2004

Body Composition Changes in Bulls from Weaning Age to Yearling Age: Muscle Fat Deposition

Gene H. Rouse
Iowa State University

Richard G. Tait Jr.
Iowa State University, rtait@iastate.edu

M. Anderson
Iowa State University

Abebe Hassen
Iowa State University

Body Composition Changes in Bulls from Weaning Age to Yearling Age: Muscle Fat Deposition

Abstract
With the advent of real-time ultrasound, repeated measures of body composition changes, such as fat cover, rib eye area, and percentage intramuscular fat have greatly added to our understanding of beef cattle growth and development.

Keywords
Animal Science

Disciplines
Agricultural Science | Agriculture | Animal Sciences

Body Composition Changes in Bulls from Weaning Age to Yearling Age: Muscle Fat Deposition

G. H. Rouse, professor
R.G. Tait, Jr., graduate assistant
M. Anderson, graduate assistant
A. Hassen, associate scientist
Department of Animal Science

Introduction

With the advent of real-time ultrasound, repeated measures of body composition changes, such as fat cover, rib eye area, and percentage intramuscular fat have greatly added to our understanding of beef cattle growth and development.

Materials and Methods

The following discussion relates serial scan information on 315 registered Angus bull calves born in 1999, 2000, or 2001 as a part of the Iowa State University beef cattle breeding project, Rhodes, Iowa. Beginning in December, bull calves were put on test, scanned with real-time ultrasound, weighed, and measured approximately every 28 days until the bulls were a year of age or older, resulting in 6 or 7 scans on each bull.

Results and Discussion

Figure 1 indicates the increase in weight from weaning (600 lbs) to yearling (1,175 lbs) for 315 bull calves. Weight gain/day is shown in Figure 2. Average daily gain from weaning to 320 days of age was more than 3.5 lbs/day, then declined as bulls were fed to 400 days of age. Subcutaneous fat thickness (waste fat) (Figure 3) increased as weight increased from weaning, 0.10 in., to yearling, 0.32 in. The rate of change in fat thickness (Figure 4) also increased as the bulls approached yearling weight. This indicates that more energy is available for fattening as the bulls approached a year of age. Figure 5, a surface plot of fat thickness as a function of age and weight, indicates weight is the significant factor influencing fat thickness increases.

Rib eye area, Figure 6, increased from weaning (7.5 inches^2) to yearling age (12.5 inches^2). The rate increase in rib eye area, however, declined as bulls increased in weight (Figure 7). This response compared with the increased rate of subcutaneous fat deposition, Figure 4, reflects a classic growth and development principle of tissue deposition. As muscle deposition slows down, enough nutrients are available to increase fat deposition. The three dimensional surface plot for rib eye area, Figure 8, reflects the importance of increased weight on increases in rib eye area, a similar response to the increase in fat cover shown in Figure 5.

Figure 9 relates the increases in percentage of intramuscular fat (taste fat) from weaning (2.5%) to yearling age (3.8%) for the 315 bull calves. The rate of change/pound of gain for percent intramuscular fat was very similar from weaning to yearling age, shown in Figure 10 (the line is nearly linear from 280 days to 400 days of age).

The three dimensional plot (Figure 11) suggests that increases in intramuscular fat are more dependent on age than weight. This difference in deposition pattern of intramuscular fat when compared with subcutaneous fat suggests that waste and taste fat are independent traits.

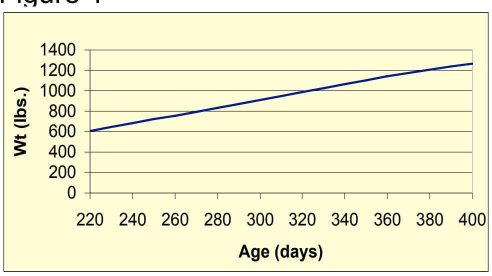
These results suggest how muscle, subcutaneous fat, and intramuscular fat are deposited from weaning age to yearling age. How might these results be explained?

- Tissue maturity—muscle matures earlier than fat in the growth process and has nutrient priority over fat when muscle is making maximum growth. Cattle normally make maximum growth, rate/day, when muscle is being deposited at the maximum rate. Why? Muscle has a much higher water content than fat, therefore, it requires less nutrients to deposit a pound of muscle than a pound of fat.

- 10 to 1 Concept—during the fattening process, 10 pounds of waste fat (subcutaneous, seam and internal fat) is deposited for each pound of taste fat, (intramuscular fat). This concept may partially explain why waste fat reaches maximum deposition after most of the muscle has been deposited and taste fat is more dependent on age than weight. There may be enough energy available for taste fat to be deposited each day. This may be controlled by the genetic potential for intramuscular fat deposition.

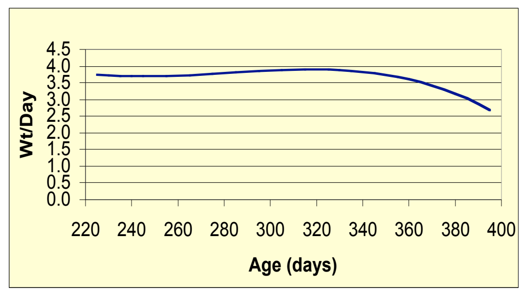
Developing expected progeny difference values (EPDs) for these three independent traits: rib eye area, subcutaneous fat, and intramuscular fat allows all segments of the industry to develop functional cattle and fit unique consumer driven carcass targets.

Figure 1



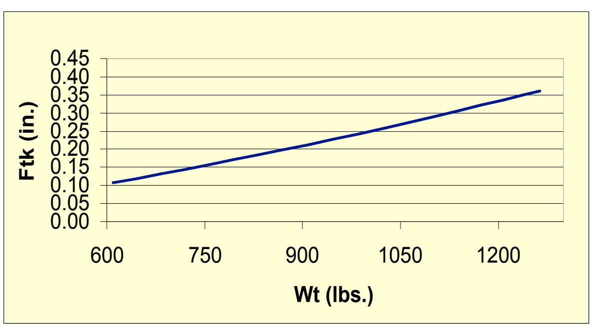
Age-weight relationship r = 0.92

Figure 2



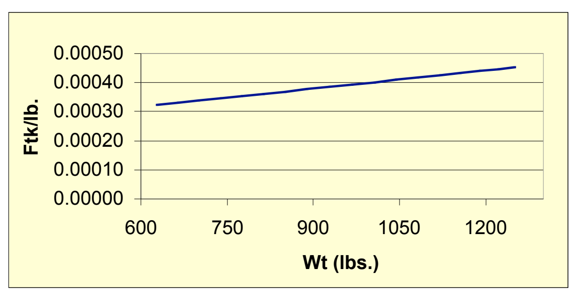
Average Daily Gain

Figure 3



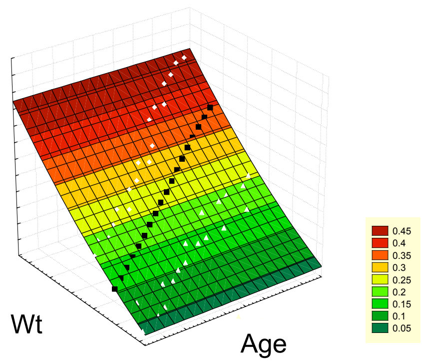
Mean 12th - 13th Rib Fat Thickness

Figure 4



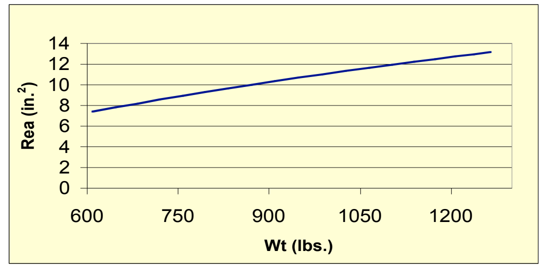
Fat Thickness Rate of Change per Pound of Gain

Figure 5



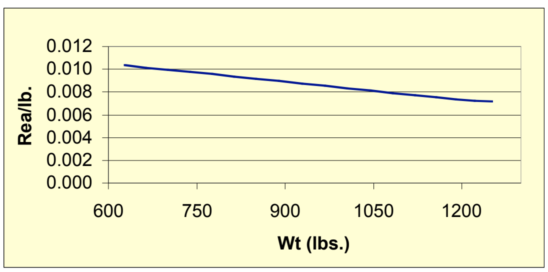
Fat thickness three dimensional surface plot as a function of age and weight.

Figure 6



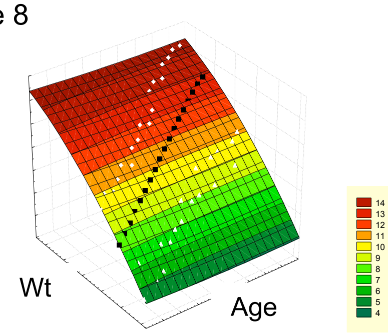
Mean Rib Eye Area

Figure 7



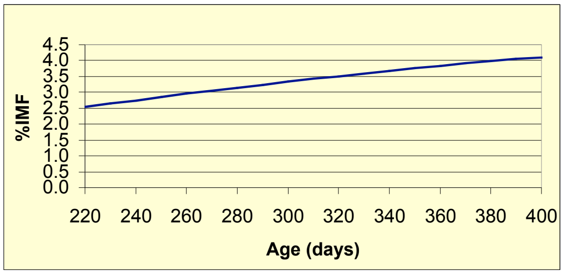
Rib Eye Area Rate of Change per Pound of Gain

Figure 8



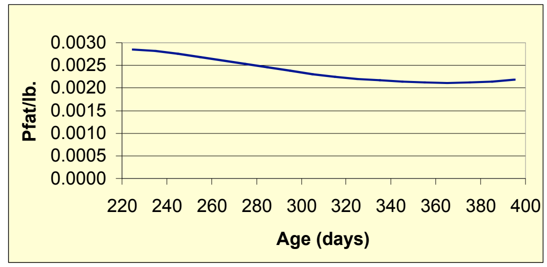
Rib eye area three dimensional surface plot as a function of age and weight.

Figure 9



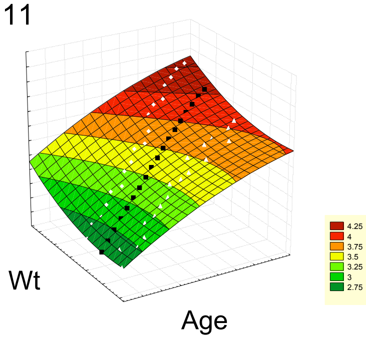
Mean Percent Intramuscular Fat

Figure 10



Percent Intramuscular Fat Rate of Change per Pound of Gain

Figure 11



Percent intramuscular three dimensional surface plot as a function of age and weight.