\$ 31.90	\$ 1,595.00
Other expenses	head	1	\$ 1.00		\$ 1.00	\$ 50.00
Labor	hours	8	\$ 10.00		\$ 80.00	\$ 4,000.00
Production Expenses					\$ 595.16	\$ 29,758.20
<b>Interest<sup>3</sup></b>	\$	595.16		6%	\$ 17.85	\$ 892.75
<b>Marketing</b>	head	0.86	\$ 29.33		\$ 25.22	\$ 1,261.23
Total Variable Expenses					\$ 638.24	\$ 31,912.17
<b>Return to Variable Expenses</b>					<b>\$ 60.10</b>	<b>\$ 3,005.13</b>

<sup>1</sup> Revenue (\$/head) = (weight X price X number of head sold) / total number of head

Cull cow: \$134.40 = (1,200 lbs X \$0.70/lb X 8 cows sold) / 50 cows

Heifer calf: \$187.46 = (515 lbs X \$1.40/lb X 13 heifers sold) / 50 cows (9 of 22 heifers retained as replacements leaving 13 for sale)

Steer calf: \$376.49 = (545 lbs X \$1.57/lb X 22 steers sold) / 50 cows

<sup>2</sup> Accounts for bull pasture and hay costs on a yearly basis. Assumes costs are 1.7 times higher than a cow. \$27.63 = (1.7 X (\$238.56/cow + \$167.69/cow) / 50 cows) X 2 bulls)

<sup>3</sup> An annual interest rate of 6% is assumed for all production expenses for six months. \$17.85 = \$595.16/cow X (6% X (6 months / 12 months))

## Weaning Rate Impact on Returns

The base scenario of an 88 percent weaning rate and a calving distribution of 40-35-25 results in a return to variable expenses of \$60.10 per cow, resulting in a total return of \$3,005.13 for the 50-cow herd (Table 2). An increase of the weaning rate to 92 percent increases the return to variable expenses by \$29.75 per cow, resulting in a total return of \$89.85 per cow and a herd total of \$4,492.49. On the contrary, a weaning percentage of 82 percent reduces the return to variable expenses to \$15.48 per cow and a total return of \$774.08 to the herd.

**Table 2. Comparison of revenue and return to variable expenses due to changes in weaning rate**

Weaning rate	82%		88%		92%	
	\$/cow	Herd Total	\$/cow	Herd Total	\$/cow	Herd Total
Revenue	\$ 651.05	\$ 32,552.33	\$ 698.35	\$ 34,917.30	\$ 729.88	\$ 36,493.95
Total variable expenses	\$ 635.56	\$ 31,778.24	\$ 638.25	\$ 31,912.17	\$ 640.03	\$ 32,001.46
<b>Return to variable expenses</b>	<b>\$ 15.48</b>	<b>\$ 774.08</b>	<b>\$ 60.10</b>	<b>\$ 3,005.13</b>	<b>\$ 89.85</b>	<b>\$ 4,492.49</b>

## Calving Distribution Impact on Returns

Table 3 contains results of how returns to variable expenses change as calving distribution changes. The base scenario with a 40-35-25 calving distribution and an 88 percent weaning rate results in a return of \$60.10 per cow and a total return to the herd of \$3,005.13. These returns are based on heifers being weaned and marketed at 515 pounds while steers are marketed at 545 pounds. Changing the calving distribution ultimately changes the average weaning weight. It was assumed weight increases 2 pounds per calf for each day increase in the average age at weaning. Thus, when the calving distribution is changed to 50-30-20, the average weaning weight for heifers increases to 524 pounds and 554 pounds for steers. This results in the return per cow increasing to \$69.33 per head and the total herd return increasing to \$3,466.73. Similarly, the 35-30-35 calving distribution results in a heifer weaning weight of 506 pounds and steer weaning weight of 536 pounds, which results in the return per cow decreasing to \$50.87 and total herd returns decreasing to \$2,543.52.

**Table 3. Comparison of revenue and return to variable expenses due to changes in calving distribution**

Calving distribution <sup>1</sup>	35-30-35		40-35-25		50-30-20	
	\$/cow	Herd Total	\$/cow	Herd Total	\$/cow	Herd Total
Revenue	\$ 688.85	\$ 34,442.64	\$ 698.35	\$ 34,917.30	\$ 707.84	\$ 35,391.96
Total variable expenses	\$ 637.98	\$ 31,899.12	\$ 638.25	\$ 31,912.17	\$ 638.50	\$ 31,925.23
<b>Return to variable expenses</b>	<b>\$ 50.87</b>	<b>\$ 2,543.52</b>	<b>\$ 60.10</b>	<b>\$ 3,005.13</b>	<b>\$ 69.33</b>	<b>\$ 3,466.73</b>

<sup>1</sup> 40-35-25: 40% of calves born the first 30 days of the calving season, 35% born from day 30 to 60, and 25% born from day 60 to 90

## Weaning Rate and Calving Distribution's Impact on Returns

Like the previous analysis, weaning rate and calving distribution could be influenced simultaneously. Compared to the base scenario of an 88 percent weaning rate and a calving distribution of 40-35-25, a weaning rate of 92 percent and a calving distribution of 50-30-20 results in returns increasing \$39.50 per head to \$99.60 per head resulting in a total return of \$4,980.09 to the 50-cow herd. Alternatively, a weaning rate of 82 percent and a calving distribution of 35-30-35 results in returns declining \$53.07 per head to \$7.03 per head, which results in the 50-cow herd only returning \$351.47.

**Table 4. Comparison of revenue and return to variable expenses due to changes in weaning rate and calving distribution**

Weaning rate	82%		88%		92%	
	35-30-35		40-35-25		50-30-20	
Calving distribution <sup>1</sup>	\$/cow	Herd Total	\$/cow	Herd Total	\$/cow	Herd Total
Revenue	\$ 642.36	\$ 32,117.76	\$ 698.35	\$ 34,917.30	\$ 739.91	\$ 36,995.34
Total variable expenses	\$ 635.33	\$ 31,766.29	\$ 638.25	\$ 31,912.17	\$ 640.31	\$ 32,015.25
<b>Return to variable expenses</b>	<b>\$ 7.03</b>	<b>\$ 351.47</b>	<b>\$ 60.10</b>	<b>\$ 3,005.13</b>	<b>\$ 99.60</b>	<b>\$ 4,980.09</b>

<sup>1</sup> 40-35-25: 40% of calves born the first 30 days of the calving season, 35% born from day 30 to 60, and 25% born from day 60 to 90

## Conclusions

This basic analysis illustrates the importance and impact of reproduction in beef cattle on returns to a 50-head beef cattle herd. The examples illustrated are not the extremes but rather a typical range of results experienced across the state of Tennessee. It is possible for a producer to improve the weaning rate and the calving distribution relative to what is analyzed here. University of Tennessee Extension demonstrations have consistently resulted in 92 percent weaning rates with 70 percent of the calves born in the first 30 days of the calving season by implementing simple, and relatively inexpensive, management protocols. Similarly, there are instances when producers experience cases when weaning rate and calving distribution are worse than the worst-case scenario presented in this publication. Many Tennessee cattle producers still do not have a defined breeding season, and given the assumptions used here, have very little likelihood of profitability. The take home message is that weaning rate and calving distribution can significantly influence returns to an operation. It is important to institute cost effective practices to increase the weaning rate and to have a higher percentage of calves born earlier in the calving season to positively influence returns to the operation.

## References

Griffith, A.P. and B. Bowling. 2020. University of Tennessee Cow-Calf Budget. Online: <https://arec.tennessee.edu/extension/budgets/>.

United States Department of Agriculture/Tennessee Department of Agriculture Market News Service (USDA Market News). 2020. Monthly Cattle Auction Reports.

United States Department of Agriculture – Animal and Plant Health Inspection Service (USDA-APHIS). 2020. Beef 2017: Beef Cow-calf Management Practices in the United States, 2017. Online: [https://www.aphis.usda.gov/animal\\_health/nahms/beefcowcalf/downloads/beef2017/Beef2017\\_dr\\_Part1.pdf](https://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/downloads/beef2017/Beef2017_dr_Part1.pdf).



[UTIA.TENNESSEE.EDU](http://UTIA.TENNESSEE.EDU)

Real. Life. Solutions.™