The Significance of Finished Cattle Sorting Methodology on Grid Market Performance and Enhanced Revenue for Calf-Fed Beef Cattle

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Introduction

During the past 15 years there has been a major change in the way finished cattle are marketed. Live bids on complete pens of cattle are less prevalent with the advent of value-based marketing where there is an increased emphasis placed on carcass quality and red meat yield. Value-based marketing establishes value based on the animal's own individual carcass merit. Various grid markets have specifications for important carcass traits that include quality grade, yield grade, and carcass weight. Carcasses that exceed the criteria receive premiums while those that fall short of the specifications receive discounts that in some cases are quite severe. Because of this newer pricing system there may be economic advantages to sort cattle at the end of the feeding period. Past research has demonstrated that sorting cattle by specific traits results in reducing the variation of the traits being evaluated. Feedlots and producers need a sort system that can be performed in a minimal amount of time and expense and is accurate in identifying animals that meet the specifications for a particular market.

Materials and Methods

The objectives of this study were to determine: 1. if live weight, visual observation and manual rib palpation could be used to accurately sort cattle for value based markets; 2. can the sorting process increase revenue to the cattle owner compared to national average figures; and, 3. is the sorting process consistent over a period of time and on multiple groups of cattle.

The cattle used in this study represent 14,454 steers and 6,179 heifers that were fed and marketed by the Tri County Steer Carcass Futurity Cooperative (TCSCF) in 2006, 2007 and 2008. This entity supervises a retained ownership program that utilizes feedlots in Southwest Iowa to feed 8, 000-10,000 cattle annually from over 400 owners in 21 states. The co-operative has established protocols for animal health and ration formulation to maintain consistency between feedlots. All feedlots are able to take individual weights. They utilize a common market that allows a carcass data collection crew to enter the plant and collect full carcass data. All cattle are double tagged on arrival to maintain individual identity. The following instrumentation was used to determine cattle marketing date and evaluate carcass merit: 1. scales to take individual weights; 2. visual observation and manual rib palpation; 3. carcass measurements for 13^{th} rib fat, rib eye area, estimate of percent kidney, pelvic and heart fat, calculated yield grade, USDA Quality Grade and USDA called Yield Grade; and 4. a comparison of the data to a recognized source of national averages.

When TCSCF receives a pen of cattle they are weighed and processed at the participating feedlot and placed in an available pen. A tentative harvest date is projected for the pen, based on the weight and frame size of the cattle and the time of year they will be fed. This tentative date may be changed during the feeding period because of health issues in the pen, weather-induced feeding conditions or other observations from the feedlot operator or TCSCF staff. On the determined date the cattle are gathered, individually weighed and visual observations with manual rib palpation at the 12^{th}-13^{th} rib are done by the sort for market determination crew which typically consists of a three member team. At that time a determination is made on whether to harvest now or feed another 35 days. Those cattle selected for first harvest are placed in another pen if the feedlot has one available or else the tags are cut on the first harvest cattle and they return to the home pen with the second harvest cattle until they are loaded for delivery, usually within 5 days.

Cattle sort is done using an "if/then" process with the first criteria being that the animal has adequate fat cover to grade choice. This determination was made by observing the animal for fat deposition in the brisket, flank and rump areas and by manually palpating the area of the 12^{th}-13^{th} rib to make a determination of fat cover. The goal for fat cover was .45 inches (acceptable range is .3 in. to .6 in.) The second criteria the animal needed to meet the carcass weight standards of 550 pounds to 950 pounds to avoid discounts. Using a 61% dressing percentage and 4% shrink, "light" cattle were those under 950 pounds live weight. "Desirable" cattle were from 950 pounds to 1,500 pounds live weight. "Heavy" cattle were above 1,500 pounds live weight. If the animal was in the "Desirable" weight category it was scheduled for harvest. For animals that did not meet these two criteria, Chart 1 indicates the order in which decisions were made to either harvest the animal or feed it for another 35 days. The third criteria, "projected weight", is the expected body weight of the animal on sort day and was calculated by taking the individual animal's ADG from on-test weight to re-implant weight, multiplying

the ADG by 85%, multiplying this product times the number of days from re-implant weigh date to sort date and adding this total to the weight at re-implant time. The formula is:
Projected weight = ((ADG, on-test to re-implant, x .85) (number of days from re-implant date to sort date)) + weight at re-implant time

If an animal did not meet the guideline for fat cover at sort time but had a "Heavy" carcass it was marketed to avoid a heavy carcass discount. If the animal did not meet the guideline for fat cover but was in the "Desirable" weight range it was designated for harvest if it's actual weight was below it's "projected weight" or fed for an additional 35 days if actual weight was above the "projected weight". For animals that were determined to be at the desirable fat cover level they were selected for harvest if weights were in the "Desirable" or "Heavy" category. Those in the "Light" weight category were fed an additional 35 days, even if the carcass had the potential to be a YG 4, with the hope that the additional days on feed would get the carcass to a desirable weight so that it would not receive a light carcass discount as well. One sort was made on each pen with the remainder of the pen marketed 35 days later.

The first comparison used three variables in the data to look at a success rate for sorting. A "successful sort" included animals that had .3 in. to .6 in. fat cover at the 13th rib, were Yield Grade 3 or better and had a hot carcass weight between 550 pounds and 950 pounds.

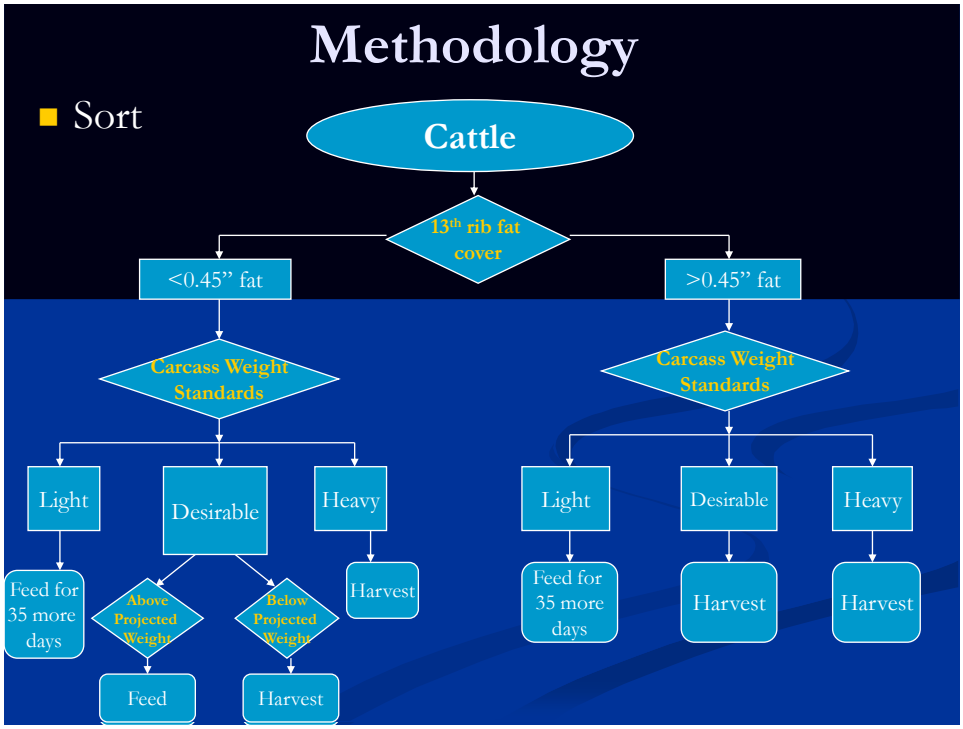

Chart 1. Sort methodology used by TriCounty Steer Carcass Futurity Cooperative.

In order to determine if economic benefit was derived from the sorting process the TCSCF sorting information was compared with another set of data that summarizes the same variables. The National Summary of Meats Graded (USDA, Agriculture Market Service) provides monthly averages on the number and percentages of cattle with quality grades that are Prime, Choice, Select and Other and also the number and percentage of cattle with yield grades that are YG1, YG2, YG3, YG4 and YG5. Each pen of TCSCF cattle marketed from January, 2006 to August, 2008 was compared to the national summary data for the same month and year to determine if differences existed. The steer and heifer data was summarized separately with 163 pens of steers and 132 pens of heifers in the comparisons. Each pen was evaluated to determine the amount of improvement compared to the national summary. For hot carcass weights comparisons a frequency distribution of hot carcass weights from the 2005 National Beef Quality Audit (Journal of Animal Science, 2008) was utilized. Premiums or discounts were applied to the calculated values. The premium and discount values used in these calculations were provided via personal interview with Darrell Busby, ISU Livestock Specialist, who co-ordinates the TCSCF program. They were best estimates based on the average premiums and discounts paid during the three year period from 2006 to 2008 (see Table 1). These premiums and

discounts were multiplied by the amount of improvement in yield grade, quality grade and hot carcass weight to provide values per head for first and second sort steers and heifers and values per lot. Minimum and maximum values per head and per lot show the extremes that were present.

Table 1. Premium and discount values used in analysis.

Yield Grade Premiums/ Discounts	Quality Grade Premiums/Discounts	Hot Carcass Weight Discounts
YG 1 $6.50	Prime $5.00	Greater than 950 lbs. ($15.00)
YG 2 $2.50	Choice $0.00	Less than 550 lbs. ($15.00)
YG 3 $0.00	Select ($7.00)	
YG 4 ($15.00)	Other ($12.00)	
YG 5 ($20.00)		

Sorting cattle at the feedlot to determine marketing order adds another working of the cattle through the processing facilities. This sorting routine has costs associated with it that must be charged to the cattle. All of the feedlots represented in this data set have a designated cattle working area with a crowding area or tub, runway, squeeze chute and scale installed under the squeeze chute to obtain individual weight information.

For this study the costs of handling equipment and labor for sorting cattle were applied on a per head basis. Assuming that some feedlots would not have a scale installed on the working chute the cost of an electronic scale is included in the capital investment list. The cost figures came from a reputable livestock equipment manufacturing company (see Table 2). ISU Extension Publication FM 1815 "Livestock Enterprise Budgets for Iowa" suggests fixed costs for depreciation of 8% of the original equipment value, interest at 5% and taxes and insurance at 1% for a total of 14% of the original investment annually.

Table 2. Purchase costs and annual fixed cost of cattle sorting equipment.

Item	Cost	Annual Fixed Cost
Crowding Tub	$4,000	$560
Runway	$3,000	$420
Squeeze Chute	$4,500	$630
Electronic Scale	$2,000	$280
Total	$13,500	$1890

Participating feedlots used the working facility to process each pen of cattle on arrival, at mid-point of the feeding period for re-implanting, and at market time to determine harvest date. According to an unpublished summary of TCSCF health data document, 11% of the cattle received a single health treatment and 7.5% received two or more treatments; therefore, about 18.5% of each pen of cattle go through the working facility for treatment. The feedlot uses the facilities 2.185 times for normal processing work and 1 time for sorting, thus a total of 3.185 times through the facility per group. The cost of the scale was completely charged off to the sorting process.

Cost per head for equipment varies with feedlot size. Calculations were made for feedlots of 500 head, 1,000 head and 1,500 head capacity with two turns per year. It was assumed the feedlots operated at 85% of total capacity.

Table 3. Fixed equipment cost per head.

Lot Capacity	500 head	1000 head	1500 head
Total head fed/year	850	1700	2550
Total equipment cost/year	$1890	$1890	$1890
Total equipment cost/head/year	$2.22	$1.11	$0.74
Equipment cost/use	$0.70	$0.35	$0.23
Fixed equipment cost/head	$0.70	$0.35	$0.23
Labor cost for sorting	$0.505	$0.505	$0.505
Total sorting cost/head	$1.205	$0.855	$0.735

Labor cost is associated with sorting cattle. TCSCF staff members kept detailed information on the number of workers and the amount of time that was spent doing the processing. Data on over 13,000 head of cattle was summarized in an unpublished document by Southwest Iowa Extension Livestock Specialist Darrell Busby. The summary includes a cost per head for working cattle on arrival, at re-implant time and sorting for market.

Calculations included the average number of workers required for these protocols and attached a per hour salary figure for the workers. This analysis showed the sorting process required 4.95 staff members. Total staff time needed was 3.03 minutes per head. Labor was charged at $10 per hour, which is comparable to a 2004 Nebraska study of feedyard labor costs. Using these figures the cost per head for labor to sort cattle was estimated at $0.505. Total sorting cost per head ranged from $.735 to $1.205 for the range in feedlot sizes used in this analysis (see Table 3).

Results and Discussion

The TCSCF sort routine procedure was ascertained to be a successful methodology because 83.6% of the 14,454 steers and 80.27% of the 6,179 heifers met the criteria set out in the evaluation. Table 4 shows the top three reasons why the sort was unsuccessful with the results being similar between steers and heifers.

Table 5 shows the improvement in Yield Grade and Quality Grade for the sorted cattle sold in 2006, 2007 and 2008 compared to the National Summary of Meats Graded data for 2006, 2007 and 2008 respectively. There were more Yield Grade 1, 2 and 3 carcasses in the sorted groups with 7.19 percentage points of improvement in 2006, 9.99 percentage points of improvement in 2007 and 6.82 percentage points of improvement in 2008. The comparison of Quality Grades indicated mixed success with a 14.19 percentage point increase in 2006, 0.56 percentage point increase in 2007 and an 8.32 percentage point decrease in 2008.

Table 6 shows the improvement in lot sale gross revenue due to reductions in yield grade discounts, improved quality grade distribution and improvements in hot carcass weight distribution due to premiums applied. Both heifers and steers had improvements due to better yield grades with avoiding 4 and 5 discounts as the primary reason; however, steers had some additional revenue gain due to premiums for 1 and 2 yield grades. Gross revenue improvement was much lower in regard to quality grades. There were small improvements in the heifers because there were fewer selects. Steers actually provided less revenue based on quality grades with only a slight improvement in Selects and more Standards.

Table 4. Reasons for unsuccessful sorts in TCSCF steers and heifers.

	Steers (no./%)	Heifers
Successful sorts	12,083 / 83.6%	4960 / 80.3%
Unsuccessful sorts	2371 / 16.4%	1219 / 19.7%
Reasons for unsuccessful sorts		
Fat cover	2005 of 2371 / 84.6%	950 of 1219 / 77.9%
Yield grade more than 3.99	266 of 2371 / 11.2%	236 of 1219 / 19.3%
Hot carcass weight out of range	100 of 2371 / 4.2%	33 of 1219 / 2.7%

Table 5. Yield and quality grade improvements for sorted cattle compared with the National Summary of Meats Graded.

	% YG 1,2,3			% Low Choice or better		
Year	TCSCF	National Summary	Percentage Point Improvement	TCSCF	National Summary	Percentage Point Improvement
2006	98.16%	90.97%	7.19	73.32%	59.13%	14.19
2007	98.30%	88.31%	9.99	61.15%	60.59%	0.56
2008	96.70%	89.88%	6.82	55.82%	64.14%	-8.32

Improvement in gross revenue due to reduction in over- and under-weight discounts occurred in both sexes. In both the steer and heifer sale lots cattle weight was used in the sorting process to market the cattle before they got too heavy and this accounted for most of the revenue improvement. In the second sort of steers there was a wide weight variation in some sale lots due to a broad range in age and genetics; thus, the economic gain was quite variable ranging from -$1,668.58 to $1,971.62. Regarding light carcasses, the sort provided small improvement in all but one category. Since all remaining cattle are sold from a pen on the 2nd sort some of the heifers were just too small to meet the hot carcass weight minimum. A note that is important to this analysis is the herds that consign cattle to the TCSCF program keep replacement heifers, so in many cases the heifers sent to be fed are ones that did not meet the size and quality requirements for replacements.

By combining the improvement in revenue from yield grades, quality grades and hot carcass weights the total improvement per head is very significant. The enhanced gross revenue per head for 1st sort steers equaled $13.97 and 1st sort heifers was $18.64 which amounts to over $1,000 per lot. The sort process helped get heifers to market with fat covers that improved their yield grades and at heavy

enough weights to avoid discounts for light carcasses. This sort process is much less effective in improving revenue through quality grade increases. This was one of the limitations of the sort process because genetic traits cannot be determined by visual observation.

Table 6. Increases in gross lot sale revenue from sorting due to improvements in quality grade, yield grade and hot carcass weight distribution.

Cattle sex	Yield Grade improvement per head	Quality Grade improvement per head	Hot carcass weight distribution improvement per head	Total gross revenue improvement per head	Total gross revenue improvement per lot
Heifers					
1st sort	$10.44	$2.67	$5.53	$18.64	$1006.56
2nd sort	$5.18	$1.12	$5.11	$11.41	$444.97
Steers					
1st sort	$10.30	($1.69)	$5.36	$13.97	$1299.21
2nd sort	$13.30	($2.62)	$4.82	$15.50	$1271.00

Combining the values for improved gross revenue from Table 6 with the cost per head to sort cattle for various feedlot sizes provides the net improvement in revenue attributed to the sorting process in this data set (see Table 7). The net improvement enhancement ranges from a low of $10.20 per head to a high of $17.90 per head by utilizing the sorting process. Custom lots may have a concern about the loss of yardage revenue as a result of making a 1st sort. If 60 percent of the pen was selected for 1st harvest and the feedlot was charging $.29 per head per day for yardage there could be a potential reduction of $6.09 per head in yardage fees due to sorting. This would be dependent on the feedlot's ability to keep their pens full to capacity.

The additional cost of sorting runs from 4% to 10% of the improvement in gross revenue generated from the process. It would appear that feedlots could profit in utilizing this type of sort methodology. However, to achieve this revenue improvement means feedlot must invest in: 1. providing personnel training in the visual observation skills and manual palpation, 2. maintain adequate equipment and facilities to perform the sorting process at chute speed and, 3. employ a record system that allows gain calculations utilized in this sorting methodology.

For the sort process to be utilized to generate results as indicated in Table 7 it has to be relatively consistent. Table 8 summarizes the percent of pens which had improvements in gross revenue due to yield grade, quality grade and carcass weight distribution. The values in this table indicate the sort process is between 80% to 100% effective for first sort improvement in revenue for yield grades and carcass weights.

The sorting process was the most effective in reducing discounts for carcass weights. First sort values from 91% to 100% improvement in gross revenue are very significant. Using known weights to make this decision keeps accuracy high. Next was yield grade with first sort values from 81% to 90%. Observation of overall body condition helped keep this part of the decision process in that range. Quality grade decisions were not as successful. Genetics have a lot to do with quality grade levels and this characteristic is much more difficult to call, even with visual appraisal and manual palpation of the rib area. Genetics for quality grade cannot be made from visual observation or taking weights. Knowing more about this genetic trait in feedlot cattle could enhance the process.

Conclusions

A sorting process utilizing scales to take individual weights and visual observation and manual rib palpation to predict degree of finish was effective in this study at providing additional revenue when compared with national average quality grade and yield grade statistics. Improvements in net revenue ranged from $10.57 to $17.80 per head which for a 1000 head feedlot running at 85% fill capacity would accrue totally from $17,969 to $30,260 in improved net profit. This sort methodology was most consistent in reducing discounts due to over- and under-weight carcasses, but the greatest amount of added

Table 7. Improvement in net revenue per head after sorting cost deductions.

Cattle sex	Gross revenue improvement	500 head feedlot size	1000 head feedlot size	1500 head feedlot size
Heifers				
1st sort	$18.64	$17.42	$17.80	$17.90
2nd sort	$11.41	$10.20	$10.57	$10.67
Steers				
1st sort	$13.97	$12.76	$13.13	$13.23
2nd sort	$15.50	$14.29	$14.66	$14.76

Table 8. Percent of lot sorts with increased gross revenue in yield grade, quality grade and hot carcass weight distribution.

Carcass trait	**Percent of pens with increased gross revenue**	
	Heifers	Steers
Yield Grade		
1st sort	81.25%	90.00%
2nd sort	72.06%	91.57%
Quality Grade		
1st sort	68.75%	47.50%
2nd sort	63.24%	40.96%
Carcass Wt Distrib. Over 950 lb.		
1st sort	96.88%	91.25%
2nd sort	100.00%	92.77%
Carcass Wt Distrib. Under 550 lb.		
1st sort	98.44%	100.00%
2nd sort	76.47%	74.70%

revenue came from reducing the number of yield grade 4 and yield grade 5 carcasses, thus reducing associated discounts. Decisions were the least effective on quality grades and only the heifers showed a small amount of additional revenue in this category. This improvement was from reducing the number of Select grading carcasses in the heifer sale lots. As previously known, visual observation is not effective in determining quality grade. Feedlots could realize additional revenue from the cattle by adopting a sorting methodology of this type. Scales to gather

individual weights are a necessity in this type of system. The visual observation and palpation are procedures that can be taught to competent employees and can be utilized to make sorting work at the feedlot level.

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