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Real-time Ultrasound and Performance Measures to Assist in Feedlot Cattle Sorting for Marketing Decisions

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Abstract

Decision support systems are necessary for producers to make informed decisions about how to manage cattle for marketing decisions. This report is designed to describe the protocol used for Iowa State University research cattle to determine when cattle should be harvested.

Real-time Ultrasound and Performance Measures to Assist in Feedlot Cattle Sorting for Marketing Decisions

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Introduction

Decision support systems are necessary for producers to make informed decisions about how to manage cattle for marketing decisions. This report is designed to describe the protocol used for Iowa State University research cattle to determine when cattle should be harvested.

Materials and Methods

Live weights (WT) and ultrasound measures including subcutaneous fat over the 12th rib (FAT), and percent intramuscular fat (PFAT), were collected on live cattle as they approached harvest. All of these measures can be determined with the collection of longitudinal ultrasound images.

A few decisions need to be made about the environment in which the cattle are likely to be marketed. These decisions are outlined in Table 1. A decision structure is then put into an If-Then-Else formula in Excel® using the decision criteria given in Table 2, and assigning a harvest group to each individual animal. Actual harvest decisions then can be modulated by how aggressively the manager wants to market cattle based on the current market and anticipated markets. A general description of cattle represented by each harvest group is given in Table 3.

Results and Discussion

The approach taken to make decisions regarding the harvest date for cattle, basically involved placing the cattle in one of two categories: 1) market soon (within one week) or 2) feed an additional 35 days. Using the decision order shown in Table 2 cattle were placed into a harvest group (Table 3).

When the cattle are weighed, one of the following decisions are made: 1) keep cattle an additional 35 days if they will not make minimum carcass weight without being discounted, 2) sell cattle that are approaching the upper limit for carcass weight, or 3) consider ultrasound measurements for cattle that are gaining adequately and are within weight bounds.

Ultrasound measures can be helpful in the marketing decision process. For example, predicting whether cattle within the acceptable weight range will grade Choice today, or are currently Select and would benefit from an additional 35 days on feed to increase the likelihood of reaching the Choice grade, is helpful in determining a marketing decision. Ultrasound fat cover measurements are also useful to predict Yield Grade and the possibility of discounts and premiums.

Table 4 relates the results of combining ultrasound measurements (PFAT relating to quality grade and FAT relating to yield grade) with weight to make a decision on whether to market now or in 35 days. Compared with an experienced visual sorting technique that routinely receives carcass data after sorting decisions are made, the greatest advantage for ultrasound may have been identifying Yield Grade 2 cattle that had enough intramuscular fat to grade Choice. Overall, ultrasound-based marketing decisions differed from visual-appraisal-based marketing decisions approximately 10–20% of the time.

Ultrasound also identified Average Choice cattle very well. All animals in both years that were identified with ultrasound to be Average Choice were subsequently graded as Average Choice at harvest. There were also animals that graded Average Choice that were not identified as Average Choice with ultrasound. This may also be useful information if there are differences between marketing channels and their premiums available for Average Choice cattle.

Table 1. Adjustable data for feedlot marketing decision making.

Term	Definition
Discounting Factors	
OUTWT	Live weight at which discounts for a carcass that is too heavy are likely to occur
OUTFAT	Fat cover at which discounts for a carcass that is too fat (YG 4) are likely to occur
TOOLIGHT	Live weight at which discounts for a carcass that is too light are likely to occur
Optimizing Factors	
ACCWT	Live weight at which enough weight has been added to consider selling
ACCPFAT	Ultrasound percent intramuscular fat measure that corresponds to USDA Choice grade
ACCFAT	Ultrasound subcutaneous fat measure that corresponds to inflection point (fattening stage) of growth curve

Table 2. Decision structure for Iowa State University research beef cattle program endpoint determinations.

Decision order	Harvest group	Criteria met
1	1.0	WT > OUTWT or FAT > OUTFAT
2	2.0	WT < TOOLIGHT
3	1.9	WT < ACCWT and FAT < ACCFAT and PFAT < ACCPFAT
4	1.1	WT > ACCWT and FAT > ACCFAT and PFAT > ACCPFAT
5	1.8	WT < ACCWT and PFAT < ACCPFAT
6	1.2	WT > ACCWT and PFAT > ACCPFAT
7	1.3	WT > ACCWT and FAT > ACCFAT
8	1.7	WT < ACCWT
9	1.5	everything else (essentially only WT > ACCWT)

Table 3. Description of cattle represented within each harvest group.

Harvest Group	Description of the cattle
1.0	Cattle likely to receive discounts for being too heavy or too fat
1.1	Cattle that have reached acceptable levels of WT, FAT, and PFAT
1.2	Cattle that have reached acceptable levels of WT and PFAT
1.3	Cattle that have reached acceptable levels of WT and FAT
1.5	Cattle that have reached acceptable levels of WT
1.7	Cattle that have **not** reached acceptable levels of WT (may be acceptable FAT or PFAT)
1.8	Cattle that have **not** reached acceptable levels of WT and PFAT (may be acceptable FAT)
1.9	Cattle that have **not** reached acceptable levels of WT, FAT, and PFAT
2.0	Cattle that have **not** reached a weight likely to avoid discounts for the carcass being too light

Table 4. Differences in marketing decisions based on ultrasound assigned harvest groups vs. visually assigned harvest groups.

Total head	First Mktg head	Number sold ultrasound[a] vs. kept visual	Premium/ discount	Reason for premium or discount from ultrasound-based decision
2001 Marketing Season				
120	80	5	Prem	Sold as YG 2 instead of YG 3
		1	Prem	Sold as YG 3 instead of YG 4
		2	Disc	Sold as Select instead of Low Choice
		7	Prem	Sold as Low Choice instead of continuing to feed
2002 Marketing Season				
139	62	5	Prem	Sold as YG 2 instead of YG 3
		1	Prem	Sold as YG 3 instead of YG 4
		9	Prem	Sold as Low Choice instead of continuing to feed

[a] Ultrasound measurements were used to make the decision to sell the cattle. This column represents the cattle that were sold at first harvest (based on the ultrasound measurements) that would not have been sold at first harvest but rather 35 days later based on the visual appraisal system,