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Age of Calf at Weaning of Spring-Calving Beef Cows and the Effect on Production Economics

Richard J. Rasby
University of Nebraska-Lincoln, rrasby1@unl.edu

Chuck Story
University of Nebraska-Lincoln

Richard T. Clark
University of Nebraska-Lincoln, rclark3@unl.edu

Todd Milton
University of Nebraska-Lincoln

Mark Dragastin
Virginia, NE

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Profit potential for different weaning systems is influenced by cow and heifer costs and time of the year when cull cows and heifers and finished steers are marketed.

Summary

Spring-calving cows were used to evaluate effects of calf age at weaning on production economics. Weaning treatments were early (calf age 150 d, EW), traditional (calf age 210 d, NW), and late (calf age 270 d, LW). Annual cow costs were greater for LW than EW and NW groups. Replacement heifer development costs were higher for EW compared to NW and LW heifers. Net income per finished steer was greater for EW and NW steers than for LW steers. When carcass data were adjusted to the fat depth of the EW steers, net income differences among groups were reduced. Breakeven for each system on a steer financial basis was lower for the NW and LW groups than for the EW group. Net income in each system is influenced by cow and replacement heifer costs and when finished steers, cull cows and heifers are marketed.

Introduction

Shifting calving and/or weaning dates can change herd performance. An increase in profit potential may be realized by greater herd reproductive performance and possibly through alternative calf marketing options when either the calving or weaning date is changed. The cow, calf, and feedlot production results of this experiment were reported in the 1999 Nebraska Beef Report. There is limited information on the economic impact of different weaning times on the production economics of weaning systems if steer calves are retained through slaughter. The objectives of this experiment were to evaluate the effects of weaning calves at 150, 210, and 270 days of age on subsequent cow and calf performance, and on factors that influence net income when calves are retained and finished.

Procedure

This experiment was conducted at the University of Nebraska's Dalbey-Halleck Farm in southeast Nebraska. In year one of this 5-year experiment, 180 MARC II (1/4 Angus, 1/4 Hereford, 1/4 Simmental, 1/4 Gelbvieh) spring (March-April) calving cows were assigned to one of three treatment groups based on weight, body condition, age and date of calving. Cows remained in their assigned groups unless culled from the herd for reproductive failure. Replacement heifers were selected from within the same group in which they were born.

Yearly, in a pre-determined sequence, one of the following three weaning times was applied to each group: August wean (EW; calf average age 150 d; n=60), October wean (NW; calf average age 210 d; n=60), or December wean (LW; calf average age 270 d; n=60). During the spring and summer, cows were managed as a single group and grazed cool and warm-season pastures. As calves were weaned, cow groups were managed in separate, but similar, pastures in order to record the amount of hay, supplement and inputs specifically associated with each group. All groups were fed to attain an average body condition score of 5 (1 = emaciated, 9 = obese) by about one month (Feb. 1) before calving. In all cases, when feeds were fed to cattle, labor and machine operating costs associated with the feeding of these feedstuffs were estimated to be $10 per ton fed.

Cows

Production costs associated with each group were documented for economic analysis. Amounts of hay, grain, protein supplement and salt and mineral fed were logged and expensed to each group. Ten-year average prices for hay and grain were used to calculate feed costs.

Grazing costs were based on the opportunity value of an animal unit month (AUM) in southeast Nebraska. During the winter months when cows grazed dormant range, value of an AUM was estimated to be about one-half of the summer value. Based on average cow weight, a suckled dam was estimated at 1.3 AU's. After weaning, the dam was estimated at 1.2 AU's. Grazing costs were calculated based on cow lactational status and AUM value. The summer and fall grazing period was six months and the winter grazing period was three months.

Cow cost included credit for cull cows and heifers, purchase-in price of replacement heifers, and heifer development costs. These calculations were based on two percentages: retainment rate, defined as the number of heifers retained for selection from the general group population divided by the number of cows in that group; and replacement rate, defined as the number of heifers selected as replacements from the retained group divided by the number of cows in that group. Cull cow credits were based on cull slaughter cow market value at the time of weaning, and cull heifer credits were based on heifer market value in February. Revenue received from selling of cull animals was allocated to the treatment group on a per cow basis. Cull cow revenue allocation was based on the group replacement rate, less an assumed death loss (1.5%), multiplied by the average weight of the cull cows, multiplied by the market value on a per unit of weight basis of the cull cows.

Revenue received from cull heifers also was allocated on a per cow basis.

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Cull heifer revenue allocation was based on group retainment rate, less group replacement rate, less an assumed death loss (.3%), multiplied by average weight Feb. 1 of cull heifers, multiplied by the market value on a per unit of weight basis of the cull heifers in February.

Both purchase-in price of replacement heifers and replacement heifer development costs were allocated similarly. Each was allocated based on the group retainment rate and allowed for the distribution of these expenses on a per cow basis.

Steers

At each weaning, steer calves were transported to the University of Nebraska feedlot at Mead, NE. An economic analysis and comparison of treatment feedlot performance was conducted yearly. The economic analysis evaluated treatment performance each year based on market prices, weaning and finishing weight, receiving and finishing DMI, days on feed (DOF), and USDA Quality and Yield Grade.

Live weight market prices used to value weaned and finished cattle were 10-year averages for the specific time periods in which the calves were weaned and marketed, and for specific weight ranges appropriate for each treatment. Ten-year average prices for feedstuffs were used in assigning ration costs. Ration costs were separated into receiving (28 d) and finishing (DOF - 28 d) ration costs. Total feed cost for each period was based on DMI, DOF and ration cost per pound.

Carcasses were discounted when Quality Grade was less than Choice (-) and/or Yield Grade 3.9. Discounts were based on 10-year average discounts for carcasses grading less than Choice (-) and/or Yield Grade 3.9 marketed during the same months as the treatment groups.

Because the NW and LW steers were slaughtered at a lower backfat thickness, feedlot performance, carcass and financial data for the NW and LW groups were adjusted, using regression, to the same final fat depth as the EW group. Using these equations, days on feed needed to achieve the same fat depth as the EW steers were determined, allowing us to calculate the financial impact of feeding all groups in the system to the same fat depth endpoint.

Gross income per steer, feed, yardage, processing, trucking, and interest expense, and net income per steer were calculated.

Replacement Heifers

Feed and labor costs associated with replacement heifer development were documented and used in the economic analysis. Ten-year average market prices for the feedstuffs used in the developing ration were used to price the ration.

Heifer value was based on the 10-year average market price for the month in which they were weaned and their average individual weight at that time. Replacement heifers were valued at feeder market price plus an assumed $100 per head premium.

Grazing costs were based on the average cost of an AUM in southeast Nebraska. AUM values during the winter months of dormant range were estimated to be one-half of the summer AUM values. We assumed that replacement heifers were equivalent to .8 AU during summer and fall. The summer and fall grazing period was six months and the winter grazing period was three months.

System Evaluation

Profit potential per cow for each system was evaluated based on the cost/return data from the cow, heifer and steer-feedlot enterprises. Income was generated by sale of feedlot finished steers, cull cows and cull heifers. Heifer replacements were bought into the cowherd in February, and valued at that time. The assigned calf value for each weaning system was based on the average weaning weight and value of steers and heifers within the particular system, and the actual replacement rate that occurred in each system. Net returns for the systems are returns to overhead, capital, management, some labor and risk. Labor for checking cattle while grazing was assumed to be covered by the AUM grazing cost while feedlot labor is part of the yardage charge. Calving and overhead labor were not estimated.

Breakevens

Breakevens for the weaned calf, finished steer on an economic basis, and finished steer on a financial basis were calculated. Breakeven for the weaned calf was calculated in the following manner: the numerator being the cow cost to produce the weaned calf, and the denominator was the average steer weight at weaning plus the average heifer weight at weaning divided by two and this quantity multiplied by percentage calves weaned of females exposed during the breeding season to produce that calf crop. The breakeven for the finished steer on an economic basis was calculated by adding the total costs of the finished steer plus the feeder calf valued at the opportunity cost and the sum divided by estimated final weight (hot carcass weight/.63). The opportunity cost for the feeder calf was determined by multiplying the average weight at the time of weaning and the steer value based on the 10-year average market price for the month in which they were weaned. Breakeven for the finished steer on a financial basis was calculated by adding the total costs of the finished steer plus the feeder calf valued at its production costs (cow costs to produce the weaned calf) and the sum divided by the estimated final weight.

Results

Yearly cow cost not including interest and depreciation expense on livestock, feed, and equipment differed ($P < .10$) for the LW group compared to both the EW and NW groups (Table 1). Total feed costs were $37.44 less for EW compared to the LW groups. Over 70% of the total feed cost difference was attributed to the greater amount of harvested forages fed to the LW cows. Cows in the LW weaned group were in lower body condition in late gestation and more harvested forages were needed to get them in an average body condition score 5 before calving.

Yearly heifer retainment rate and replacement rate also were used in the calculation of annual cow costs. Over the five years, heifer retainment rate averaged 21% for all groups and replacement rate averaged 11, 8, and 6 %

Table 1. Yearly cow costs per head not including interest and depreciation expense on livestock, feed, and equipment for Early (EW), Normal (NW), and Late (LW) weaned groups.

	Treatment			
	EW	NW	LW	SE
Harvest forage[a]	$82.23	$90.00	$108.69	
Grain[b]	$0.10	$0.13	$0.38	
Protein supplement[c]	$4.09	$4.76	$8.96	
Salt & mineral[d]	$8.03	$7.95	$7.65	
Grazing[e]	$195.07	$199.22	$201.30	
Total feed costs	$289.54	$302.06	$326.98	
Labor[f]	$14.13	$15.45	$18.73	
Sum of cull cow & heifer credits[g] less purchase-in cost of replacement heifer[h]	$18.75	$25.94	$28.10	
Heifer development costs[i]	$87.74	$77.76	$69.51	
Total cost	$410.16[j]	$421.21[j]	$443.32[k]	7.92

[a]Forage cost based on hay at $60.00/ton.
[b]Grain cost based on corn at $2.48/bu.
[c]Protein supplement cost based on 38% protein pellet at $280.00/ton.
[d]Salt & Mineral cost based on $300.00/ton.
[e]Grazing cost based on AU value and AUM's required. A summer and fall AUM was valued at $20.75, and a winter AUM was valued at $10.38.
[f]Labor cost based on a charge of $10.00/ton of feed fed.
[g]Cow and heifer cull credits were calculated using retainment and replacement rates, cull cow and heifer market values, with an assumed death loss of cows to be 1.5% and heifers to be .3%.
[h]Purchase-in price of replacement heifers was assumed to be market value of heifer + $100.00. Retainment rate was also used in this calculation.
[i]Heifer feed and grazing costs were calculated and allocated to cow costs using retainment rate.
[jk]Numbers within a row with differing superscripts are different (P < .10).

Table 2.Steer feedlot economic information and calculations for Early (EW), Normal (NW), and Late (LW) weaned groups.

	Treatment			
	EW	NW	LW	SE
Weaning wt, lb	428	537	592	
Market value @ weaning, $/cwt	$93.59	$81.75	$81.35	
Days on feed	247	204	164	
ADG, lb/day	2.94	3.11	3.32	
Estimated final wt, lb[a]	1154	1173	1136	
Market value @ finishing, $/cwt	$73.79	$72.00	$69.92	
Gross income from finished steer	$851.54	$844.06	$794.29	
Calf cost if purchased into feedyard	($400.57)	($439.00)	($481.59)	
Feed Costs:				
Receiving period, days [b]	28	28	28	
Receiving DMI, lb/day	10.93	13.66	16.76	
Receiving ration costs[c]	$.0378	$.0378	$.0378	
	($11.57)	($14.46)	($17.74)	
Finishing period, days[d]	219	176	136	
Finishing DMI, lb/day	18.99	20.88	22.81	
Finishing ration cost[c]	$.0544	$.0544	$.0544	
	($226.24)	($199.91)	($168.76)	
Miscellaneous expenses:				
Yardage[e]	$74.10	$61.20	$49.20	
Feedlot processing	$10.44	$10.44	$10.44	
Trucking[f]	$5.85	$6.32	$6.39	
Cattle and trucking interest[g]	$24.49	$22.18	$19.55	
Feed and yardage interest[g]	$4.99	$3.85	$2.78	
	($119.87)	($103.99)	($88.36)	
Less carcass discounts:				
YG 4 discount[h]	$12.42	—	—	
Select discount[h]	$5.52	$24.54	$27.76	
	($17.94)	($24.54)	($27.76)	
Net income per steer	$75.36[i]	$62.16[i]	$10.09[j]	6
Net income per steer, adjusted[k]	$75.36	$78.16	$41.76	

[a]Estimated final weight = hot carcass weight/63% yield.
[b]Receiving period represents the first 28 days on feed at the feedlot.
[c]Ration costs were based on 10-year average feedstuff prices.
[d]Finishing period represents DOF - 28 days.
[e]Charged at $0.30/head/day.
[f]Charged at $0.00375/lb of live weight transported.
[g]9% APR charged.
[h]Carcass discounts are based on 10 year average discounts for the time period in which calves were marketed.
[j]Numbers within a row with differing superscripts are different (P < .001).
[k]Net income per steer when steers are adjusted to the fat depth of the EW group.

for EW, NW, and LW groups, respectively. Heifer development costs per cow were $18.23 greater for the EW compared to the LW groups.

Feedlot phase net income per steer was calculated using the feed and performance parameters measured and is summarized in Table 2. Feedlot phase net income per steer was different (P < .001) between the LW ($10.09 + 6) steers compared to the EW ($75.36 + 6) and NW ($62.16 + 6) steers. Purchase-in costs were less for EW steers, but finishing ration costs were lower for NW and LW steers. NW and LW steers spend fewer days in the feedlot compared to the EW steers.

The EW had a greater fat depth than the NW and LW steers. We used equations to determine days needed in the feedlot for the NW and LW steers to achieve the same fat depth as the EW steers. Using these equations, we determined that the NW steers needed 10 more days and LW steers needed 33 more days in the feedlot to achieve the same fat depth as the EW steers. After carcass traits for the NW and LW steers were adjusted to the same fat depth of the EW steers, those parameters that comprise the calculations for net income per steer were calculated using the adjusted numbers. Differences in net income per steer among groups narrowed when steers were marketed at the same fat depth and averaged $75.36, $78.15, and $41.79 for EW, NW, and LW steers, respectively (Table 2).

Heifer development costs were different (P < .001) among all groups (Table 3). Total heifer development costs were $90.39 greater for EW heifers compared to LW heifers. Feed costs were $81.68 greater for EW compared to LW heifers. EW heifers spent more total days in the dry-lot being developed compared to the NW and LW groups.

System Analysis

System economic analysis evaluated calf value at weaning, yearly cow costs per head, and realized net revenue or loss from the marketing of a finished steer (Table 4). The system analysis indicated that a management system

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Table 3. Replacement heifer development costs per head not including interest and depreciation expense on livestock, feed, and equipment for Early (EW), Normal (NW), and Late (LW) weaned groups.

	Treatment			
	EW	NW	LW	SE
Hay[a]	$144.96	$133.74	$116.79	
Grain[b]	$68.14	$50.67	$40.20	
Protein supplement[c]	$46.55	$33.33	$22.93	
Salt & mineral[d]	$5.10	$3.60	$3.15	
Grazing costs[e]	$124.51	$124.51	$124.51	
Total feed costs	$389.26	$345.85	$307.58	
Labor[f]	$30.55	$26.21	$21.84	
Total development cost	$419.81[g]	$372.06[h]	$329.42[i]	6

[a]Forage cost based on hay at $60.00/ton (10 year average).
[b]Grain cost based on corn at $2.48/bu (10 year average).
[c]Protein supplement cost based on 38% protein pellet at $280.00/ton (10 year average).
[d]Salt & Mineral cost based on $300/ton.
[e]Grazing cost based on AU value and AUM's required. A summer and fall AUM was valued at $20.75, and a winter AUM was valued at $10.38.
[f]Labor cost based on a charge of $10/ton of feed fed.
[ghi]Numbers within a row with differing superscripts are different (P < .001).

Table 4. Net revenue or loss generated by system not including interest and depreciation expense on livestock, feed, and equipment for Early (EW), Normal (NW), and Late (LW).

	Treatment			
	EW	NW	LW	SE
Calf market value @ weaning per head[a]	$325.33	$393.75	$430.19	
Cow costs per head	($410.16)	($421.21)	($443.32)	
Net revenue from sale of finished steer[b]	$33.54	$28.90	$4.74	
Net revenue or loss per cow	-$51.29[c]	$1.44[d]	-$8.39[d]	4
Net revenue or loss per cow, adjusted[e]	-$51.29	$8.88	$6.52	

[a]Average market value of steer and heifer at their time of weaning multiplied by percentage of calves weaned of cows exposed during the breading season to produce that calf crop.
[b]Net revenue = sale revenue from steer minus feedlot cost and this revenue was adjusted to a per exposed cow basis. The adjustment for per cow exposed was calculated by dividing the percentage calves weaned of cows exposed by 2 (1/2 calf crop being steers).
[cd]Numbers within a row with differing superscripts are different (P < .001).
[e]Net revenue or loss per cow when steers are adjusted to the fat depth of the EW group.

Table 5. Breakevens for the weaned calf, finished steer-economic cost, finished steer- financial cost for Early (EW), Normal (NW), and Late (LW) management systems.

	Treatment			
	EW	NW	LW	SE
Breakeven for:		$/cwt		
Weaned calf	113.18[d]	86.81[e]	82.76[e]	2.06
Finished steer-economic[b]	65.76[f]	64.63[g]	66.78[h]	.30
Finished steer-financial[c]	66.05[i]	62.58[j] (64.00)[k]	62.70[j] (63.61)	1.22

[a]Cow costs to produce weaned calf/[(average weaning weight steer calf + average weaning weight heifer calf)/2] * percent calves weaned of females exposed during the breeding season to produce that calf crop.
[b]Finished steer-economic cost = [(Total costs for finished steer plus the feeder calf valued at the opportunity cost)/estimated final weight]*100.
[c]Finished steer-financial cost = [(Total costs for finished steer plus the feeder calf valued at its production cost)/estimated final weight]*100. The feeder calf valued at its production cost is the cow costs to produced the weaned calf.
[de]Numbers within a row with differing superscripts are different (P < .001).
[fgh]Numbers within a row with differing superscripts are different (P < .05).
[ij]Numbers within a row with differing superscripts are different (P < .08).
[k]Number in parentheses is the breakeven for the finished steer on a financial basis if the NW and LW steers were fed to the fat depth of the EW steers.

of NW ($1.44 + 4.26) generated the greatest (P < .001) net revenue per cow, and the EW (-$51.29 + 4.26) weaning management systems generated the least. Net revenue per cow for the LW group was not statistically different from that of the NW group. A similar pattern was observed when net revenue or loss per cow was calculated using the data when all steers were marketed at the same fat depth. Net revenue generated for the NW and LW systems was greater than that generated in the EW system.

Breakevens

Breakevens for the weaned calf, finished steer on an economic basis and finished steer on a financial basis are summarized in Table 5. Breakeven for the weaned calf was greater (P < .001) for the EW ($113.18/cwt) group than the NW ($86.81/cwt) and LW ($82.76/cwt) groups. Breakeven for the finished steer on an economic basis were different (P < .05) among groups and was greatest for LW steers, lowest for NW steers, and EW steers were intermediate the LW and NW groups. However, when breakeven for finished steers was calculated on a financial basis, breakeven was greater (P < .08) for the EW steer compared to the NW and LW steers and the breakeven between NW and LW steers were not different.

In conclusion, items that impact the profitability of alternate weaning systems are replacement rate, feed costs for the cow herd, replacement heifer development costs and time of the year when cull cows, cull heifers and finished cattle are marketed. When weaning age is the management tool chosen, producers need to understand how shifting costs from one livestock enterprise to another influences the economics of the operation and a livestock marketing plan needs to be developed.

[1]Rick Rasby, associate professor, Animal Science, Lincoln; Chuck Story, former graduate student; Dick Clark, professor, Ag Economics, West Central Research and Extension Center, North Platte; Todd Milton, assistant professor, Animal Science, Lincoln; Mark Dragastin, Farm Manager, Virginia, NE.