Growth and Development of Angus-Wagyu Crossbred Steers

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Summary

Serially scanning Angus-Wagyu crossbred steers with real-time ultrasound suggests the following conclusions:

- **Comparing real-time ultrasound measurements, including fat cover, percent intramuscular fat and rib eye area, with carcass measurements at harvest time suggests ultrasound measurements are accurate enough to be used as a body composition evaluation tool.**
- **Serial ultrasound measurements indicate that muscle deposition based on rib eye area occurred linearly from 772 to 1,406 pounds, and perhaps to a heavier weight than expected.**
- **Subcutaneous fat ultrasonic measurements suggest a slow linear increase in fat cover until the cattle weighed 1,100 lbs., and then fat cover increased at a much faster rate.**
- **Percent intramuscular fat in these unique Angus-Wagyu steers was equivalent to low choice at 772 pounds and continued at the same linear rate until the cattle were harvested.**
- **It is possible to produce cattle that have the genetic potential to produce carcasses with high levels of intramuscular fat while remaining relatively lean.**

Introduction

Value-based marketing and branded beef programs suggest the need to better understand and be able to predict body compositional changes and tissue deposition endpoints of feedlot cattle. The objective of this study was to evaluate the use of real-time ultrasound to serially scan and ultimately predict compositional differences in fat and lean deposition on a unique group of Angus-Wagyu steer calves. Rib eye area, fat cover and percent intramuscular fat measurements were predicted serially with real-time ultrasound during the feeding period and compared at harvest with carcass measurements and percent intramuscular fat determined chemically.

Materials and Methods

Nine Wagyu-Angus crossbred steer calves were fed for the Prima Corporation at the ISU Teaching Farm. The calves averaged 499 lbs. on November 20, 1996. The calves were started on a 50% concentrate diet and increased gradually up to an 80% concentrate corn-corn silage diet after being on feed 40 days. They were then increased to 85% concentrate over the next 30 days and remained on this diet until the last 75 days when the corn was increased to provide an 89% concentrate diet. Protein supplement was fed to meet the metabolizable protein requirement.

These steers were scanned serially with an Aloka 500V real-time ultrasound machine fitted with a 17 cm, 3.5 MHg transducer. Scanning began after the steers had been on feed 97 days and weighed 772 lbs. (February 25, 1997) and continued at 50-60 day intervals until a week before harvest when they weighed 1,502 lbs. (December 5, 1998). The cattle were scanned and weighed seven times during the feeding period; live weights and days on feed at each of the seven scanning dates are shown in Figure 1. The steers gained 2.65 lbs/day during the total 380 days on feed. They gained faster (2.81 pounds/day) during the first 190 days than they did the remaining 190 days (2.46 lbs/day).

At harvest, routine carcass measurements were obtained; hot carcass weight, fat cover and ribeye area were measured at the 12^{th} rib, and percent kidney, heart and pelvic fat and marbling score was determined to the nearest 10^{th} of a degree (i.e., Moderate^{20}). In addition a one-fourth inch thick facing of the rib eye muscle from each steer was collected and returned to the ISU Meat Laboratory for hexane extraction to determine percent intramuscular fat.

Results and Discussion

Table 1 relates the final ultrasound scan to the corresponding carcass measurements at harvest. The mean values and rank for fat cover and rib eye area indicate that the real-time ultrasound measurements were similar to carcass measurements. Fat cover measured on the carcass was 0.07 inches fatter than the ultrasound prediction, similar results have been observed in earlier studies, suggesting that on fatter cattle, ultrasound, usually underestimates the carcass measurement. Mean values for rib eye area were 15.1 and 15.0 for carcass and ultrasound respectively. Percent intramuscular fat ultrasound predictions are within parameters established in model development and reflect accurately an intramuscular fat level higher than most of the rib samples from cattle utilized in model development.

Figure 2 relates rib eye area development during the feeding period. Rib eye muscle growth was nearly linear when measured from 97 days until 344 days on feed, then reduced dramatically during the last 36 days. Perhaps the most interesting aspect of muscle growth was that it continued until the cattle weighed 1,400 pounds, considering these steers were neither heavy muscled nor large framed.

Figures 3 and 4 reflect fat deposition for two different fat depots on Angus-Wagyu cross steers. Figure 3 indicates

subcutaneous fat deposition evaluated by fat cover at the 12th rib; Figure 4 relates the level of intramuscular fat.

Subcutaneous fat increased at a rather slow linear rate during the first 272 days on feed (increasing from 0.20 inches to 0.37 inches from 97-272 days, respectively). During the remaining 108 days on feed fat deposition nearly doubled (increasing from 0.37 in. to 0.66). A very dramatic increase in the rate of subcutaneous fat deposition is depicted graphically by the change in slope in Figure 3.

Percent intramuscular fat shown in Figure 4 relates a rather linear increase in fat deposition after the steers had been on feed 139 days. It is also interesting to note that these steers had more than 4.00% intramuscular fat (equivalent to the low choice grade) in their rib eyes after 97 days on feed and only 0.2 inches of subcutaneous fat. This result would suggest that these cattle had the genetic potential to deposit high levels of intramuscular fat while remaining relatively lean (i.e., 6.84% intramuscular fat and 0.37 inches of subcutaneous fat).

Implications

Real-time ultrasound has the potential to be used as a tool to serially predict muscle and fat deposition changes during the feedlot phase of cattle production. Genetically these are cattle that had the potential to deposit intramuscular fat at a faster rate and at higher levels than typical feedlot cattle, while remaining relatively lean.

Table 1. Final ultrasound scan and corresponding carcass measurements.

Steer ID	Live Wt. lbs.	Carcass Wt. lbs.	[a]C-fat cover, in	[b]U-fat cover	C-REA, in^2	U-REA, in^2	C-% IMFat	U-% IMFat	Marbling Score	Quality Grade
6097	1495	976	0.85	0.70	14.8	13.1	09.08	07.79	SLAB 1330	Pr-
6111	1410	889	1.00	0.77	15.2	15.4	12.49	10.60	SLAB 1300	Pr-
6114	1450	942	0.65	0.66	13.8	15.9	06.92	07.18	SLAB 1300	Pr-
6121	1460	1003	0.40	0.42	15.5	14.3	09.28	08.91	SLAB 1330	Pr-
6127	1425	950	0.90	0.87	15.7	15.1	10.49	08.45	SLAB 1320	Pr-
6137	1440	915	0.65	0.59	14.9	14.8	08.79	06.85	MD 1290	Ch+
6146	1475	931	0.75	0.67	14.7	14.6	12.04	08.49	SLAB 1350	Pr-
6180	1420	921	0.80	0.54	14.3	15.2	07.80	07.93	SLAB 1310	Pr-
6246	1745	1117	0.60	0.72	17.4	16.3	07.48	07.49	MD 1280	Ch+
Means	1491	960	0.73	0.66	15.1	15.0	09.37	08.19	1312	

Figure 1. Mean weight of Angus-Wagyu cross steers at each scanning date.

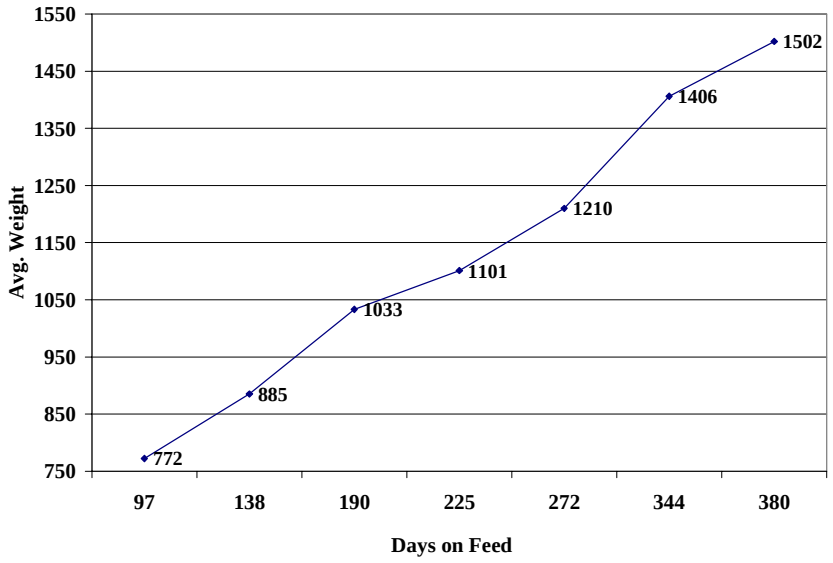

Figure 2. Ultrasound serial scan measurements for rib eye area.

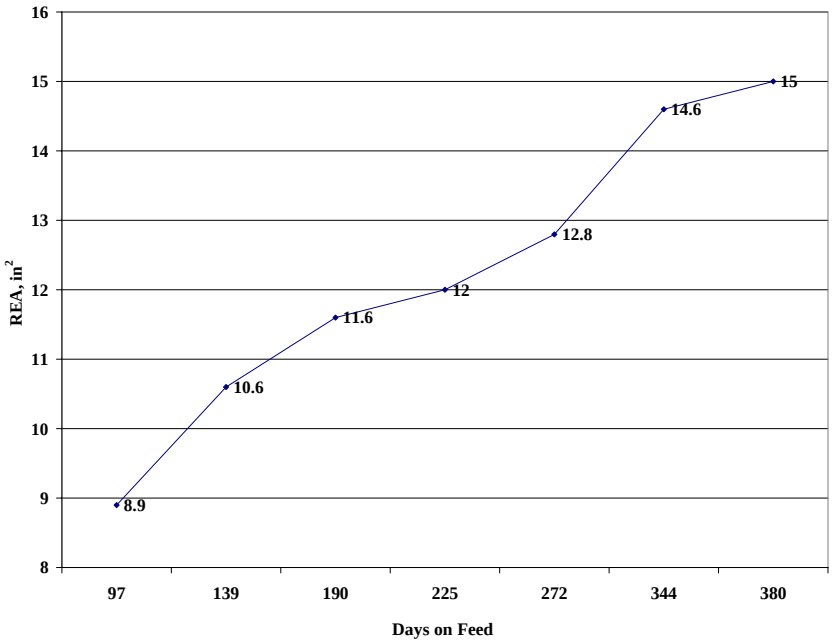

Figure 3. Ultrasound serial scan measurements for fat cover.

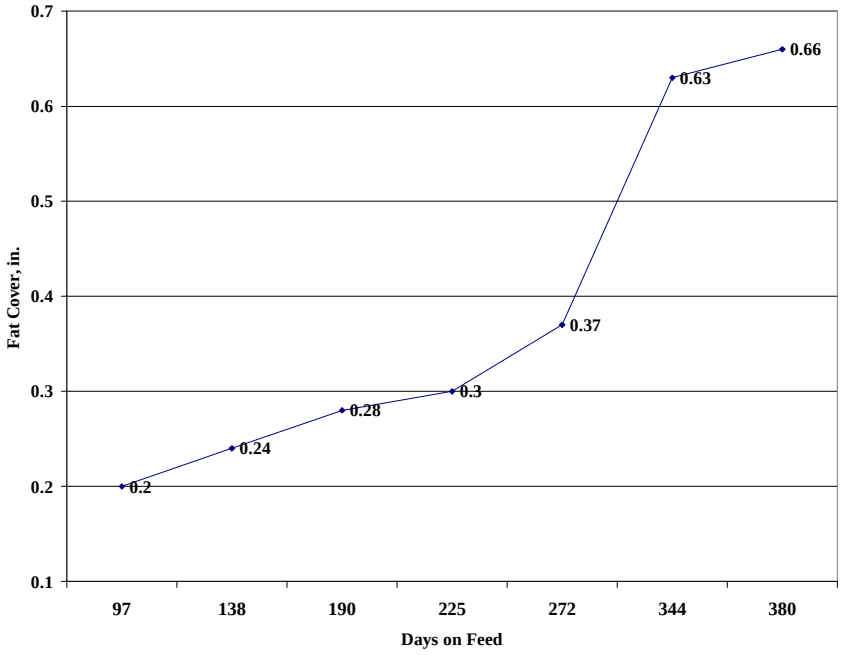

Figure 4. Ultrasound serial scan measurements for % intramuscular fat.