SERIAL REAL-TIME ULTRASOUND TO PREDICT CARCASS QUALITY IN COMMERCIAL BEEF CATTLE

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Summary

Serial ultrasound measurements were obtained from cattle in three feedlots across Ontario. There was a strong positive correlation between ultrasound measurements taken from the time of entry into the feedlot, until 180 days on feed (which was the average number of days on feed for cattle in the trial). Final ultrasound measurements (closest to slaughter time) were compared to corresponding measurements on the carcass. Strong relationships between ultrasound and carcass measurements were observed. Ultrasound technology as a management tool to sort cattle for different feeding programs could be an invaluable tool to feedlot producers. In addition, ultrasound data can provide producers with information on how the animal is expected to finish (fat cover, marbling, and lean yield), and subsequently predict returns as well as discounts.

Introduction

Ultrasound technology has the potential to be a management tool for feedlot producers. Research has shown that ultrasound measurements have the ability to predict carcass composition. In addition, there is a high correlation between repeated measurements taken on the same animal. This project studied the correlation between serial (repeated) ultrasound measurements taken on feedlot cattle from the time of entry into the feedlot, until slaughter. Final ultrasound measurements were compared to carcass measurements.

Materials and Methods

Ultrasound measurements were obtained from three feedlots across Ontario from May 2000 to January 2001. Cattle were scanned from the time of entry into the feedlot, and periodically right up to the time they were slaughtered. The ultrasound measurements included rib-eye area (REA), backfat thickness (BF), and marbling (measured as a percentage of intra-muscular fat - IMF), on a total of 363 cattle. The number of scans per animal ranged between 3 and 6. In addition, cattle were also tagged with BIO-Link tags, to enable complete carcass data collection from the slaughtering plant.

An ultrasound technician set up chute-side to scan the animals for rib-eye area, backfat depth, and an estimate of intra-muscular fat. The site for scanning was located at the interface between the 12^{th} and 13^{th} rib. A certified technician, Crosby Devitt from Beef Improvement Ontario, (using the same technology that is used to scan bulls on test in the province), collected and interpreted all data. Collection of the carcass data included hot carcass weight, three back fat measurements (F1 = mm fat depth at the acorn, F2 = mm fat depth at the 1/2 mark, F3 = mm fat depth at the 3/4 mark), a grade fat measurement (the minimum fat depth in mm at the 3/4 range), rib-eye area (sq cm), a quality grade (ex. AAA) based on marbling score, and marbling percent (the degree of marbling within each quality grade ranging from 0-100%). The quality grade and marbling percentage were combined and then converted to a percentage of intra-muscular fat (based on estimates determined by Wilson et al. at Iowa State University). An estimate of cutability (a subjective estimate of lean yield) was also recorded from the carcass. Canadian Beef Grading Agency Graders recorded and reported all carcass measurements. Table 1 represents the carcass data by individual feedlot.

The data were analysed to estimate the change in RTU traits over time within animal, to determine the relationship between RTU traits taken at different times.

Results and Discussion

Figures 1, 2, and 3 provide a visual representation of the correlation between ultrasound measurements at various days on feed to the ultrasound measurement taken at 180 days on feed (the average number of days on feed). Of the three measurements, ultrasound backfat depth had the highest correlations (all > 0.7) when comparing the backfat measurements from 0 - 140 days on feed to the measurement obtained at 180 days.
For ultrasound measured rib-eye area, and intra-muscular fat, the correlations were between 0.4 and 0.6. Ultrasound is able to predict backfat depth better than rib-eye area, or marbling. Results indicate that measures taken shortly after arrival in the feedlot can predict measures at 180 days, as well as later measures. This shows promise of using early ultrasound measures in feedlot cattle to predict feedlot finishing, and final carcass grade outcome.

The second analysis, involved comparing the final ultrasound scan measurements with the carcass measures taken at the packing plant. Correlations between ultrasound rib-eye area, backfat depth, and percentage intra-muscular fat with their respective measurements on the carcass (carcass rib-eye area, F1, F2, F3, Average fat, grade fat, and converted quality grade) were 0.53, 0.68, 0.75, 0.74, 0.74, 0.74, and 0.61. Correlation estimates from ultrasound and carcass data are not perfect because there is variation in taking both sets of measurements. That is, measurements on the carcass in the packing plant are not perfect, they are measured with a certain amount of error.

Significance to the Industry

There is no doubt that an early method of identifying the way in which cattle would finish would be an invaluable tool to feedlot producers. Producers would be able to better manage the feeding programs they employ to ensure that they are feeding their animals as economically and efficiently as possible. Such a tool for sorting cattle would allow producers to select animals for market, that would get them the best returns based on carcass characteristics. Producers would be able to market their animals with known carcass characteristics. Ultrasound technology provides producers with the opportunity to "foresee" the way in which an animal will finish. The method is simple, non-invasive, and fairly cost-effective. Feedlot producers should be able to sort cattle into uniform groups to produce carcasses which have both consistent weight and yield grade based on ultrasound measures.

Acknowledgements

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Table 1. Summary of carcass data by feedlot

Trait	Farm	Mean	Std Dev	Min	Max
Hot carcass weight (HCW) (kg)	A	331.8	23.4	270.9	386.8
	B	360.9	30.6	302.1	419.6
	C	349.6	23.8	285.1	405.1
Fat1 (mm)	A	16.4	3.2	11.0	24.0
	B	13.4	4.5	5.0	26.0
	C	22.5	7.5	10.0	39.0
Fat2 (mm)	A	9.8	2.8	5.0	17.0
	B	11.3	4.3	5.0	26.0
	C	14.9	6.5	5.0	35.0
Fat3 (mm)	A	9.0	2.0	5.0	15.0
	B	10.2	4.3	4.0	25.0
	C	14.0	5.2	5.0	28.0
Average Fat (mm)	A	11.7	2.3	7.7	18.3
	B	11.6	3.9	5.0	23.3
	C	17.3	6.2	7.0	32.3
Grade fat (mm)	A	9.0	2.0	5.0	15.0
	B	10.2	4.3	4.0	25.0
	C	14.0	5.2	5.0	28.0
Rib-eye area (cm^2)	A	81.2	8.0	61.0	99.0
	B	73.9	11.1	57.0	95.0
	C	87.6	11.5	59.0	114.0
Marbling* (points)	A	4.49	1.00	2.97	7.91
	B	5.86	1.42	3.76	8.40
	C	6.24	1.61	3.59	8.90
Cutability	A	59.6	1.8	53.0	62.0
	B	58.3	3.1	50.0	64.0
	C	56.3	3.7	49.0	63.0

*Marbling points based on estimates by Wilson et al., Iowa State University, Department of Animal Science, Ames, Iowa.

Figure 1. Correlation of ultrasound rib-eye area over time with a scan at 180 days on feed

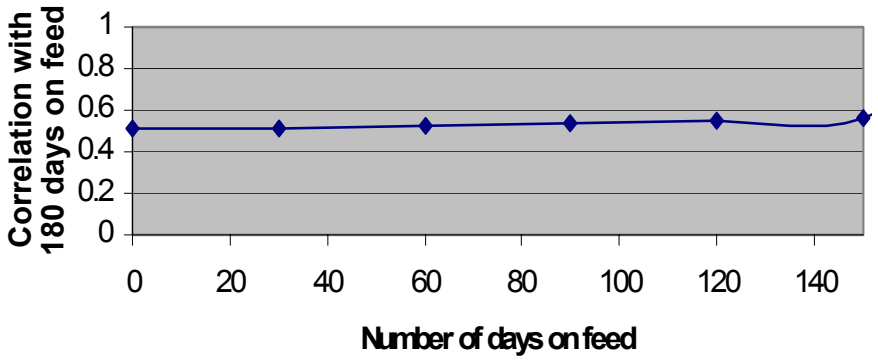

Figure 2. Correlation of ultrasound backfat depth over time with a scan at 180 days on feed

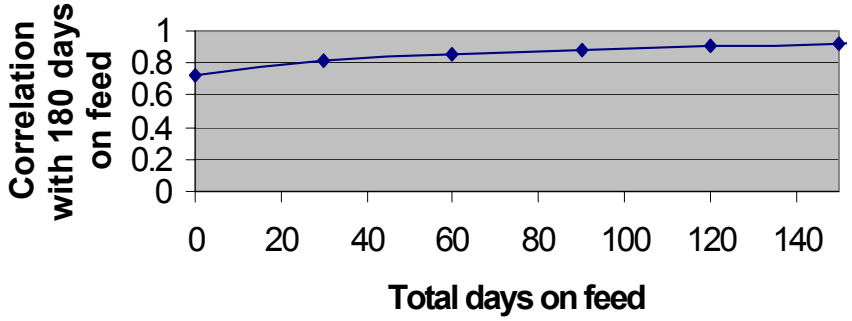

Figure 3. Correlation of ultrasound intra-muscular fat over time with a scan at 180 days on feed