Potential Value of Ultrasound to Sort Feeder Cattle into More Uniform Groups for Finishing and Marketing

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Summary

Cattle in three experiments were scanned with ultrasound as feeders to measure ribeye area and thickness of fat cover to determine if cattle could be sorted into outcome groups with respect to carcass yield. Sorting the cattle into low fat cover or large ribeye groups resulted in improved carcass yield grades. There were no effects on carcass quality grades related to sorting of the cattle. Cattle with greater fat cover at the beginning of the feeding period were heavier, seemed to be more mature and had less muscle growth during the finishing period. There were no significant differences in gain among the groups, but cattle with more fat cover had poorer feed efficiency. Ultrasound seems to have potential to sort feeder cattle, but before it can be used in practice, growth curves need to be developed to predict final end points of individual cattle.

Introduction

There is considerable variation among cattle within pens, which diminishes opportunities for precision feeding and value-based marketing. If cattle within a pen were more uniform, they could be fed more precisely according to requirements, rather than feeding for the average which over- or underfeeds a portion of the cattle. Likewise marketing beef to the retail trade requires considerable sorting of carcasses at the packing plant for most lots of cattle. And in a genuine value-based market this will result in some premiums as well as discounts. Most cattle probably have a place in the marketplace, if they could be properly managed and marketed. Variation in management to optimize economic returns and carcass desirability in the marketplace could include energy concentration in the growing and finishing diets, length of feeding, and implant strategies. The objective of these studies was to determine if scanning feeder cattle with ultrasound could help sort cattle into more uniform groups.

Materials and Methods

Data from three cattle feeding trials will be summarized. All the cattle were scanned initially with an Aloka 500V machine (Corometrics Medical System, Inc., Wallingford, CT) equipped with a 3.5 Mhz, 17 centimeter linear array transducer to measure fat thickness and ribeye area at the 12-13 ribs. The cattle were scanned at about four-week intervals, but only data from the initial scans will be summarized in this report.

Trial 1 One hundred fifty-six yearling heifers weighing 790 pounds were purchased at auction in late September. The heifers were of mixed breeding and color and had been grazing pastures in Western Iowa during the summer. The heifers were pregnancy checked, immunized and treated for external and internal parasites before beginning the test in early October. Six heifers were allotted to each pen from weight-outcome groups to equalize average weight within each pen. The first ultrasound scans were made after the heifers were allotted to the pens. All the heifers were implanted with Synovex H® and Finaplix H® at the beginning of the study. The heifers were fed corn-based diets on a dry basis containing 14% crude protein and 0.63 Mcal NEg/lb. Some of the heifers were sorted out by visual appraisal to be sold after being on experiment 84 days. The remainder were sold after 134 days.

Trial 2 Ninety-six yearling steers weighing 840 pounds were purchased at auction in September following grazing during the summer. The steers were predominantly Charolais cross. They were immunized and treated for external and internal parasites before beginning the test in October. The steers were scanned with ultrasound and allotted to sixteen pens based on ribeye area and thickness of fat cover. They were all fed one diet, a corn-based diet containing on a dry basis 14% crude protein and 0.63 Mcal NEg/lb. Half of the steers within each ultrasound group were implanted with Revalor S®one week after the experiment was started. The steers were fed 158 days.

Trial 3 Ninety-six steers weighing 940 pounds were purchased from one herd in Southern Iowa in early March. The steers had been preconditioned, weaned and backgrounded on roughage and grain during the winter. The steers were scanned with ultrasound and allotted to 16 pens based on ribeye area and thickness of fat cover. The steers were fed corn-based diets containing on a dry basis 14% crude protein and 0.63 Mcal NEg/lb. All the steers were implanted with Revalor S® after they had been on feed four weeks. The steers were fed for 113 days.

All the cattle were sold at commercial beef-packing plants. Weights of hot carcasses were taken after slaughter and measurements on the carcasses were obtained after 24-hr chill (Trials 1 and 2) or 48 hr (Trial 3). Yield grades for individual carcasses were calculated

from measurements on the carcasses using the standard yield grade equation.

For the purposes of this analysis, the cattle within each experiment were divided into four groups based on the initial ultrasound scan: small ribeye area and low fat cover (SmLo), small ribeye area and high fat cover (SmHi), large ribeye area and low fat cover (LgLo), and large ribeye area and high fat cover (LgHi). In Trial 1 the heifers in these groups were scattered among the pens. In Trials 2 and 3, steers were allotted to pens based on this grouping.

Results and Discussion

Trial 1 The influence of grouping the heifers according to ultrasound measurements as feeders on average daily gain and carcass measurements are summarized in Table 1. The heifers were not managed in these groups, but the data were sorted into the groups based on the ultrasound measurements. Initially the heifers with low and high fat cover averaged .17 and .32 inches, respectively. The animals with small and large ribeye areas averaged 10.0 and 11.4 square inches, respectively. When finished the heifers that initially had low and high fat cover averaged .32 and .49 inches. Those with initial small and large ribeyes averaged 13.4 and 14.6 square inches. Based on visual appraisal thirty-five of the seventy-eight heifers with more initial fat cover were sold early, whereas only eight of the heifers with low initial fat cover were sold early. Heifers with more fat cover tended to weigh more at the beginning of the study and to gain faster during the study, but some of the difference in gain might have resulted from selling a greater portion of the heifers with more initial fat earlier. Heifers with less initial fat cover had lower average yield grades, and more of those heifers graded 1 and 2. Heifers with larger ribeye area increased gain somewhat, improved average yield grade, and resulted in more heifers grading 1 and 2. A few more heifers with high initial fat cover graded Prime and Choice. There was no significant different in quality grades among heifers with large or small initial ribeye areas.

Table 1. Performance and carcass measurements from heifers with different ultrasound measurements at the start of the feeding period (Trial 1).

	Ultrasound group[a]			
	SmLo	SmHi	LgLo	LgHi
First ultrasound				
Ribeye area, in^2	9.9	10.0	11.4	11.4
Fat thickness, in	.17	.32	.17	.32
Performance				
No. heifers	39	39	39	39
No. sold @84 days	2	16	6	19
Start weight, lb	753	792	788	796
End weight, lb	1157	1160	1165	1178
Daily gain, lb	3.08	3.31	3.15	3.53
Carcass				
Carcass wt, lb	698.6	715.9	724.4	763.8
Fat cover, in	.34	.51	.30	.47
Ribeye area, in^2	13.7	13.2	15.0	14.3
Yield grade	2.02	2.79	1.74	2.33
1	21	5	24	11
2	15	18	14	24
3	3	14		4
4		2		
USDA Prime		1		
USDA Choice	16	24	18	20
USDA Select	23	14	20	19

[a]Sm and Lg refer to smaller or larger ribeye areas and Lo and Hi refer to less or more fat thickness based on initial ultrasound scan.

Trial 2 The results of this trial were similar to the study with heifers in that steers with low initial fat thickness or larger ribeye area had more carcasses with yield grades 1 and 2 (Table 2). As observed with the heifers, steers with more fat cover or larger ribeyes were heavier at the start of the trial. The initial ultrasound measurements had minimal effects on carcass quality grades. Steers with less initial fat thickness tended to gain somewhat faster and had superior feed conversion. Steers with larger ribeyes did not have superior gains or feed conversion.

Revalor S® increased rate of gain, improved feed conversion and resulted in heavier carcasses. Yield grades were not improved with implants because the heavier carcasses offset the larger ribeye areas in the implanted steers. Carcass quality grades of implanted steers were somewhat lower, especially carcasses from steers with larger initial ribeye areas.

Trial 3 The younger and larger-frame steers used in Trial 3 were not as well finished with respect to carcass quality grades, but the same differences in relation to ultrasound measurements as observed in the two previous trials occurred in this study (Table 3). Sorting out the steers with less fat cover increased the percentage of yield grade 1 and 2 carcasses. Sorting the steers with larger ribeye areas had less effect in this study compared with the other two studies. Sorting the steers based on fat thickness or ribeye area did not greatly affect carcass quality grades when the cattle were finished. Steers with less initial fat cover had greater daily gains and utilized feed more efficiently. There was no improvement in gain or feed utilization in the steers with larger initial ribeye areas.

Table 2. Performance and carcass measurements from steers with different ultrasound measurements at the start of the feeding period (Trial 2).

	Ultrasound group[a]							
Item	SmLo		SmHi		LgLo		LgHi	
	C[b]	I	C	I	C	I	C	I
First ultrasound								
Ribeye area, in^2	8.2	8.2	8.4	8.4	9.6	9.6	9.6	9.7
Fat thickness, in	.08	.09	.14	.13	.10	.11	.16	.15
Performance								
No. steers	12	12	12	12	12	12	12	12
Start weight, lb	799	805	837	826	830	842	883	882
End weight, lb	1251	1372	1258	1328	1279	1346	1311	1404
Daily gain, lb	2.82	3.54	2.63	3.13	2.81	3.15	2.67	3.26
Feed DM/d, lb	20.5	22.2	19.8	22.3	19.8	21.9	20.9	22.2
Feed/gain	7.25	6.33	7.65	7.13	7.11	6.98	7.83	7.25
Carcass								
Carcass wt, lb	759.4	846.9	776.6	821.0	796.2	843.8	811.2	869.0
Fat cover, in	.27	.33	.40	.44	.35	.39	.49	.48
Ribeye area, in^2	12.6	13.2	12.2	12.6	13.4	13.9	12.5	13.7
Yield grade	2.48	2.72	2.93	3.19	2.60	2.65	3.30	3.03
1	4	3		1	4	4		1
2	4	5	7	2	5	4	6	7
3	4	3	4	8	2	3	4	3
4		1		1	1	1	2	1
USDA Prime		1	1					1
USDA Choice	10	8	10	12	10	8	10	7
USDA Select	2	3			2	4	2	4

[a]Sm and Lg refer to smaller or larger ribeye areas and Lo and Hi refer to less or more fat thickness based on initial ultrasound scan.
[b]C an I refer to control and implanted steers.

In all comparisons within trials the difference between carcass measurements and the measurements from ultrasound scans divided by number of days between the two measurements resulted in an average rate of increase for ribeye area and fat cover. The calculations, showing significant growth of muscle as well as fat in all the cattle, indicated that the finishing phase is a period of rapid growth of muscle as well as fat in more mature yearling cattle. The range in growth rates were 0.023 to 0.042 square inches per day for ribeye area and 0.0012 to 0.0019 inches per day for fat thickness. Cattle with more initial fat cover had lower rates of increase in ribeye area and a greater rate of average increase in fat thickness in each trial. The steers in Trial 3 were younger, not having been allowed to graze before being placed in the feedlot. These younger steers averaged 0.039 square inches per day increase in ribeye area compared with 0.027 square inches per day for implanted steers in Trial 2 and 0.028 for implanted heifers in Trial 1. Implanted steers in trial 2 had 17% faster growth of ribeye area and 13% faster rate of increase of fat thickness compared with nonimplanted control steers. These results suggest that the cattle with more fat thickness were more mature at the beginning of the experiments and that implants extended the period of active growth to heavier weights.

Sorting out the cattle with less fat cover at the beginning of the feeding period increased the percentage of yield grade 1 and 2 carcasses. Seventy-nine percent of all the cattle had yield grades 1 and 2, compared with 92% of the cattle with large ribeye area and low fat cover and 60% of the cattle with small ribeye area and high fat cover. Just sorting the cattle out with low initial fat cover resulted in 89% having yield grades 1 and 2.

The results of this analysis indicate that sorting any lot of cattle into a low fat cover group or a group with low fat cover and larger ribeye area will increase the percentage of cattle that would qualify for premiums in a quality-based market paying for high-yielding carcasses. However, before ultrasound will be of much value to the beef industry, mathematical equations representing the growth of fat cover and ribeye area need to be developed so potential yield of individual animals can be predicted without comparing to contemporary animals within a group. Accurate prediction of eventual outcome of cattle with respect to carcass measurements might require measurements in addition to ultrasound scans.

Implications

The results of this analysis indicated that scanning feeder cattle with ultrasound to measure ribeye area and fat thickness can be used to sort cattle into groups with more potential to have high yielding carcasses. Sorting cattle based on initial fat thickness was of somewhat more value than initial measurements of ribeye area. Using both measurements was most effective in sorting cattle into potentially high yielding carcasses.

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Table 3. Performance and carcass measurements from steers with different ultrasound measurements at the start of the feeding period (Trial 3).

	Ultrasound group[a]			
Item	SmLo	SmHi	LgLo	LgHi
First ultrasound				
Ribeye area, in^2	9.4	9.6	10.7	10.9
Fat thickness, in	.14	.22	.15	.25
Performance				
No. steers	24	24	24	24
Start weight, lb	915	910	948	994
End weight, lb	1263	1236	1325	1334
Daily gain, lb	3.15	2.91	3.34	3.05
Feed DM/d, lb	18.8	17.6	19.0	18.7
Feed/gain	5.98	6.08	5.72	6.24
Carcass				
Carcass wt, lb	769.4	766.5	809.4	835.0
Fat cover, in	.30	.46	.25	.45
Ribeye area, in^2	14.0	13.6	15.6	15.2
Yield grade	2.20	2.76	1.67	2.44
1	7	2	17	4
2	16	16	7	15
3		4		5
4		1		
USDA Choice	4	7	3	5
USDA Select	13	11	16	18
USDA Standard	6	5	5	1

[a]Sm and Lg refer to smaller or larger ribeye areas and Lo and Hi refer to less or more fat thickness based on initial ultrasound scan.