

A Report on Use of Ultrasound to Evaluate Differences in 1998 Tennessee Test Station Bulls

J. D. Gresham, F. D. Kirkpatrick, F. M. Hopkins, J. L. Sims and K. Thompson

**University of Tennessee
and
Middle Tennessee Bull Test Station**

INTRODUCTION

The Tennessee Bull Test Station at Middle Tennessee Experiment Station in Spring Hill, Tennessee was established in 1971. Since that time over 3500 bulls have undergone performance testing with 2500 being offered at public auction to Tennessee producers. These bulls have been normally evaluated on traits such as average daily gain, scrotal circumference and frame score along with a breeding soundness examination to determine fertility and breeding potential. In addition, usual performance data available from pedigree records are included with test results. Recently, real-time ultrasound has been employed to offer additional information such as rib fat at the 12th/13th rib, rib eye area and intramuscular fat. This report is intended to summarize the data from the 1998 Senior and Junior bull tests and to evaluate the relationship of ultrasound data to other objective measurements obtained at the end of the normal testing period.

EXPERIMENTAL PROCEDURES

A total of 135 bulls are represented in this report with 93 being from the senior test and 43 from the junior test. Senior bulls started the 112 day test on August 5, 1997 and ended on November 25, 1997. Junior bulls started on October 7, 1997 and finished on January 27, 1998. Included within these two age groups are six breeds; Angus (n = 112), Charolais (n = 5), Hereford (n = 6), Gelbvieh (n = 1), Brangus (n = 1) and Simmental (n = 6).

All bulls were weighed and measured for hip height at the beginning of the test (Day 00), at 56 days on test (Day 56) and at the conclusion of the test (Day 112). Average of two consecutive day weights were used as on-test (Day 00) and off-test (Day 112) weights. All bulls were immunized, dewormed and fed (12% crude protein) according to previously established protocol for the Tennessee Bull Test Station (Kirkpatrick, 1997). Ultrasound measurements for rib fat, rib eye area and intramuscular fat were accomplished at the end of the test (Day 112) using a Pie Scanner 200, equipped with an ASP-18 3.5 MHz linear array probe as described by Gresham (1996, 1997). Scrotal circumference measurement was as described by Coulter et al., 1975.

RESULTS AND DISCUSSION

Senior versus Junior Test

Table 1 presents the least squares means for selected variables by age group (senior versus junior).

Table 1. Least squares means for live animal and ultrasound traits by age group.

VARIABLE	AGE GROUP	
	SENIOR	JUNIOR
Final live weight, lb.	1279 ^a	1154 ^a
Age, days	414 ^b	371 ^b
Wt./day of age, lb.	3.09	3.11
Hip height, in.	53.2 ^c	52.5 ^c
Average daily gain, lb./day	4.24 ^d	4.00 ^d
Scrotal circumference, cm.	35.9 ^e	33.4 ^e
Rib fat, in.	0.26	0.29
Rib eye area, sq. in.	14.5	14.1
Rib eye area, sq. in. per cwt.	1.14 ^f	1.22 ^f
Intramuscular fat, %	2.78 ^g	2.15 ^g
Marbling EPD	0.092	0.077

Means with common superscript within each row are significantly ($P < .05$ or greater) different.

The differences noted in Table 1 between the senior bulls and junior bulls are expected since the senior bulls are older (approximately 43 days) when they enter the test. While the senior bulls are significantly heavier, taller and gain faster, it is interesting to note that there is no significant difference in weight per day of age, rib fat, rib eye area or marbling EPD's between the two groups. However when rib eye area is expressed per hundredweight live, the junior bulls have significantly larger (1.22 vs. 1.14) eye muscle areas. Intramuscular fat estimation for the senior bulls is significantly higher (2.78 vs. 2.15 %) than the junior bulls and this closely parallels the differences reported for marbling EPD's and may be partially attributed to their older age.

Breed comparison

Table 2 presents the least square means for most of the same variables listed in Table 1 but by breed. **WHILE ALL SIX BREEDS ARE LISTED, CONSIDERATION MUST BE MADE OF THE FACT THAT SOME BREEDS HAVE VERY LIMITED NUMBERS AND THESE FIGURES ARE NOT TO BE INTERPRETED AS REPRESENTATIVE OF THE BREED.**

Table 2. Least squares means for live animal and ultrasound measurements by breeds represented in Junior and Senior tests in 1997-98.

VARIABLE	BREED					
	ANGUS (n = 112)	CHAROLAIS (n = 5)	HEREFORD (n = 6)	GELBIEH (n = 1)	BRANGUS (n = 1)	SIMMENTAL (n = 10)
Final live weight, lb.	1285 ^a	1161 ^b	1176 ^b	1199 ^b	1195 ^b	1287 ^a
Hip height, in.	51.8 ^c	52.6 ^c	51.2 ^c	53.3 ^c	54.2 ^c	54.0 ^d
Average daily gain, lb./day	4.36 ^e	3.95 ^f	3.79 ^f	4.06 ^f	4.41 ^f	4.14 ^f
Scrotal circumference, cm.	35.0	34.1	34.0	36.8	32.2	35.9
Rib fat, in.	0.41 ^g	0.24 ^h	0.41 ^g	0.09 ⁱ	0.22 ^h	0.27 ^h
Rib eye area, sq. in.	14.3 ^j	14.4 ^j	12.4 ^{j,k}	16.5 ^j	12.4 ^j	15.7 ^{j,l}
Rib eye area, sq. in per cwt.	1.12	1.24	1.06	1.40	1.04	1.23
Intramuscular fat, %	4.14 ^m	2.20 ^{m,n}	2.33 ^{m,n}	2.33 ^{m,n}	1.69 ⁿ	2.10 ^{m,n}

Means within each row with superscripts not containing a common letter are significantly ($P < .05$ or greater) different.

Because of the limited numbers for most breeds, any detailed discussion of significance and comparisons of data presented in Table 2 would be unfair. However, certain trends are evident and reflect biological differences that might be expected with the represented breeds. The Angus and Simmental bulls were significantly heavier off-test than the other breeds with the Charolais bulls being the lightest. The continental breeds are taller at the hip and might be expected with the later maturing, larger framed cattle typical of those breeds. There were small differences in performance as represented by average daily gain with gains in excess of 4.0 lb/hd/day except for the Charolais and Hereford representatives being lower than the other breeds. There was no significant difference in scrotal circumference among the six breeds represented in these two test groups.

Evaluating the ultrasound data across the breed groups reflects some significant differences in composition of the bulls. Two breeds, Angus and Hereford were significantly fatter than all other breeds with both breeds averaging 0.41 inches rib fat at the 12th/13th rib. Also, the Gelbvieh bull measured 0.09 inches of rib fat after 112 days on test, however only one bull is represented in this report. The continental breeds (Gelbvieh, Charolais and Simmental) averaged larger ribeye areas (15.5 sq. in.) while the Angus bulls averaged 14.3 sq. in. and the six Hereford and one Brangus bull had 12.4 sq. in. rib eye areas. Intramuscular fat percentage estimation by ultrasound found the Angus to have the highest amount of intramuscular fat with the Brangus being the lowest (only one sire represented).

Ultrasound and EPD's

While ultrasound is a commonly used tool to estimate rib fat, rib eye area and intramuscular fat in potential breeding sires, there still might be hesitation on some breeders part of use such data. Of the 112 Angus bulls on test in both age groups, a total of 59 of these sires had marbling EPD's available from the Angus Sire Summary. Statistical analysis produced a simple correlation of 0.44 ($P < .0005$) between ultrasound intramuscular fat (utilizing the chute-side analysis system available in the Pie Scanner) and marbling EPD's. This would indicate that the ultrasound data from the sires off test is highly representative of EPD's generated by earlier progeny testing of ancestors. If this relationship continues to improve in future evaluation programs, producers could then feel confident in using ultrasound as a selection tool to identify genetically superior sires for marbling.

Table 3. Simple correlation coefficients for selected traits.^a

VARIABLE	1	2	3	4	5	6	7	8
Final live weight, lb. (1)	1.00	.51	.49	.50	.26	.33	.30	.09
Hip height, in. (2)		1.00	.22	.32	-.19	.22	-.14	.27
Average daily gain, lb./day (3)			1.00	.27	.08	.22	.26	.06
Scrotal circumference, cm. (4)				1.00	.08	.11	.16	.06
Rib fat at 12 th rib, in. (5)					1.00	-.11	.43	.10
Rib eye area, sq. in. (6)						1.00	-.07	-.21
Intramuscular fat, % (7)							1.00	.44
Marbling EPD (8)								1.00

^aCorrelation coefficients of 0.17 or greater are statistically significant ($P < .05$ or greater) for all traits except Marbling EPD where significance level is 0.25 ($P < .05$ or greater).

Table 3 provides simple correlation figures for selected traits. Final live weight has a significant positive correlation on all measured traits. Hip height was positively correlated with all traits except rib fat and intramuscular fat where it was negative indicating taller cattle were leaner and had less intramuscular fat. Scrotal circumference was positively correlated with growth traits such as final live weight, hip height, average daily gain but was not statistically correlated with rib fat and rib eye area. Bulls with larger scrotal circumference also were higher in intramuscular fat. Intramuscular fat was highly correlated with rib fat for these test bulls with a negative, but non-significant correlation with rib eye area.

Marbling EPD correlations are within the 59 head of Angus bulls only. Marbling EPD within the Angus bulls is positively and significantly correlated with hip height and intramuscular fat. No other measurements are correlated with the marbling EPD value. These results would suggest that breeders can select for larger framed Angus bulls and still have high marbling potential. Also, it is interesting to note no correlation between marbling EPD and rib fat. A positive correlation was noted between scrotal circumference and intramuscular fat (and Marbling EPD) but the correlation was statistically non-significant in this study.

IMPLICATIONS

While this report serves to only present the observed differences in the junior and senior bulls for one year, several questions are raised that deserve future and more detailed study for bulls that have been through performance test stations. One point of particular interest is the correlation with intramuscular fat and growth and how this relates to carcass marbling EPD data. If ultrasound is to be an effective tool in selecting breeding sires from test stations, the intramuscular fat figure as generated by ultrasound must be representative of the genetics of the bull and not a factor of management or performance in the station. However, it is logical to assume that the test station allows bulls to express their genetic potential, and if this is so, adds more creditability to test station data.

LITERATURE CITED

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