A Profile of Cattle Feeding: Beyond the Averages
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Introduction
Feedlots balance numerous considerations in managing cattle feeding operations year around. Overall averages mask a great deal of variability in feedlot production dynamics (table 1). Feedlot managers make daily decisions about what size, gender and quality of animals to purchase and place in the feedlot. These decisions depend on feed cost, price and availability of feeder cattle by size, season of the year and other factors. This analysis provides a detailed profile of cattle feeding in a large commercial feedlot.

The data used for this analysis are for an individual feedlot and no doubt reflect some characteristics unique to the management of this particular feedlot and the Southern Plains Region. However, generally it is believed, this data is representative of the majority of commercial cattle feeding in the United States. Seven
Table 1. Feedlot Summary for Steers and Heifers, Average and (Standard Deviation).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>All Animals</th>
<th>Steers</th>
<th>Heifers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Weight*</td>
<td>Lbs.</td>
<td>729</td>
<td>758</td>
<td>671</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(95.6)</td>
<td>(96.3)</td>
<td></td>
</tr>
<tr>
<td>Marketing Weight</td>
<td>Lbs.</td>
<td>1291</td>
<td>1342</td>
<td>1191</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(71.9)</td>
<td>(69.3)</td>
<td></td>
</tr>
<tr>
<td>Shrink, Incoming**</td>
<td>%</td>
<td>3.33</td>
<td>3.18</td>
<td>3.62</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.77)</td>
<td>(1.98)</td>
<td></td>
</tr>
<tr>
<td>Days on Feed</td>
<td>Days</td>
<td>161</td>
<td>160</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(21.4)</td>
<td>(23.1)</td>
<td></td>
</tr>
<tr>
<td>Avg. Daily Gain (ADG)</td>
<td>Lbs./day</td>
<td>3.66</td>
<td>3.81</td>
<td>3.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.43)</td>
<td>(0.38)</td>
<td></td>
</tr>
<tr>
<td>Feed:Gain ratio</td>
<td>DM Lbs.</td>
<td>6.00</td>
<td>5.94</td>
<td>6.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.71)</td>
<td>(0.75)</td>
<td></td>
</tr>
<tr>
<td>Sick Head Days***</td>
<td>%</td>
<td>0.69</td>
<td>0.62</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.87)</td>
<td>(2.1)</td>
<td></td>
</tr>
<tr>
<td>Death Loss</td>
<td>%</td>
<td>1.84</td>
<td>1.83</td>
<td>1.87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.69)</td>
<td>(2.73)</td>
<td>(2.64)</td>
</tr>
<tr>
<td>Total Head</td>
<td>Head</td>
<td>519,979</td>
<td>343,539</td>
<td>176,440</td>
</tr>
<tr>
<td>% of Total Head</td>
<td>%</td>
<td>100</td>
<td>66.1</td>
<td>33.9</td>
</tr>
<tr>
<td>Total Pens</td>
<td>Count</td>
<td>4648</td>
<td>2878</td>
<td>1770</td>
</tr>
<tr>
<td>Average Pen Size</td>
<td>Head/Pen</td>
<td>112</td>
<td>119</td>
<td>100</td>
</tr>
</tbody>
</table>

* Purchase weight here refers to actual pay weight and differs from placement weight.
** Shrink is calculated as the difference in purchase weight and placement weight as a percent of purchase weight.

years of pen-level data from a large commercial feedlot are used to provide a detailed picture of cattle feeding.¹ Cattle ownership in the feedlot is a mix of company and customer cattle. This article is based on data summarized by Stehle. Pen-level data provide a unique insight into the variability of cattle feeding by weight of feeder cattle placed and by time of year.² Table 1 shows the overall averages for steers and heifers for a seven year period. The feedlot marketed a total of 519,979 head of cattle over the period made up of 66.1 percent steers and 33.9 percent heifers (data do not include cull cows, cull bulls, or bullocks). These animals were finished in a total of 4,648 pens with an overall average pen size of 112 head/pen and average steer pen size of 119 head, compared to heifer pens of 100 head.

Table 1 confirms general expectations about average cattle feeding parameters. On average, steers are placed and marketed at heavier weights compared to heifers. Average days on feed are similar for steers and heifers. Steers have a higher average daily gain (ADG) and lower feed-to-gain ratio. Steers have a lower morbidity (sickness) rate and slightly lower mortality (death loss) than heifers. Steers have less shrink on arrival than heifers. However, the pen-level data summarized below reveals substantial variation around these averages.

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¹ Data are from one feedlot of a multi-feedlot firm in the Southern Plains for a continuous seven year period in the past decade. Firm identity, exact location, and the exact time period are not disclosed to protect proprietary firm information.
² Most feedlot data is presented for the closeout month, which means that many values reflect conditions and levels of production over the previous five to six months. Data specifically related to purchases is adjusted by days on feed to reflect placement month (figures 6 and 8).
The Feedlot Year
Over the seven year period, the feedlot marketed an average of 664 pens/year or 55 pens per month. The average number of pens marketed per month ranged from a high of 74 pens in July to a low of 47 pens in March and November (figure 1). Steer pens made up 62 percent of pens and ranged from a high of 46 pens in June to a low of 28 pens in November. Steers represented the highest percentage of pens marketed in February (68.4 percent). Heifers made up 38 percent of pens marketed on average and ranged from a high of 29 pens in July to a low of 16 pens in February. Heifers represented the highest percentage of pens marketed in May (42.8 percent) followed closely by September (42.4 percent).

Weight Demographics by Gender
Figures 2 and 3 show the composition of feedlot placements by 50-pound weight groups for steers and heifers. The majority of steers are placed from 650 to 850 pounds (72.8 percent and all 50-pound intervals exceed 10 percent of the total). Contrast that with heifers, where the majority of placements ranged from 550 to 800 pounds (85.1 percent with all 50-pound intervals exceeding 10 percent).

More specifically, steer placements of 700-750 pounds comprise 22.2 percent of steer placement, the largest single weight group of placements. Placements between 700 and 800 pounds account for 42.4 percent of steer purchases. Placements weighing 650-700 pounds added another 16.6 percent to placements along with steers 800-850 pounds representing 13.8 percent of placements. In total, steers weighing between 600 and 900 pounds represent 89.3 percent of steer placements. Most of the remaining placements are over 900 pounds with 3

This analysis uses the term “purchase weight” to refer to actual pay weight of feeder cattle and “placement weight” to refer to actual in-weight on arrival at the feedlot. Shrink is calculated as the difference in purchase weight and placement weight as a percent of purchase weight (See Table 1 and Figures 7 and 8).
Note: OLS results included in grey box based on: Steer DOF = f(Placement Weight, Placement Weight^2); using the midpoint of each weight group as the independent variable. All coefficients are significantly different from zero at the 1% significance level.
less than 5 percent below 600 pounds.

Specifically, for heifers, the largest weight group of placements was 600-650 pounds accounting for 23.9 percent of heifer placements. Total heifer placements between 600-700 pounds represent 44.2 percent of all heifers placed. A total of 72.7 percent of heifers are placed weighing between 550-750 pounds with 750-800 pound heifers adding another 12.4 percent. Heifers weighing less than 550 pounds comprised 6.1 percent of total heifer placement with another 6.4 percent weighing 800-850 pounds.

**Days on Feed**

Days on feed (DOF) for steers and heifers by placement weight group are shown in figure 4. Not surprisingly, as placement weight increases, DOF decreases for both steers and heifers. However, the relationship is not perfectly linear – which is largely attributed to feeding efficiency discussed later. Steer DOF ranged from 238 days for placements under 550 pounds to 129 days for placements over 950 pounds with an overall average of 160 days (table 1). For the majority of steers placed between 600 and 900 pounds, DOF ranged from 189 to 138 days. DOF for heifers ranged from 206 for animals less than 550 pounds to 119 for heifers over 950 pounds with an overall average of 162 days (table 1). For the most common heifer placement weights of 550-800 pounds, DOF ranged from 185 to 138 days. Heifer DOF averaged 16 days less across all placement weight categories compared to steers. However, table 1 shows that average DOF for heifers and steers are nearly identical. Heifers are typically placed 100-150 pounds lighter than steers which results in a lighter market weight. Given this fact combined with lower heifer ADG (heifers take more days to achieve a given level of weight gain) results in average DOF for heifers similar to steers. The overall average of DOF for both steers and heifers of 161 days on feed (table 1) suggests an average rate of 2.27 turns of cattle per year for the feedlot.

![Figure 6. Purchase Weight Average by Placement Month](image)

*Figure 6. Purchase Weight Average by Placement Month*

*Calculated from closeout months adjusted for days on feed*
Days on feed are highest for pens marketed in the spring with peak DOF of 170 days for steers marketed in March and April (figure 5) where the bulk of the feeding period occurs during the winter. DOF are highest at 172 days for heifers marketed in May. Steers and heifers marketed in September have the lowest average days on feed at 154 days.

**Placement and Marketing Weight**
Steer purchase weights average 758 pounds annually (table 1) and range from a peak of 799 pounds in April to a low of 702 pounds in November (figure 6). Heifer purchase weights average 671 pounds annually (table 1) and follow a similar pattern with a peak weight of 711 pounds in April to a low of 625 pounds in December (figure 6). The purchase weight pattern reflects the seasonal demographics of feedlot placements with more yearlings in the first half of the year and more calves placed late in the year.

The feedlot data includes purchase weight and the in-weight of cattle on arrival, referred to as placement weight in this analysis (footnote 3). Shrink is calculated as the difference in purchase and placement weight as a percent of purchase weight. Average steer shrink is 3.18 percent, less than heifers, which average 3.62 percent (table 1). Figure 7 shows that shrink is quite variable across placement weights. Shrink is generally higher for lighter weight cattle, with steers at 3.72 percent and heifers at 4.18 percent for 550-600 pound placements. Shrink declines to a low at the 800-850 pound range, with 2.65 percent for steers and 2.74 percent for heifers, before increasing for the heaviest placement weights.

Figure 8 shows the seasonal pattern of shrink by placement month. Shrink is generally highest on cattle purchased in the summer and lowest in the winter. Steer shrink is highest for cattle purchased in June at 3.65 percent and lowest in November at 2.72 percent. Heifers also have peak shrink in June at 4.03 percent and lowest in December at 3.21 percent.

Annual average steer marketing weights of 1,342 pounds (table 1) display a seasonal variation ranging from a low of 1,275 pounds in April to 1,375 pounds in December (figure 9). Marketing weights are generally higher in the second half of the year for both steers and heifers. Heifer average marketing weights are 1,191 pounds.
Figure 10. Total Feedlot Gain
By Placement Weight

Figure 11. Average Marketing Weight
By Placement Weight
pounds and vary from a low of 1,145 pounds in May to a high of 1,218 pounds in September.

On average, steers gained 607 pounds between placement weight and marketing weight while heifers gained 544 pounds on average. However, the amount of gain varies by placement weight. Average gain by placement weight for steers varies between 745 pounds for placement under 550 pounds to 548 pounds of gain for steers placed over 950 pounds (figure 10). Heifers placed under 550 pounds averaged 626 pounds of gain while those placed over 950 pounds averaged 522 pound of gain. Figure 10 exhibits slight convexity, implying that although total gain tends to decline as placement weight increases, at heavy placement weights (above 900 pounds) steer gain stabilizes then increases slightly, while heifers (above 850 pounds) show a more pronounced increase in total gain at heavy placement weights. This could be a cost of production phenomenon where heavier placed cattle are held longer to recover fixed costs.

There is a positive correlation between feedlot placement weight and marketing weight; cattle placed at heavier weights finish at heavier weights (figure 11). This is true for both steers and heifers. However, the correlation between changes in placement weight and marketing weight is not 1:1. For steers placed at weights from 550 to 850 pounds, each pound of additional placement weight adds 0.5 pounds to marketing weight. Similarly, for heifers up to 800 pounds, the ratio of changes in placement weight and marketing weight is 1.00:0.49. In other words, for every 1 pound increase in placement weight within the normal range of placement weights for steers and heifers, marketing weight increases by about 0.5 pound. However, at heavier placement weights, the rate of change increases whereby heavier placement weights result in a bigger impact on marketing weight. At placement weights greater than 850 pounds, steer marketing weight increases by 0.83 pounds for each 1 pound increase in placement weight. For heifers above 800 pounds, marketing weight increases by 1.13 pounds for each additional pound of placement weight.

![Figure 12. Average Daily Gain (ADG) By Placement Weight](image_url)
Figure 13. Average Daily Gain (ADG)
Average by Closeout Month

Figure 14. Feed:Gain Ratio (dry matter basis)
By Placement Weight
Average Daily Gain
On average, steers have a higher average daily gain (ADG) at 3.81 pounds compared to heifers at 3.38 pounds per day (table 1). In general, heavier placement weight is positively correlated with increased ADG (figure 12). For example, steers placed at 550-600 pounds have an average ADG of 3.47 compared to steers placed at 900-950 pounds which average 4.10 ADG. Heifers at 550-600 pounds have an average ADG of 3.21 while heifers 800-850 pounds have an average ADG of 3.83.

Steer and heifer ADG exhibit seasonality that reflects impacts of the weather on animal performance as well as the variation in placement weights throughout the year (figure 13). Steer ADG varies from a low of 3.52 in April to a high of 4.01 in December. Heifers have a low ADG of 3.16 in April and a seasonal high of 3.50 in January. The seasonal low ADG corresponds to placements fed through winter as well as the higher percentage of lighter weight cattle placed in fall (figure 6).

Feed Intake
On average, steers have a lower feed to gain ratio (feed: gain) compared to heifers. Table 1 shows that steers, on average, have a feed: gain ratio of 5.94 (dry matter basis) compared to 6.12 pounds of feed per pound of gain for heifers (a smaller value implies fewer pounds of feed required for each pound of cattle weight gain, or more simply a better feed efficiency). Feedlot cattle placed at heavier weights have lower feed efficiency, measured as a higher feed: gain ratio (figure 14). By placement weight category, steer feed efficiency ranges from a low feed: gain ratio of 5.70 pounds of feed per pound of gain for steers placed at 550-600 pounds to a high of 6.35 for steers over 950 pounds. Heifers vary from a 5.85 feed: gain ratio for heifers weighing less than 550 pounds at placement to a high of 8.29 feed: gain ratio for heifers placed over 950 pounds.

Steers are more efficient, i.e., have a lower feed: gain ratio every month of the year (figure 15). Steer feed: gain ratio varies from a high of 6.16 in February to a seasonal low of 5.76 for cattle marketed in June.
Heifers have a similar pattern with a high feed: gain ratio with a monthly high 6.40 pounds of feed per pound of gain to a low of 6.00 in May and June.

Figure 16 combines the discussions of average daily gain (ADG) and feed efficiency to highlight one of the principal dilemmas of feedlot animal performance: heavier placements have a higher ADG but a lower feed efficiency.

Sick Head Days
The feedlot data includes sick head days (SHD) as a measure of cattle morbidity. Sick head days are the total days that all animals in each pen spend in the hospital pen as a percent of the total head days on feed for the pen. For example, if 1 animal spent 5 days in the hospital or if 5 animals spent 1 day each in the hospital, the pen has 5 SHD. The average SHD for steers is 0.62 percent (table 1). Using the averages in table 1 as an example, a pen of 119 head of steers on feed for 160 days would have an average of 118 SHD calculated as 119 x 160 x 0.0062. Supposing that each sick animal spends 5 days in the hospital pen implies that 24 animals received treatment resulting in approximately a 20 percent morbidity rate. Heifers average 0.81 percent SHD.

Sick head days (SHD) show no pronounced trend on steer and heifer placements up to 800 pounds (figure 17). Interestingly, at placement weights above 700 pounds, steer SHD declines while heifers placed larger than 800 pounds show a noticeable increase in SHD. Some of this is likely due to the small number of heifer pens at heavy placement weights, especially above 900 pounds. SHD are highest for spring closeouts (figure 18), which likely reflects both weather impacts of winter feeding and the fact that more lightweight cattle are fed through the winter (figure 6). Steer SHD peak in April at 1.04 percent and are lowest in September at 0.42 percent. Heifer SHD are highest in May at 1.25 and lowest in September at 0.50 percent.
Figure 17. Sick Head Days
By Placement Weight

Figure 18. Sick Head Days
Average by Closeout Month
**Death Loss**

Feedlot mortality (death loss) averages 1.83 percent for steers and 1.87 percent for heifers (table 1). Mortality is generally highest for lightweight placements declining continuously at larger placement weights for steers (figure 19). Heifer mortality declines with placement weight to 800 pounds then increases. Heifer death loss for placements above 900 pounds is very high and may reflect the small number of pens rather than general conditions for heavy heifer placements (dashed bars in figure 19 extend beyond the upper limit of the axis). Feedlot mortality, much like morbidity, peaks in the spring and is lowest in the fall (Figure 20). Steer death loss is highest in April at 3.08 percent and lowest in September at 1.24 percent. Heifer death loss peaks in June at 2.51 percent and is lowest in October at 1.36 percent.

![Figure 19. Death Loss](image)

**Summary**

The pen-level data profiled in this article provides a unique look into cattle feeding and opens the door to a multitude of academic studies to investigate and better understand feedlot production and economics. For example, from an economic perspective the relationship between placement weight, days on feed, average daily gain, and feeding efficiency is interesting and warrants further research. These opportunities are the subject of a variety of current and planned research projects. This report provides a general context on the myriad of feedlot factors of production. Not surprisingly, there is notable seasonality across many of these factors. Further, placement weight appears to be highly impactful when examining each factor. This summary does not include input/output prices, feeder cattle supplies, and fed cattle demand, all of which influence feedlot management decisions.
Feedlot placement weights are often dictated by cattle availability and feeding cost of gain. However, this correlation directly impacts days on feed and this article shows the relationships of DOF as well as finish weights. Feedlots juggle a large set of factors while attempting to optimize cattle feeding. The pen-level data summarized here shows that feedlots face a wide variation in most all production parameters across placement weights, gender and season. Much of this variation is not obvious when only broad averages are considered across all animals and across time. This feedlot profile provides insight to improve understanding of U.S. cattle feeding.

References