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PRODUCTION SYSTEMS

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INTRODUCTION

Expansion of the ethanol industry is having a major impact on all of agriculture including the cattle industry — the largest impact of any development we have seen in the past 40 years. Cattle feeding has enjoyed relatively inexpensive corn and therefore greater amounts of weight have been put on cattle in feedlots rather than outside of feedlots. Calf-feeding has developed to the point where up to one third of fed cattle might be considered calf-feds. Increased corn production in 2007 is keeping corn prices at moderate levels — higher than the last 40 years but less than the prices of late 2006 and early 2007. At current crude oil prices and government subsidies, ethanol plants can afford to pay $4 to $5/bu. for corn. We as a cattle industry need to prepare for the eventuality of that corn price. How then does the industry compete with $4.50/bu corn? Beef cattle are extremely versatile and we believe there are good opportunities for the use of forages and byproducts in the production of beef.

YEARLINGS VERSUS CALF-FEDS

As the price of corn increases relative to forages and byproducts, there is incentive to put more weight on cattle outside the feedlot. We have summarized eight years of research comparing calf-feds to long yearlings. The goal of the yearling research was to put as much gain on the cattle outside the feedlot as possible. Calves for calf-fed trials were weaned in October, acclimated to the feedlot for 20 to 40 days and placed directly on feed. The diets were based on 25 to 40% wet corn gluten feed (WCGF). The calves were fed for 168 days and marketed in May. The calf-feds were the heavier calves received in the fall (average 642 lb) and included 804 head fed in 80 pens.

Calves for the yearling system were received in October and November and were lighter weight than the calf-feds (average 526 lb). The calves were placed on corn stalks in late November and remained on stalks until cool-season grass was available around April 20. The calves were supplemented with 5 lb dry matter from WCGF to achieve a gain of 1.5 lb/day. In mid May the yearlings were moved to Sandhills range where they grazed until early September. At that time they were placed on finishing diets with 45% WCGF.

At receiving in October and November, calf-feds were 116 lb heavier than calves entering the yearling grow-finish system (Table 1). Yearlings gained 431 lb during the growing phase and were 315 lb heavier than the calf-feds when they entered the feedlot. The yearlings were 83 lb heavier at slaughter so they gained a total of 839 lb compared to 640 lb for the calf-feds. Yearlings ate more feed/day and gained faster but were less efficient than calf-feds. Yearlings ate about 77% as much total feed in the feedlot but because they gained more total pounds of weight over the entire growing- finishing period, they consumed about 58% as

much feed in the feedlot relative to the amount of total gain. While the yearlings made significant weight gains outside the feedlot, the cost of feedlot gain remains important.

EFFECT OF CORN PRICE ON CALF-FED AND YEARLING ECONOMICS

Good forecasting models for feeder cattle prices that are based on corn price are limited. Historical relationships do, however, suggest an inverse relationship between feeder cattle and corn prices occurs up to the point where feeder prices are bid high enough to result in a forecasted finished breakeven price. Therefore, to determine initial price paid for each steer, a calf-fed breakeven analysis utilizing data from Table 1 was used to determine the amount a producer could pay for cattle in a $2.50, $3.50, or a $4.50/bu corn market based on expected $90.00/cwt fed cattle price. Results indicate that breakeven purchase price for a 650 lb steer would be $131.07, $121.24, and $112.31, when corn prices are $2.50, $3.50, and $4.50/bu, respectively. Typically the price slide, or spread across feeder cattle weights, varies with corn prices. As corn prices increase, the price slide declines i.e., the price for lighter feeders declines relative to heavier feeders. The model of Dhuyvetter et al., 2001was used to estimate the annual average slide under varying corn prices. These spreads (550 to 650 lb) were $9.18, $7.01, and $4.84/cwt for $2.50, $3.50, and $4.50/bu, respectively. The ten-year-average slide by month (Nebraska calves; 650 lb to 550 lb) shows that the slide in October and November is only 61% the annual average. Therefore, the slides for October and November were $5.60, $4.28, and $2.95/cwt for $2.50, $3.50, and $4.50/bu, respectively. Final live value of steers was calculated using an average fed cattle price of $90.00/cwt. The interest rate used was determined using the 7-yr average prime interest rate plus 1% for the months that cattle were owned (7.6%).

Calf-fed Economics. Interest was applied to initial cost of the animal over the entire ownership period. Health, processing, and implanting were assessed a flat rate of $16.66/hd. Feed costs for calf-feds were based on the current prices for supplement and alfalfa hay for the months that ingredients were used. Corn was priced into the diet using $2.50, $3.50, or $4.50/bushel corn prices, and WCGF was priced using 95% the price of the corn used in the diets. Diet costs were $105.77, $141.94, and $178.11/ton (DM-basis) for $2.50, $3.50, and $4.50, respectively. Yardage was charged at $0.35/hd daily. Interest was charged on finishing diet and yardage for half of the feeding period. A 2% death loss was assumed.

Long-yearling Economics. The cost of corn residue was charged at $0.32/hd daily. This cost includes $0.12/hd daily for the rent of cornstalk residue and $0.20/hd daily yardage while steers grazed cornstalk residue. This yardage cost includes the costs of fencing stalk fields and labor to deliver WCGF and water to the cattle. Steers were supplemented with 5 lb/hd daily of WCGF (DM-basis). A 1.5% death loss during the wintering period was assumed. Interest was charged on the WCGF for half of the winter period and the remainder of ownership.

Summer grazing cost was charged using the seven-year average animal unit month (AUM) value of $23.29 for native range. To determine the animal unit equivalent of the steers used in this study the initial weight and weight of cattle when they were removed from grass was averaged and divided by 1000 lb. Cattle were charged $8.33 for summer health cost, $.10/day yardage (care) and a death loss of 0.3% was assessed during the summer grazing period. Interest was charged for the cost of the grass and health cost.

Finishing costs for yearlings were similar to calf-feds using the same yardage rate of $0.35/hd daily. Feed costs for yearlings were based on the current prices for supplement and alfalfa hay for the months that ingredients were used. Corn was priced at $2.50, $3.50, or $4.50/bu and wet corn gluten feed was priced using 95% the price of corn used in the diets. Diet costs were $104.75, $140.57, and $176.39/ton (DM-basis) for $2.50, $3.50, and $4.50/bu, respectively. A death loss of 0.2% was assessed during the finishing period. Interest was charged on finishing diet and yardage for half of the feeding period.

For all budget analyses the same yardage values for each production system and the same final values for steers in each production system were used. However, total feedlot yardage was \$27.36/hd greater for calf-feds ($P < 0.01$) compared with yearlings because of more days fed and final live value for yearlings was \$73.64/hd greater than calf-feds ($P = 0.02$) because of larger final weights. Cost of gain is represented as the cost of gain for the entire production system. Cost of production for all corn prices are presented in Table 2. Profitability for each production system with varying corn prices is presented in Table 4.

\$2.50/bu Corn Price. Average initial steer price was calculated to be \$140.63/cwt for yearlings and \$131.91/cwt for calf-feds, causing steer cost to be \$107.10 per steer higher for calf-feds compared with yearlings ($P < 0.01$) because of greater BW. Interest costs were greater for yearlings compared with calf-feds ($P < 0.01$) because of increased length of ownership. Feed cost was \$45.75/hd higher for calf-feds compared to yearlings ($P < 0.01$). Cost of gain was \$5.63/cwt less for yearlings compared with calf-feds ($P = 0.10$) and total cost of production was \$29.10 greater for yearlings ($P < 0.01$). Breakevens were \$3.33/cwt less for yearlings (P = 0.12) and profit was \$43.66 more for yearlings (P = 0.12).

\$3.50/bu Corn Price. Average initial steer price was calculated to be \$126.75 for yearlings and \$121.83/cwt for calf-feds, causing steer cost to be \$115.42 higher for calf-feds compared with yearlings ($P < 0.01$). Interest cost was \$28.22 greater for yearlings compared with calf-feds ($P < 0.01$) because of increased length of ownership. Feed cost was \$61.31/hd higher for calf-feds compared to yearlings ($P < 0.01$). Cost of gain was \$4.67/cwt less for yearlings compared with calf-feds ($P < 0.01$). However, total cost of production was \$27.04 greater for yearlings compared with calf-feds ($P < 0.01$). Breakevens were \$3.48/cwt less for yearlings (P = 0.08) and profit was \$46.53 more for yearlings (P = 0.08).

\$4.50/bu Corn Price. Average initial steer price was calculated to be \$115.97/cwt for yearlings and \$112.55/cwt for calf-feds, causing steer cost to be \$112.56 higher for calf-feds compared with yearlings ($P < 0.01$). Interest cost was \$25.48 greater for yearlings compared with calf-feds ($P < 0.01$) because of increased length of ownership. Feed cost was \$76.88/hd higher for calf-fed compared to yearlings ($P < 0.01$). Cost of gain was \$3.36/cwt less for yearlings compared with calf-feds ($P < 0.01$). However, total cost of production was \$26.71 greater for yearlings compared with calf-feds ($P = 0.03$). Breakevens were \$3.51/cwt less for yearlings (P = 0.06) and profit was \$47.41 more for yearlings (P = 0.06).

Two factors that affect this relationship are yardage cost and pasture cost. We used yardage cost of \$0.35/d but yardage cost may be as high as \$0.45/d. This \$0.10 difference would increase the yearling advantage by \$7.80/hd. Alternatively, grass was priced at the seven-year average of \$23.39/AUM. The total grazing cost was approximately \$90/hd. Grass lease rates have increased over time and will likely continue to increase. A 10% increase in grass cost would reduce the yearling advantage by \$9/hd.

Table 1. Animal performance as a main effect of production system

Item	Calf-fed	Yearling	SEM
Initial BW, lb	642[a]	526[b]	5
FINT[c], lb	642[a]	957[b]	7
Final BW, lb	1282[a]	1365[b]	8
Feedlot ADG	3.81[a]	4.53[b]	0.04
DOF[d]	168[a]	90[b]	1
DMI, lb/d	21.36[a]	30.56[b]	0.15
F/G	5.63[a]	6.76[b]	0.02
Total Feed[e], lb	3591[a]	2754[b]	32.1

[a,b]Means within a row with different superscripts differ ($P < 0.01$)
[c]FINT = initial BW at the beginning of the finishing period
[d]DOF = days on feed
[e]Total Feed = amount of feed consumed during the finishing period

Overall the yearling production system was more profitable than the calf-fed system. However, increasing corn price had little effect on the profitability advantage of yearlings. This is counterintuitive but likely the market adjusts. The slide (650 to 550) declined from $5.60 at $2.50/bu corn down to $2.95 at $4.50/bu corn. Overall prices that would be paid for calf-feds declined by $19.36/cwt. Price of calves to produce yearlings decreased $24.66/cwt. The smaller slide with higher prices of corn logically suggest the extra weight of calf-feds was being valued more at higher priced corn.

Table 2. Cost analysis of production systems as an effect of corn price

Item	Calf-fed	Yearling	SEM
	$2.50/bu		
Steer cost, $	846.84[a]	739.74[b]	4.18
Interest[1], $	30.42[a]	61.52[b]	1.26
Feed cost, $	189.93[a]	144.20[b]	6.60
Yardage, $	58.94[a]	31.58[b]	1.57
Total Cost[2], $	1155.33[a]	1184.43[b]	8.18
COG[3], $/cwt	52.71[a]	47.08[b]	1.35
	$3.50/bu		
Steer cost, $	782.15[a]	666.73[b]	6.23
Interest[1], $	29.44[a]	57.66[b]	1.22
Feed cost, $	254.82[a]	193.51[b]	8.54
Yardage, $	58.94[a]	31.58[b]	1.57
Total Cost[2], $	1154.49[a]	1181.53[b]	9.52
COG[3], $/cwt	62.43[a]	57.76[b]	1.59
	$4.50/bu		
Steer cost, $	722.57[a]	610.01[b]	74.91
Interest[1], $	27.31[a]	52.58[b]	1.15
Feed cost, $	319.71[a]	242.83[b]	10.48
Yardage, $	58.94[a]	31.58[b]	1.57
Total Cost[2], $	1153.95[a]	1180.66[b]	11.07
COG[3], $/cwt	72.15[a]	68.79[b]	1.87

[a,b]Means within a row with different superscripts differ ($P < 0.05$)
[1]Interest is the total amount of interest accrued from the animal and all costs of production
[2]Includes backgrounding cost from Table 3 plus health costs and cost of death loss
[3]COG is the cost of gain for the entire production system

Table 3. Cost associated with backgrounding yearling steers

Item	Cost ($/steer)	Cost of Gain ($/cwt)
Fixed cost[1]		
Wintering program		
Stalk cost	17.81	---
Stalk yardage	29.69	---
	47.50	
Summer grazing		
Grass cost	90.10	---
Grass yardage	13.61	---
	103.71	53.18
Variable cost		
$2.50/bu		
WCGF[2]	36.37	---
Total winter	83.87	35.80
$3.50/bu		
WCGF[2]	51.24	---
Total winter	98.74	42.78
$4.50/bu		
WCGF[2]	65.88	---
Total winter	113.38	48.76

[1]Fixed cost = cost that remains constant with varying corn price
[2]WCGF = wet corn gluten feed cost with varying corn price

Table 4. Profitability analysis of production systems as an effect of corn price

Item	Calf-fed	Yearling	SEM
Live Value[c], $	1154.45[a]	1228.09[b]	23.68
$2.50/bu			
Breakeven, $/cwt	90.2	86.87	1.41
Live p/l[d], $/hd	0.00	43.66	19.03
$3.50/bu			
Breakeven, $/cwt	90.14	86.66	1.36
Live p/l[d], $/hd	0.00	46.53	18.45
$4.50/bu			
Breakeven, $/cwt	90.10	86.59	1.32
Live p/l[d], $/hd	0.00	47.41	18.10

[a,b]Means within a row with different superscripts differ ($P < 0.05$)
[c]Live value is based on a live price of $90/cwt for all corn prices
[d]p/l is profit or loss

Historically, the feeder cattle price slide has narrowed during the September to November period. The slide has averaged about $6/cwt during this period but widens to about $12/cwt during January to April. We interpret this to mean cattle feeders are willing to pay more for heavier calves in the fall because they are ready to sell during higher fed cattle markets in April and May. This means September and October is the best time to sell 650 lb calf-fed steers. It also means that this is seasonally the worst time to sell 500 lb steers. If 500 lb calves are backgrounded at 1.5 lb/day gain, then the calves would be 650 lb in February. The 500 lb calves that sold for $106/cwt in October would sell for $97/cwt in February, a slide of only $6/cwt.

SYSTEMS INFLUENCERS

Matching cattle to system. The market, as previously discussed, wants 650 lb calf-feds in September to November. Lighter cattle fit better into systems that involve some growing period before finishing. A study was designed to determine if sorting into feeding systems by weight would decrease variation in feedlot performance and carcass characteristics.

Ranch direct calves that were received in November with average BW of 591 lb (374-870 lbs) were assigned randomly into one of two different groups, sorted and unsorted cattle. At this time, the cattle in the unsorted group were assigned randomly to calf-feds, summer yearlings or fall yearlings. For the sorted group, the heaviest 1/3 were placed into the calf-fed feeding system. The remaining 2/3 were placed on cornstalks with the summer and fall yearlings from the unsorted group. The sorted and unsorted cattle grazed cornstalks and grass as one group. In April, when the summer and fall yearlings were removed from cornstalks, 2-d BW were collected and the cattle in the sorted group were assigned into either the summer yearling or fall yearling feeding system based on BW. The heaviest _ of the remaining 2/3 of the sorted group entered the feedlot as summer yearlings. The lightest _ of the remaining 2/3 of the sorted group were then placed into the fall yearling feeding group. The summer yearling cattle entered the feedlot in late May and were fed until mid October when marketed. The fall yearlings were taken to the Sandhills to graze native range until late September when the cattle entered the feedlot. Fall yearlings were marketed in January.

There were no differences in DMI, ADG, and F: G between the sorted and unsorted groups of cattle (Table 5). There was no effect of sorting on HCW, ADG, and F: G, fat thickness, marbling, or number of cattle with YG ≥ 4 (P>0.21). Sorting increased average initial weights of calf-feds by 91 lb and reduced the average initial feedlot weights of fall yearlings by 64 lb. Sorting also decreased the amount of variation in initial feedlot BW and HCW. In the summer yearlings, sorting decreased the SD by 38 lb, and in the fall yearlings, sorting decreased the SD by 51 lb. The HCW SD was decreased by 33 lb in the summer yearlings and 32 lb in the fall yearlings.

Sorting cattle into feeding systems decreased the number of carcasses over 950 lb and 1000 lb (Table 6). The unsorted group for the fall yearlings had 42% of the carcasses over 950 lbs compared to only 11% in the sorted group. In the summer yearlings, the unsorted group had 19% over 950 lb while the sorted summer yearlings only had 4% over 950 lb. In the fall yearling unsorted group, 23% of the carcasses were over 1000 lb while only 2% in the sorted group of fall yearlings. When combining all of the unsorted groups together and all of the sorted groups together, the carcass weights were 858 lb (SD=66 lb) for sorted cattle compared to 859 lb (SD=105 lb) for the unsorted cattle. The combined unsorted group had 21% of the carcasses heavier than 950 lbs while only 7% of the carcasses were over 950 lbs in the combined sorted group.

Sorting cattle decreased the variation of HCW and the number of overweight carcasses without affecting fat thickness. Sorting worked well because cattle were able to be marketed in more uniform groups. The number of carcasses over 950 lb was lower and the amount of variation was also lower within the feeding periods without affecting the performance or carcass characteristics.

Winter costs. The systems described herein involve wintering calves on cornstalks supplemented with ethanol byproducts (Table 3). This is a very economical system. The byproducts can be purchased at about the price of corn and supply the protein, P and energy needed by the calves. We have demonstrated increasing gains of calves on stalks with increasing supplemented levels of gluten feed (Jordon et al., 2001) and distillers grains (Gustad et al., 2006). Once a target level of ADG is determined, then the needed amount of byproduct can be estimated. The total cost of gain for calves on stalks supplemented with byproducts is $.50 to $.55/lb (Griffin et al., 2008).

Similar costs of gain were determined for calves wintered on dormant range (Stalker et al., 2005). Calves gained 1.8 lb/day supplemented with about 4.5 lb distillers grains. Feed cost per lb of gain was about $.24/lb of gain. Interest, health and animal care costs would add another $.15 to $.20 per lb of gain. Penning calves up and feeding harvested feeds increases these costs of gain.

Grass expense, gains and supplements. At $25/AUM the cost of grass for an 800 lb steer is $.67/day. If the steer is gaining 1.25 lb/day the feed cost of gain is $.53/lb. If the steer gains 2 lb/day, the feed cost of gain is $.34/lb. Additional costs for interest, health and animal care could be $.20 to $.25/day brining total cost of gain to about $.56/lb at 1.6 lb/day gain. That's a lot of numbers! The important points are that cost of grass, gains on grass and other costs are very important.

Supplementation of yearlings on grass is a means of increasing gains without markedly increasing costs other than the supplement. A summary of eight experiments showed an increase in daily gains from 1.6 lb/day up to 2.13 lb/day by supplementing with 4 lb dry distillers grains (Klopfenstein et al., 2007). If the distillers grains cost $.28/day, the total cost of gain would be $.50/lb compared to the $.56 discussed for 1.6 lb/day gain. The economics of supplementation depend upon the cost of the supplement, the cost of delivery, the grass saved and the subsequent performance of the yearlings in the feedlot. With June-born calves, Taylor et al. (2005) estimated a profit of about $16/head by supplementing with 2 lb/day of distillers grains.

Calving date. Our research in the Sandhills (Carriker et al., 2001) shows that June-calving cows had $76 less production expense than March calving cows. Even though calves were lighter at weaning in January for the June - calving cows, the calves returned as many dollars at weaning because of $10/cwt higher price (January vs. October). Those data are based on 1998 prices. We really don't have historical data to use to project how higher corn prices will affect these relationships. We believe the cost savings occurring to June calving will be as great or greater in the future.

A primary motivation for March (or other early date) calving is to produce high weaning weights in October. We have previously pointed out that the feeder market rewards heavy feeders capable of being finished by May. As discussed, there are costs incurred in producing calf-fed feeders. Further, if the calves are not large enough in October to be calf-feds, they are somewhat discounted. Therefore, it appears that one needs to target the calf-fed feeder market or not sell feeders in October and November. June calving (or any month later than March to April) allows one to make the cost savings. If one is going to background the calves, then October weights or weaning weights are irrelevant. Profit whenever the backgrounded calves/yearlings are sold is the important item.

For a rancher, the question is "do I sell at the high markets in January or do I background for a later market?" Two years of data on production systems with June-born calves were summarized (Taylor et al., 2008). Backgrounding the steer calves from January to May using winter range and DDGS cost about $100 for 277 lb gain. Because of the excellent market for718 lb pasture calves in May the calves returned $158 more than if sold in January for a backgrounding profit of about $58. The profit for backgrounding and grazing the calves/yearlings to September was about $54 which is positive but not as much as selling in May. Supplementing DDGS on grass (2 lb/day) increased the profit to $60 and continuing grazing on wet meadows until November with DDGS supplement further increased the profit to $83. Finishing the cattle was not profitable so in this situation, retained ownership would not be recommended.

Similarly, Griffen et al. (2007) showed that yearlings were more profitable than calf-feds at $2.25/bu corn (using data in Table 1). The calves had a profit of $39.47 after the wintering phase, $54.93 after the pasture phase and $68.45 after the finishing phase. As with the previous data set, the calves were profitable if sold in May, however pasture and finishing were also profitable.

These budget analyses were conducted using average prices from 1996 to 2005. It is not clear how higher corn prices will affect these relationships. Cattle feeding is a margin business so we would expect feeder prices to reflect feedlot breakevens. If finished cattle prices are between $90 and $100/cwt over the next few years and the feedlot cost of gain is $70 to $75/cwt, then 850 lb feeders (from the June-born system) would be worth $99 to $115/cwt. March born, 950 lb feeders would be worth $96 to $111/cwt in September.

Table 5. Performance data

Feeding System Sort/unsort	Calf feds Unsort	Calf feds Sort	Summer yearling Unsort	Summer yearling Sort	Fall yearlings Unsort	Fall yearlings Sort	SEM	System	P-value Sort	System* Sort
Initial BW[1]	605	696	824	823	1008	944	4	<0.01	0.02	<0.01
IW[2] SD	66	57	71	33	121	70				
HCW	777	820	867	865	933	878	8	0.01	0.83	<0.01
HCW[3] SD	68	68	77	44	105	73				
DMI	20.92	21.49	25.75	25.75	28.91	27.25	0.28	<0.01	0.20	<0.01
ADG	3.76	3.72	4.15	4.14	4.08	3.87	0.08	<0.01	0.22	0.50
F:G	5.56	5.78	6.17	6.21	7.09	7.01	0.10	<0.01	0.23	0.27

[1]Feedlot entry weight
[2]Initial weight standard deviation
[3]Hot carcass weight standard deviation

Table 6. Overweight carcass data by feeding system

Feeding System	Sort/Control	Carcasses over 950 lb	Carcasses over 1000 lb
Calf-fed	Unsorted	2%	0%
Calf-fed	Sorted	6%	2%
Summer yearling	Unsorted	19%	2%
Summer yearling	Sorted	4%	0%
Fall yearling	Unsorted	42%	23%
Fall yearling	Sorted	11%	2%

Transportation. All of the feed resources may not be in the same geographical area for optimum system production. As energy costs have increased, the costs of transporting cattle from one feed resource to another have increased by 50 to 100%. So the costs of harvesting feed and maybe hauling feed must be balanced with the costs of hauling cattle.

SUMMARY

Corn price will affect the price of feeder cattle but it is not clear that there will be large profits for backgrounding cattle — putting more of the weight on with forages, residues and byproducts. We just don't have good historical data at high corn prices to make predictions because we haven't had high corn prices. We have attempted to present the biology involved in producing cattle with varying amounts of backgrounding. Each producer will need to fit a production system to the resources at hand. Table 7 is presented as a summary of what we believe are the important considerations in having a successful system.

Table 7. Yearling checklist

1. Cost (value) of calves	3. Cost of grass
a. month of sale or purchase	a. transportation
2. Cost of winter feed	4. Grass gains
a. grazed versus harvested	a. supplements
b. yardage	b. byproducts
c. byproducts	5. Retained ownership
d. transportation	6. Calving date

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