Calving date and wintering system effects on cow and calf performance II: Economic analysis

W. A. Griffin,* PAS, L. A. Stalker,† M. C. Stockton,† D. C. Adams,† R. N. Funston,† and T. J. Klopfenstein*

*Department of Animal Science, University of Nebraska, Lincoln 68583; and †University of Nebraska–Lincoln, West Central Research and Extension Center, North Platte 69101

ABSTRACT
Data from a 4-yr study involving 217 cows/yr (3/4 Red Angus, 1/4 Simmental) were used to compare net returns among 5 cow/calf production systems: 1) March (Mar) calving cows wintered on native range, 2) Mar calving cows wintered on corn residue, 3) June (Jun) calving cows wintered on native range, 4) Jun calving cows wintered on corn residue, and 5) August (Aug) calving cows wintered on corn residue. Steers born in Mar entered the feedlot at weaning (November; calf-fed). Steers and heifers born in Jun and Aug were divided equally into 2 postweaning management treatments. Half entered the feedlot immediately after weaning (May; calf-fed), Steers and heifers born in Jun and Aug were divided equally into 2 postweaning management treatments. Half entered the feedlot immediately after weaning (May, calf-fed) and the other half grazed subirrigated meadow and entered the feedlot as yearlings (September to October). Average USDA reported monthly prices for the yr 2007 to 2010 were used to value both inputs and outputs. Prices utilized were at time of purchase for feed ingredients and replacement cows and time of sale for cattle. Costs were not different (P = 0.81) among calving dates, but net returns were greatest (P < 0.001) for Jun calving cows and least for Mar calving cows because of differences in weaned calf value. Wintering cows on corn residue increased net returns for Jun calving cows but decreased them for Mar calving cows. Retaining ownership of calf-fed steers through finishing increased net returns compared with selling at weaning. Winter treatment did not affect (P > 0.21) calf feedlot performance. Steers generated greater (P < 0.01) net returns than heifers when ownership was retained. Net returns were greater (P < 0.02) for calf-fed compared with yearling cattle when purchased at weaning and sold on a marketing-grid basis. Purchasing and finishing yearlings was not profitable. Net returns vary by calving date, wintering system, ownership length, postweaning management system, and calf sex.

Key words: beef cattle, calving date, wintering system, postweaning management, net return

INTRODUCTION
Profitability of beef cattle production is highly dependent upon cost of production. The single largest variable cost associated with cow/calf production is feed cost (May et al., 1999). In the Nebraska Sandhills cows most commonly calve in late winter (Clark et al., 2004). Dormant winter range does not contain sufficient nutrients to meet the requirements of cows in late gestation or early lactation (Lardy et al., 2004); therefore, hay is commonly fed during the winter. Purchased and harvested feeds together with the labor to feed them increases the cost of production. However, the required amount of purchased and harvested feedstuffs needed to support a cow is directly dependent on choice of calving date. Selecting a calving date which matches the cow’s nutrient requirements with grazed forage nutrient content has the potential to reduce costs (Stockton et al., 2007).

A second factor affecting profitability of beef cattle production is revenue. Cattle markets tend to have seasonal variation throughout the year and vary with respect to calf size and class, creating opportunities to match a production system with optimal markets. The traditional spring calving system produces weaned calves and culls animals that are generally...
Economic Analysis

The economic returns for each of the 5 cow treatment groups were examined as 16 different production systems. Net returns were calculated for 3 possible marketing times within each production system, 1) weaning, 2) at end of summer grazing (for Jun and Aug calving systems), and 3) at harvest using both live and grid pricing. The economic analysis estimates the amount returned within the system; therefore, all net returns are represented as dollars returned per cow that started the study. This analysis accounts for seasonal trends in costs and revenues, which affect profitability of each system. Prices for feedstuffs and cattle are the average monthly price from 2007 to 2010 and were assigned based on the time of occurrence within each system. The objective was to compare long-term profitability differences among systems; therefore, multi-year average prices were used to make those comparisons as has been done in numerous other studies (Phillips et al., 2003; Griffin et al., 2007; Stockton et al., 2007).

Cow Inputs. Range grazing costs were calculated using land rent costs in the northern region of Nebraska (Johnson et al., 2010). The GSL is located in the portion of the Nebraska Sandhills where the recommended stocking rate is 1.5 animal unit months (AUM)/ha. Cows or cow-calf pairs were normalized to an animal unit (AU) by dividing their BW or combined BW by 454 kg to determine their average AU equivalent. Total AUM used were then multiplied by the average 2007 to 2010 AUM price (Johnson et al., 2010). Cost of grazing during the growing season (May 1 to Oct 31) averaged $25.42 per AUM. Cost of grazing during winter (November 1 to April 30) was estimated as half the value of summer range ($12.71/AUM). Cows on range were charged an additional cost of $0.10/d per cow to account for labor, management, and equipment cost associated with grazing range. On days when cows were supplemented, $0.05/cow was charged to account for equipment and labor costs associated with supplementation in addition to the purchase price of the supplement, which was $0.29/kg of DM.

Cost for cows without calves grazing corn residue was charged at $0.50/d per AU. This is the actual price paid
to rent corn residue for grazing and included fence building and maintenance, water and supplement delivery, and daily care. The cost for cow-calf pairs grazing corn residue was adjusted by the weight of the calf similar to the AU calculations for range cost such that cow-calf pairs were normalized to AU equivalents, then multiplied by the $0.50/d per AU cost. The distance from the GSL to the corn fields was 84 km. The cost for transporting averaged $2.48 per loaded km. One truck carried 35 cows without calves. The Jun and Aug cow/calf pairs were transported together with an average load being 26 pairs.

Hay was fed to Mar calving cows during their calving season (Mar 1 through Apr 30). Hay consumption was based on actual amount of hay offered and averaged 11.5 (DM basis) kg/d. Hay value averaged $0.106/kg (DM basis; USDA NASS, 2007–2010). A yardage fee of $0.25/d per cow was added for labor, equipment, and facility expenses while cows were fed hay.

Animals to replace culled cows from all treatment groups were produced external to this experiment. Cost to produce replacement heifers for the various calving dates was not assessed and is left for future analysis. Culling occurred at 2 time points. Cows which started the study but failed to produce a healthy calf by the end of the calving season were sold at the end of the calving season. Cows which failed to become pregnant during the breeding season were sold immediately after pregnancy status determination, which occurred simultaneous with calf weaning. In each treatment, pregnant cows were introduced at the time of calf weaning. To account for seasonal differences in the value of culled cows and cost of replacement cows for each treatment, the replacement value was based on average price for each in the month weaning occurred. Pregnant cow prices were obtained from Cattle Fax (Centennial, CO) and averaged $947.46 for Mar calving replacements and $1,025.06 for both Jun and Aug calving replacements. Prices were $46.66/45 kg for Mar calving cull cows and $53.28/45 kg for Jun and Aug calving cull cows (Cattle Fax).

Labor during calving was recorded for each treatment and valued at $15.00/h. Calves from the various groups had varying BW at weaning, making it necessary to use a price slide. The 4-yr average price slide was $3.66/45 kg (USDA NASS, 2007–2010). This slide was applied inversely to weight, where heavier animals sold at a discount relative to lighter animals. Average price for calves born in Mar, weighing 238 kg in November, was $108.61/45 kg. Weaned calves born in Aug were valued as if sold in May weighing 234 kg, with an average price of $122.85/45 kg. Weaned calves born in Jun were also valued as if sold in May and were the heaviest, averaging 253 kg and sold for $121.24/45 kg.

**Postweaning Management System Inputs.** Preconditioning cost for calves varied with length of preconditioning and amount of supplemental feed. Cost of supplement was $0.29/kg of DM. Forage cost for calves during preconditioning was calculated using the AU equivalent method similar to that used for the cows and was charged at the growing season rate of $25.42/AUM. A charge of $0.05/d per calf was assessed to account for labor and equipment associated with delivering supplement during the preconditioning period.

The cost for grazing calves that were part of the yearling treatment groups was estimated with the same AU equivalent method used to estimate cow forage cost. In addition $0.15/d per yearling was added for labor and equipment cost. During the summer grazing period, all yearlings were fed dried distillers grains at a rate of 0.6% BW. Distillers grains was priced at 84% the price of corn (USDA NASS, 2007–2010). Average corn prices were $0.19/kg DM, making distillers DM price almost $0.16/kg DM. June-born steers and heifers were valued at an average price of $115.57/45 kg, and $105.77/45 kg, respectively, after summer grazing. August-born steers averaged $112.83/45 kg, and Aug-born heifers averaged $101.43/45 kg.

All cattle were transported (160 km) to the West Central Research and Extension Center (North Platte, NE) feedlot for finishing. Transportation cost to the feedlot was $2.48/loaded km with 90 calf-fed animals per truck and 70 yearlings per truck. Vaccination and medical treatment costs were constant across all groups and were included in the total cost of production. Yardage charged during the feedlot period was $0.45/d per animal, which is the Nebraska average cost reported by Jensen and Mark (2010). Ration ingredient prices were taken from USDA NASS (2007–2010) except for corn gluten feed, which was priced at 90% of corn prices. Ration cost varied about 0.3%/kg for the treatment groups. Variation in ration costs are due to differences in ingredient costs, which vary by season. Interest on operating expenses and capital was charged at 7.5%.

Finished animals were valued in 2 ways: 1) the 2007 through 2010 average live cattle price, and 2) on a grid pricing scheme. The grid pricing scheme premiums and discounts are listed in Table 1 (USDA AMS, 2007–2010). Prices received for cattle on the grid were determined by dividing live cattle price by 0.65 (dressing percentage) and adding/subtracting premiums and discounts. Live prices for Jun calf-fed and yearling, Aug calf-fed and yearling, and Mar calf-fed were $84.98/45 kg, $85.03/45 kg, $84.98/45 kg, $85.03/45 kg, and $88.92/45 kg, respectively. Total net returns for each system were divided by the number of cows that started the study and are presented on a per-cow basis.

**Statistical Analysis**

Cow data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Institute Inc., Cary, NC) as a 2 (Mar or Jun calving) × 2 (wintered on range or corn residue) + 1 (Aug calving wintered on corn residue) factorial ar-
rangement of treatments. Experimen-
tal unit for all data collected up to
weaning was group of cow/calf pairs
assigned to the same calving date and
wintering system. Replication was
achieved by repeating the experiment
for 4 yr, resulting in 4 observations
per treatment. The data set included
all the data collected from all 3 calv-
ing systems before and including
weaning. The model included calving
date, wintering system, and the calv-
ing date × wintering system interac-
tion as a fixed effects and year as a
random effect. A Kenward-Rogers
degrees of freedom adjustment was
applied to this analysis to account
for unequal numbers of cows within
each treatment group. This served to
weight the means according to the dif-
ferring number of observational units.

Calf data collected postweaning
were analyzed as a completely ran-
domized design using the MIXED pro-
cedure of SAS (SAS Inst. Inc., Cary,
NC). Group of calves of the same sex
born in the same calving season to
dams on the same wintering system
assigned to the same postweaning
management treatment served as the
experimental unit in each analysis.
Replication was achieved by repeat-
ing the experiment for 4 yr, resulting
in 4 observations per treatment. In
the first analysis, data collected from
calf-fed steers were used to determine
effects of calving date on feedlot net
returns. The analysis included only
the feedlot performance data from
steer calves in all 3 calving systems
that entered the feedlot as calf-feds.
The original model included the effect
of calving date, maternal winter-
ing system, and the calving date ×
maternal wintering system interaction
as fixed effects and year as a random
effect. The calving date × wintering
system interaction was not significant
(P > 0.20) for any variable and was
eliminated from the final model. In
the second analysis, data collected
from calves born in Jun were used to
closeeffect of maternal wintering
system and postweaning manage-
ment on calf net returns. The data
set included feedlot finishing data
collected from all calves born in Jun
only. The model included postweaning
management system (i.e., calf-fed vs.
yearling), calf sex and their interaction
as fixed effects, and year as a random
effect. In the third analysis, data col-
lected from calves born in Aug were
used to determine effect of calf sex
and postweaning management system.

Table 1. Grid premiums and discounts for finished cattle born in March,
June, or August1

<table>
<thead>
<tr>
<th>Month</th>
<th>Choice-Select spread</th>
<th>Carcass over 455 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>7.41</td>
<td>19.52</td>
</tr>
<tr>
<td>February</td>
<td>3.05</td>
<td>19.27</td>
</tr>
<tr>
<td>June</td>
<td>4.49</td>
<td>19.25</td>
</tr>
<tr>
<td>December</td>
<td>7.20</td>
<td>19.80</td>
</tr>
</tbody>
</table>

1 Prices reported are from USDA AMS (2007–2010) and are $/45 kg carcass weight.

RESULTS AND DISCUSSION

Cow/Calf

Results of the economic analysis for
each production system from start of
the study to weaning are presented in
Table 2. Costs associated with grazing
residue including transportation did not differ among year within
wintering system because days spent
grazing residue and the price were the
same each year. June and Aug calving
cows grazed residue longer than Mar
calving cows and therefore had greater
costs. Costs to transport cows win-
tered on corn residue varied because
Jun and Aug calving groups included
calves. Calving date and wintering
system interacted (P = 0.01) for cost
of range consumed by cows and was
affected by both calving date (P =
0.001) and wintering system (P <
0.001). Supplement amount and cost
did not differ among year within any
wintering system. June calving cows
wintered on range were fed 1.14 kg/d
of supplement, whereas Jun calving
cows wintered on corn residue were
fed only 0.45 kg/d, causing a large
difference in supplement cost between
the treatments. March calving cows
were the only groups that incurred a
drylot cost because Jun and Aug calv-
ing cows grazed year round. Calving
date and wintering system interacted
(P < 0.001) for total costs associ-
ated with feeding the cow herd and
were greatest (P = 0.004) for Jun
calving cows wintered on range and
least for Aug calving cows wintered
on corn residue. Grazing corn residue
lowered feed costs for Jun calving
cows but not for Mar calving cows.
This is caused by our accounting for
range grazing cost on an AUM basis
and corn residue cost on an animal
day basis. Each was accounted
for on a different basis to be consis-
tent with the markets. Additionally,
summer range was valued at half the
cost of winter range to account for
nutritional differences. If winter range
would have been valued equivalent
to summer range, then corn residue
grazing would have cost less for both
calving dates.

Labor cost for calving was identical
between treatments within the same
calving date, but decreased for later
calving periods. On average, replace-
ment animals cost about $118 more
than the salvage value of the animals.
they replaced and was not affected by either calving date \((P = 0.17)\) or wintering system \((P = 0.91)\). Cull value was greater for Jun and Aug calving cows than for Mar calving cows but so was the cost of a replacement animal, making the net difference between a cull and replacement about the same regardless of calving date. Failure of the cow to become pregnant during the breeding season was the largest factor affecting replacement rate. Because pregnancy rate was not different among treatments and the net difference in value between a cull and a replacement was about the same, no difference in replacement cost is expected. The percentage of cows that started the study but failed to produce a healthy calf at the end of the calving season, and therefore sold at that time, was not different among treatments. Even though market value of cows culled for calving failure was greatly different among treatments, overall calving failure rate was quite low, which diminished the influence of the difference. Calving date and wintering system interacted \((P = 0.01)\) for opportunity cost associated with cattle ownership but was not affected by either calving date \((P = 0.82)\) or wintering system \((P = 0.20)\).

By design, calving date and wintering system interacted \((P < 0.001)\) for calf range costs and were greatest for calves born in Jun wintered on range and least for calves born in Aug \((P < 0.001)\).

Calving date and wintering system interacted \((P = 0.01)\) for total costs per cow and varied by as much as $72 from the most expensive to the least expensive but were not affected by either calving date \((P = 0.81)\) or wintering system \((P = 0.20)\). Because all cows did not wean a calf but all incurred expenses, total costs per cow were divided by the weaning rate, which was not different among treatments \((P = 0.81)\), to calculate total costs per calf weaned. Calving date and wintering system also interacted \((P = 0.01)\) for total costs per calf but were not affected by either calving date \((P = 0.81)\) or wintering system \((P = 0.20)\). However, revenue associated with sale of the calf at weaning was greatest \((P < 0.001)\) for Jun calving cows, intermediate for Aug calving cows, and least for Mar calving cows. This difference in revenue is a function of both seasonally elevated prices

### Table 2. Returns and costs to produce weaned calves born in March, June, or August to cows wintered on corn residue or native range

<table>
<thead>
<tr>
<th>Item, $</th>
<th>Corn residue</th>
<th>Range</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>March</td>
<td>June</td>
<td>August</td>
</tr>
<tr>
<td>Cow costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn residue grazing</td>
<td>55.00</td>
<td>72.00</td>
<td>72.00</td>
</tr>
<tr>
<td>Transportation</td>
<td>23.77</td>
<td>33.28</td>
<td>32.00</td>
</tr>
<tr>
<td>Range grazing</td>
<td>176.14</td>
<td>184.83</td>
<td>179.90</td>
</tr>
<tr>
<td>Other range costs</td>
<td>19.40</td>
<td>22.10</td>
<td>22.10</td>
</tr>
<tr>
<td>Supplement</td>
<td>7.99</td>
<td>42.20</td>
<td>36.76</td>
</tr>
<tr>
<td>Drylot cost</td>
<td>99.22</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total feed costs</td>
<td>381.52</td>
<td>354.41</td>
<td>342.76</td>
</tr>
<tr>
<td>Calving labor</td>
<td>63.00</td>
<td>22.50</td>
<td>19.50</td>
</tr>
<tr>
<td>Replacement</td>
<td>113.04</td>
<td>106.44</td>
<td>146.01</td>
</tr>
<tr>
<td>Opportunity cost</td>
<td>44.44</td>
<td>40.69</td>
<td>41.72</td>
</tr>
<tr>
<td>Calf costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn residue grazing</td>
<td>—</td>
<td>27.05</td>
<td>24.09</td>
</tr>
<tr>
<td>Range grazing</td>
<td>35.01</td>
<td>32.18</td>
<td>23.93</td>
</tr>
<tr>
<td>Total costs per cow</td>
<td>637.01</td>
<td>583.27</td>
<td>598.01</td>
</tr>
<tr>
<td>Total costs per calf</td>
<td>676.50</td>
<td>619.41</td>
<td>635.08</td>
</tr>
<tr>
<td>Revenue per calf</td>
<td>591.74</td>
<td>662.64</td>
<td>628.88</td>
</tr>
<tr>
<td>Net returns per calf</td>
<td>−84.76</td>
<td>43.23</td>
<td>−6.20</td>
</tr>
</tbody>
</table>

---

*Within a row, means with unlike superscript letters differ \((P < 0.05)\).

1Standard error of the simple effect mean.

2Main effect of calving date.

3Main effect of wintering system.

4Calving date × wintering system interaction.

5Did not vary among year with in treatment combination.

6Costs associated with labor and management of cows while grazing range.

7Net difference in value between replacements and culls.

8Interest on variable costs associated with production.
at the time of marketing Jun and Aug born calves and the age, and therefore weight, of the calf at weaning. Calving date and wintering system interacted \((P = 0.01)\) for net returns for each system, which ranged from \(-$85\) to \$43/calf and were affected by both calving date \((P < 0.001)\) and wintering system \((P = 0.02)\). The only treatment with positive net returns was Jun calving cows wintered on corn residue. June calving cows wintered on range and Aug calving cows lost the same amount, followed by Mar calving cows wintered on range, and Mar calving cows wintered on corn residue lost the most.

Calving later in the year than Mar has been shown to lower cost of production (May et al., 1999; Stockton et al., 2007; Payne et al., 2009). The lower cost comes from a reduction in feeding harvested forage and calving labor. In the current study, calving date had no effect on cow costs even though later calving resulted in a reduction in feeding harvested feeds. This may be a result of our extending the grazing season of the Mar calving cows through the winter and only feeding hay for about 2 mo. Stockton et al. (2007) reported greater net returns associated with Jun calving compared with Mar calving. Results observed in the current study agree but for a different reason. Stockton et al. (2007) attributed the greater net returns from Jun calving to reduced costs. In the current study, the difference is caused by increased revenue. Amount of hay fed to Mar calving cows was much greater in the Stockton et al. (2007) study, and age of the Jun born calf at weaning was much greater in the current study, which explains most of the difference between the 2 studies.

Larson et al. (2009) reported wintering cows on corn residue resulted in greater net returns at weaning compared with wintering on native range. However, Anderson et al. (2005) reported lower cost when cows were wintered on corn residue but no difference in net returns per cow when calves were sold at weaning. Results observed in the current study did not demonstrate a reduction in cost associated with corn residue grazing, but net returns from grazing corn residue interacted \((P < 0.001)\) with calving date where grazing corn residue was preferable to grazing winter range for Jun calving cows but not for Mar calving cows. This is caused by the shorter corn residue grazing period of the Mar calving cows resulting in fewer days over which to spread the fixed costs associated with transportation.

### Calf Feeding

The calf-fed steers from each calving date and wintering system combination were compared with determine the effect of calving date and wintering system on the economics of postweaning management system. Interaction between calving date and wintering system did not occur, so results are presented separately. The value at feedlot entry of calf-fed steers born in Mar, Jun, and Aug are shown in Table 3. Feedlot entry value is a function of both BW and seasonality of markets. Yardage, a direct result of DOF, was lower \((P < 0.001)\) for steers born in Jun than steers born in either Mar or Aug, which were not different from each other. Feed costs and all other costs except interest were greatest \((P < 0.001)\) for steers born in Jun, intermediate for steers born in Aug, and least for steers born in Mar. Cost of gain was similar \((P = 0.60)\) among treatments. Revenue generated from selling the steers on a live-animal basis was not different \((P = 0.21)\) among treatments but tended \((P = 0.06)\) to be greater for steers born in Jun when sold on a marketing grid. The difference in revenue between selling the steers on a marketing grid, which accounts for premiums and discounts according to carcass merit, and a live animal basis was greatest \((P < 0.001)\) for steers born in Jun, intermediate for steers born in Aug, and least for steers born in Mar. If the feedlot phase was considered a separate enterprise from the cow/calf phase, net returns were greater for steers born in Mar compared with steers born in Jun or Aug whether marketed on a live \((P = 0.05)\) or grid \((P = 0.03)\) basis. If ownership of the steers was maintained through finishing, where total costs per cow (Table 2) and total feedlot costs are subtracted from feedlot revenue, net returns did not differ among treatments, regardless of whether steers were marked on a live \((P = 0.84)\) or grid \((P = 0.56)\) basis. In all instances, returns were greater when steers were marketed on a grid rather than live basis.

If ownership is retained through finishing, differences in net returns are not a function of finishing performance alone but are the cumulative effect of production cost from conception to weaning, amount of BW sold, and seasonality of markets. Stockton et al. (2007) reported calves born in Jun were more profitable than calves born in Mar when ownership was retained through a calf-fed system due to greater returns, greater seasonal prices, greater BW, and lower production costs. In the current study, neither revenue nor cow costs differed by calving date.

Wintering system to which a calf-fed steer’s dam was assigned did not affect feedlot entry value \((P = 0.80)\), feedlot costs \((P > 0.21)\), revenue \((P > 0.80)\) or net returns regardless of whether steers were purchased at feedlot entry \((P > 0.47)\) or ownership was retained through finishing \((P > 0.89)\; \text{Table 4}\). Cow wintering system did not affect feedlot performance (Griffin et al., 2012), cow costs, or revenue (Table 2), so a lack of difference is expected. These results agree with Larson et al. (2009), who reported no difference in feedlot performance or net returns when cows are wintered either on corn residue or winter range.

### Yearlings

Both calving date \((P < 0.001)\) and calf sex \((P < 0.001)\) affected the purchase value of the cattle at the start of the summer grazing period (Table 5). Steers were more valuable than heifers, and cattle born in Jun were older and therefore heavier than
those born in Aug. The study was designed to achieve similar feedlot entry BW among all 4 groups; therefore, length of the summer grazing period was shortest for steers born in Jun, intermediate for heifers born in Jun and steers born in Aug, and longest for heifers born in Aug. All costs were a direct result of length of the grazing period and were affected by both calving date \((P < 0.002)\) and calf sex \((P < 0.001)\). Cost of gain was lower \((P = 0.02)\) for steers born in Aug compared with heifers born in either month. Revenue was greater \((P = 0.002)\) for steers than heifers but was not affected by calving date \((P = 0.14)\). If the summer grazing phase was considered a unique enterprise, where summer grazing costs and purchase value were subtracted from revenue generated from sale at end of summer grazing, net returns were greater \((P = 0.01)\) for steers than for heifers born in Aug. If ownership of the cattle was retained through the summer grazing period, where grazing costs and cow costs per calf (Table 2) were subtracted from revenue generated from sale at end of summer grazing, net returns were greater \((P < 0.001)\) for steers than for heifers and greater \((P = 0.04)\) for cattle born in Jun compared with cattle born in Aug.

**June Calving**

Costs, revenue, and net returns of calves born in Jun are presented in Table 6. Interactions between sex and postweaning management system occurred for feedlot yardage \((P < 0.001)\), feed cost \((P = 0.02)\), interest \((P = 0.002)\), and feedlot cost of gain \((P = 0.05)\). The difference in cost between yearling steers and heifers was much greater than the difference in cost between calf-fed steers and heifers. These results are the combined effects of DMI and DOF.

Both postweaning management system \((P < 0.02)\) and calf sex \((P < 0.001)\) affected feedlot entry value and revenue when the cattle were sold on a live-animal basis. When sold on a marketing-grid basis, only sex affected \((P < 0.001)\) revenue. This is because the difference in revenue between selling on a grid vs. live basis was greater \((P < 0.001)\) for calf-feds than for yearlings. In all instances, net returns were increased when cattle were sold on a marketing-grid basis compared with selling on a live-animal basis. If the feedlot phase was considered

### Table 3. Returns and costs to produce a finished calf-fed steer born in March, June, or August

<table>
<thead>
<tr>
<th>Item</th>
<th>March</th>
<th>June</th>
<th>August</th>
<th>SE(^1)</th>
<th>(P)-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase value, $$</td>
<td>629.75(^c)</td>
<td>706.47(^a)</td>
<td>667.55(^b)</td>
<td>9.13</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yardage, $$</td>
<td>97.44(^a)</td>
<td>94.18(^b)</td>
<td>97.11(^a)</td>
<td>1.28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Feed, $$</td>
<td>260.67(^a)</td>
<td>299.83(^a)</td>
<td>295.58(^b)</td>
<td>11.92</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Interest, $$</td>
<td>25.21</td>
<td>28.11</td>
<td>27.72</td>
<td>0.97</td>
<td>0.12</td>
</tr>
<tr>
<td>Other,(^2) $$</td>
<td>64.29(^a)</td>
<td>75.02(^b)</td>
<td>72.33(^a)</td>
<td>0.69</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cost of gain, $/kg</td>
<td>1.36</td>
<td>1.41</td>
<td>1.40</td>
<td>0.05</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live,(^3) $$</td>
<td>1,128.79</td>
<td>1,172.66</td>
<td>1,125.65</td>
<td>22.66</td>
<td>0.21</td>
</tr>
<tr>
<td>Grid,(^4) $$</td>
<td>1,194.19</td>
<td>1,251.65</td>
<td>1,193.11</td>
<td>23.20</td>
<td>0.06</td>
</tr>
<tr>
<td>Grid vs. live difference, $$</td>
<td>65.40(^c)</td>
<td>78.99(^a)</td>
<td>67.46(^b)</td>
<td>4.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Net returns, $</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live,(^5) $$</td>
<td>50.82(^a)</td>
<td>-30.95(^a)</td>
<td>-34.64(^a)</td>
<td>24.39</td>
<td>0.05</td>
</tr>
<tr>
<td>Grid,(^6) $$</td>
<td>116.21(^a)</td>
<td>48.04(^a)</td>
<td>32.81(^a)</td>
<td>20.72</td>
<td>0.03</td>
</tr>
<tr>
<td>Retained ownership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live,(^7) $$</td>
<td>18.51</td>
<td>17.80</td>
<td>-2.17</td>
<td>19.71</td>
<td>0.84</td>
</tr>
<tr>
<td>Grid,(^8) $$</td>
<td>83.91</td>
<td>96.79</td>
<td>65.28</td>
<td>18.95</td>
<td>0.56</td>
</tr>
</tbody>
</table>

\(^{a–c}\)Within a row, means with unlike superscript letters differ \((P < 0.05)\).

\(^1\)Standard error of the simple effect mean.

\(^2\)Costs associated with transportation, veterinary, death loss, and so on.

\(^3\)Value of finished steer when sold on a live basis.

\(^4\)Value of finished steer when sold on a marketing grid basis.

\(^5\)Net returns per steer when purchased at feedlot entry and sold on a live basis.

\(^6\)Net returns per steer when purchased at feedlot entry and sold on a marketing grid basis.

\(^7\)Net returns per steer when ownership was retained through finishing and sold on a live basis.

\(^8\)Net returns per steer when ownership was retained through finishing and sold on a marketing grid basis.
Table 4. Returns and costs to produce a finished calf-fed steer born to a cow wintered on corn residue or native range

<table>
<thead>
<tr>
<th>Winter system</th>
<th>Corn residue</th>
<th>Winter range</th>
<th>SE(^1)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase value, $</td>
<td>650.43</td>
<td>657.60</td>
<td>8.00</td>
<td>0.80</td>
</tr>
<tr>
<td>Yardage, $</td>
<td>96.34</td>
<td>96.50</td>
<td>1.35</td>
<td>0.70</td>
</tr>
<tr>
<td>Feed, $</td>
<td>274.23</td>
<td>271.64</td>
<td>8.90</td>
<td>0.60</td>
</tr>
<tr>
<td>Interest, $</td>
<td>26.64</td>
<td>26.42</td>
<td>0.47</td>
<td>0.21</td>
</tr>
<tr>
<td>Other, $</td>
<td>67.50</td>
<td>67.85</td>
<td>0.63</td>
<td>0.25</td>
</tr>
<tr>
<td>Cost of gain, $/kg</td>
<td>1.38</td>
<td>1.38</td>
<td>0.02</td>
<td>0.90</td>
</tr>
<tr>
<td>Revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>1,141.64</td>
<td>1,143.61</td>
<td>17.59</td>
<td>0.80</td>
</tr>
<tr>
<td>Grid, $</td>
<td>1,212.79</td>
<td>1,211.67</td>
<td>19.30</td>
<td>0.98</td>
</tr>
<tr>
<td>Grid vs. live difference, $</td>
<td>71.15</td>
<td>68.06</td>
<td>3.44</td>
<td>0.89</td>
</tr>
<tr>
<td>Net returns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>26.51</td>
<td>23.60</td>
<td>12.39</td>
<td>0.47</td>
</tr>
<tr>
<td>Grid, $</td>
<td>97.66</td>
<td>91.67</td>
<td>12.77</td>
<td>0.52</td>
</tr>
<tr>
<td>Retained ownership</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>28.98</td>
<td>9.38</td>
<td>15.00</td>
<td>0.89</td>
</tr>
<tr>
<td>Grid, $</td>
<td>100.13</td>
<td>78.44</td>
<td>15.28</td>
<td>0.95</td>
</tr>
</tbody>
</table>

\(^1\) Standard error of the mean.

\(^2\) Costs associated with transportation, veterinary, death loss, and so on.

\(^3\) Value of finished steer when sold on a live basis.

\(^4\) Value of finished steer when sold on a marketing grid basis.

\(^5\) Net returns per steer when purchased at feedlot entry and sold on a live basis.

\(^6\) Net returns per steer when purchased at feedlot entry and sold on a marketing grid basis.

\(^7\) Net returns per steer when ownership was retained through finishing and sold on a live basis.

\(^8\) Net returns per steer when ownership was retained through finishing and sold on a marketing grid basis.

The difference in revenue between selling calf-feds on the marketing grid vs. live was greater than the difference between selling yearlings on the marketing grid vs. live, there was no difference (P = 0.83) in net returns between calf-fed and yearlings if cattle were sold on a marketing grid and ownership retained. However, steers were still more profitable (P < 0.001) than heifers. If ownership of the animals was maintained from weaning to harvest, yearling steers returned more (P < 0.001) than yearling heifers and calf-feds.

August Calving

Costs, revenue, and net returns of calves born in Aug are presented in a standalone enterprise where cattle were purchased upon feedlot entry, net returns were better (P < 0.01) for calf-feds than yearlings but were not different (P > 0.36) for steers compared with heifers. Net returns were negative for all treatments when cattle were sold on a live-animal basis but were positive for calf-feds when sold on a marketing grid. If ownership of the cattle was retained through finishing, where feedlot costs, total cow costs per calf (Table 2), and summer grazing costs (Table 5) were subtracted from revenue generated from sale of the finished animal, net returns were better for steers than for heifers (P < 0.001) and for yearlings than for calf-feds (P = 0.003) when sold on a live-animal basis. Because
0.22) and postweaning treatment (P > 0.10). In all instances, net returns were increased when cattle were sold on a marketing-grid basis compared with selling on a live-animal basis.

**Postweaning Management System and Sex**

Steers were more expensive to purchase and had greater feedlot cost but also generated more revenue on both a live and market-grid basis, resulting in greater net returns. The major reason for increased net returns for steers compared with heifers is differences in BW (Owens et al., 1993; Shain et al., 2005). Steers were heavier at marketing and had lower cost of gain. However, heifers benefited more from grid marketing compared with live marketing because they produced fewer overweight carcasses and had similar or better QG than steers. Still, heifer cost of production would need to be reduced to generate the same net returns as steers. These results illustrate the importance of producing steers in terminal systems.

Yearlings had greater costs, but not necessarily greater revenue. Griffin et al. (2007) reported yearlings had greater total costs of production but also greater net returns compared with calf-feds. However, in Griffin et al. (2007) calves were sorted by BW into each postweaning management system. In the current study calves were assigned randomly to postweaning management system. Adams et al. (2010) randomly assigned cattle into postweaning production systems and reported yearlings had greater cost compared with calf-feds and profitability was lower for yearlings compared with calf-feds. Adams et al. (2010) concluded their poor yearling economic outcome was caused by low pasture gains, highlighting the degree to which summer gains for yearlings on grass affect subsequent feedlot economics.

**Weight is a major driver for economics in cattle production** (Owens et al., 1993; Shain et al., 2005). In the current study, more weight was sold with yearlings compared with calf-feds but did not result in significantly greater returns. In addition, QG was not different between calf-feds and yearlings, but the number of carcasses over 454 kg was greater for yearlings. However, increased weight sold for yearlings offset overweight discounts.

**Profitability of Each Phase**

In this analysis, profitability was evaluated using 4 different scenarios for each group of calves: 1) selling at weaning, 2) selling at the end of summer grazing, 3) selling on a live-animal basis at harvest, and 4) selling on a grid-based market at harvest. Based on our analysis, the greatest net returns of all possible enterprises was achieved by purchasing Mar born steers and finishing them as calf feds. Selling Jun and Aug born steers at weaning was profitable especially if their dam was wintered on corn residue. Selling Mar born steers and all heifers at weaning was not profitable. In all instances, if ownership was retained and finishing cattle were sold on a marketing-grid basis, net returns were improved compared with selling at weaning. A cow/calf operator would experience the greatest net returns by selling heifers born in Jun at the end of summer grazing and retaining ownership of Jun born steers through finishing. If Jun born

### Table 5. Returns and cost to graze a yearling steer or heifer born in June or August during the summer

<table>
<thead>
<tr>
<th>Item</th>
<th>June</th>
<th>August</th>
<th>P-value</th>
<th>CD</th>
<th>Sex</th>
<th>CD × Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heifer</td>
<td>Steer</td>
<td>Heifer</td>
<td>Steer</td>
<td>SE</td>
<td>CD</td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase value, $</td>
<td>629.49</td>
<td>702.13</td>
<td>594.49</td>
<td>662.27</td>
<td>10.75</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Meadow grazing, $</td>
<td>65.17</td>
<td>50.74</td>
<td>81.70</td>
<td>65.88</td>
<td>6.73</td>
<td>0.002</td>
</tr>
<tr>
<td>Other grazing, $</td>
<td>39.29</td>
<td>35.30</td>
<td>43.71</td>
<td>39.32</td>
<td>1.98</td>
<td>0.001</td>
</tr>
<tr>
<td>Supplement, $</td>
<td>32.60</td>
<td>25.35</td>
<td>40.87</td>
<td>32.96</td>
<td>3.37</td>
<td>0.002</td>
</tr>
<tr>
<td>Interest, $</td>
<td>9.58</td>
<td>7.44</td>
<td>12.33</td>
<td>9.98</td>
<td>1.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cost of gain, $/kg</td>
<td>1.32</td>
<td>1.25</td>
<td>1.30</td>
<td>1.19</td>
<td>0.07</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td>821.80</td>
<td>893.38</td>
<td>799.17</td>
<td>872.98</td>
<td>23.31</td>
<td>0.23</td>
</tr>
<tr>
<td><strong>Net returns</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise, $</td>
<td>45.77</td>
<td>72.38</td>
<td>26.07</td>
<td>62.56</td>
<td>10.89</td>
<td>0.04</td>
</tr>
<tr>
<td>Retain, $</td>
<td>14.99</td>
<td>118.99</td>
<td>−14.52</td>
<td>89.75</td>
<td>14.76</td>
<td></td>
</tr>
</tbody>
</table>

1Standard error of the simple effect mean.
2Main effect of calving date.
3Main effect of calf sex.
4Calving date × sex interaction.
5Costs associated with labor and management of cattle while grazing.
6Net returns per animal when purchased at weaning.
7Net returns per animal when ownership was retained through summer grazing.
cattle were purchased at weaning, net returns were similar for steers and heifers and for calf-feds and yearlings if sold on a marketing grid. These results illustrate the reason why weaned heifers sell at a discount to steers. Purchasing Jun born yearlings for finishing was not profitable. The most profitable scenario for a cow/calf operator to manage Aug born calves was to sell the heifers at the end of summer grazing. Selling Aug born steers at the end of summer grazing, as calf-feds or as finished yearlings, resulted in equivalent net returns. If Aug born cattle were purchased at weaning, net returns were similar for steers and heifers and for calf-feds and yearlings. Purchasing Aug born yearlings for finishing was not profitable. Selling cattle on a marketing grid increased profitability compared with selling on a live-animal basis in every instance.

Results from this study illustrate how the economic impact of inputs into the system are dependent on the physical production and seasonal trends in markets related to the system whether it be season of calving, wintering system, or postweaning calf management.

**IMPLICATIONS**

Reproduction, growth performance, and timing of calf and cull animal marketing are critical to profitability of production systems. Production

---

**Table 6. Returns and cost to produce a finished calf-fed or yearling steer or heifer born in June**

<table>
<thead>
<tr>
<th>Item</th>
<th>Calf-fed</th>
<th>Yearling</th>
<th>Calf-fed</th>
<th>Yearling</th>
<th>SE¹</th>
<th>Sex²</th>
<th>FS³</th>
<th>Sex × FS⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase value, $</td>
<td>618.52⁶</td>
<td>821.90⁵</td>
<td>706.47⁴</td>
<td>893.38³</td>
<td>19.70</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.76</td>
</tr>
<tr>
<td>Yardage, $</td>
<td>95.48⁴</td>
<td>59.51³</td>
<td>94.18²</td>
<td>68.49¹</td>
<td>0.27</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Feed, $</td>
<td>277.48²</td>
<td>153.64¹</td>
<td>289.83¹</td>
<td>235.17¹</td>
<td>10.41</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.02</td>
</tr>
<tr>
<td>Interest, $</td>
<td>26.66²</td>
<td>15.31¹</td>
<td>28.11¹</td>
<td>19.59¹</td>
<td>1.07</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>Other, $</td>
<td>71.33³</td>
<td>50.67²</td>
<td>75.02¹</td>
<td>52.67¹</td>
<td>0.65</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.14</td>
</tr>
<tr>
<td>Cost of gain, $/kg</td>
<td>1.52⁴</td>
<td>1.50⁴</td>
<td>1.41¹</td>
<td>1.27¹</td>
<td>0.04</td>
<td>0.01</td>
<td>&lt;0.001</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>1,057.97³</td>
<td>1,076.39³</td>
<td>1,172.66¹</td>
<td>1,217.38⁰</td>
<td>17.58</td>
<td>0.02</td>
<td>&lt;0.001</td>
<td>0.25</td>
</tr>
<tr>
<td>Grid, $</td>
<td>1,140.50³</td>
<td>1,127.15³</td>
<td>1,251.65¹</td>
<td>1,252.15⁰</td>
<td>20.85</td>
<td>&lt;0.001</td>
<td>0.77</td>
<td>0.56</td>
</tr>
<tr>
<td>Grid vs. live difference, $</td>
<td>82.53³</td>
<td>50.76³</td>
<td>78.99⁰</td>
<td>34.77⁰</td>
<td>6.23</td>
<td>0.10</td>
<td>&lt;0.001</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Net returns</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>−31.52⁹</td>
<td>−64.65⁷</td>
<td>−30.95⁹</td>
<td>−52.11⁹</td>
<td>15.84</td>
<td>0.91</td>
<td>0.01</td>
<td>0.63</td>
</tr>
<tr>
<td>Grid, $</td>
<td>51.01⁸</td>
<td>−13.88⁵</td>
<td>48.04⁵</td>
<td>−17.33⁵</td>
<td>13.99</td>
<td>0.36</td>
<td>&lt;0.001</td>
<td>0.89</td>
</tr>
<tr>
<td>Retained ownership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>−70.72⁹</td>
<td>−47.10⁷</td>
<td>17.80⁶</td>
<td>64.69⁶</td>
<td>12.60</td>
<td>&lt;0.001</td>
<td>0.003</td>
<td>0.25</td>
</tr>
<tr>
<td>Grid, $</td>
<td>11.81⁶</td>
<td>3.66⁶</td>
<td>96.79⁴</td>
<td>99.47⁴</td>
<td>13.02</td>
<td>&lt;0.001</td>
<td>0.83</td>
<td>0.54</td>
</tr>
<tr>
<td>Wean to finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live, $</td>
<td>−31.52⁹</td>
<td>−18.87⁷</td>
<td>−30.95⁹</td>
<td>20.27⁹</td>
<td>14.48</td>
<td>0.11</td>
<td>&lt;0.001</td>
<td>0.02</td>
</tr>
<tr>
<td>Grid, $</td>
<td>51.01⁸</td>
<td>31.89⁸</td>
<td>48.04⁸</td>
<td>55.05⁸</td>
<td>13.16</td>
<td>0.59</td>
<td>0.47</td>
<td>0.17</td>
</tr>
</tbody>
</table>

²–dWithin a row, means with unlike superscript letters differ (P < 0.05).

¹Standard error of the simple effect mean.

²Main effect of calf sex.

³Main effect of finishing system.

⁴Calf sex × finishing system interaction.

⁵Costs associated with transportation, veterinary, death loss, and so on.

⁶Value of finished animal when sold on a live basis.

⁷Value of finished animal when sold on a marketing grid basis.

⁸Net returns per animal when purchased at feedlot entry and sold on a live basis.

⁹Net returns per animal when purchased at feedlot entry and sold on a marketing grid basis.

¹⁰Net returns per animal when ownership was retained through finishing and sold on a live basis.

¹¹Net returns per animal when ownership was retained through finishing and sold on a marketing grid basis.

¹²Net returns per animal when purchased at weaning and ownership was retained through finishing and sold on a live basis.

¹³Net returns per animal when purchased at weaning and ownership was retained through finishing and sold on a marketing grid basis.
system inputs such as harvested feeds and labor have a large influence on costs and are a major component of profitability over which a producer has control. Seasonal trends in market prices for both inputs and outputs have an impact on profit relative to the production and marketing strategy of each system. Results from this study indicate retaining ownership of steers through finishing can maintain or increase net returns. Profitability of any production system is dependent on both economic factors, and physical production and opportunity exists to alter both. Profitability does not come from one factor alone but is a function of the whole system.

**LITERATURE CITED**


Griffin, W. A., T. J. Klopfenstein, G. E. Erickson, D. M. Feuz, J. C. MacDonald, and D.


