# Body Composition Changes in Bulls from Weaning to Yearling Part I — Muscle, Waste Fat and Taste Fat Deposition

**A. S. Leaflet R1822**

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**Summary**

**These results suggest how muscle, subcutaneous fat and intramuscular fat are deposited from weaning to yearling. 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 then a pound of fat.**

- **10-1 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 keep ticking along each day - determined by the genetic potential for intramuscular fat.**

**Developing 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 by "managing fat" fit unique consumer driven carcass targets.**

## Introduction

What do we know about beef cattle growth?
What determines how beef cattle grow and develop?

How do we get to a desired end product — a yearling bull, a replacement female or a fed steer. How do we evaluate that end product? Meat scientists say "at a constant weight", animal breeders say "at a constant age". Maybe they are both right, maybe they are both wrong.

When do calves between weaning and a year of age deposit the most muscle, the most subcutaneous fat? Is intramuscular fat deposition and marbling related directly to subcutaneous fat? These are all questions I have heard cattleman, beef cattle industry personnel and animal scientists ask during the past 30 years. Answers to these questions have been difficult to obtain.

Previously most of these questions could only be answered by serial slaughter techniques that are very limited in size and very expensive. More recently with the advent of real-time ultrasound to measure repeatedly on the same animals, measures of body composition changes, such as fat cover, rib eye area, and percent intramuscular fat has greatly added to our understanding of beef cattle growth and development. The following discussion relates serial scan information on 315 Registered Angus Bull calves born either in the spring of 1999, 2000 or 2001 as a part of the Iowa State University Beef Cattle breeding project, Rhodes, Iowa.

## Materials and Methods

Beginning in December, bull calves were put on a gain 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 6-7 scans on each bull.

ISU Scan Team

Images collected are shown below including: a rump image (Image 1), a 12th and 13th rib cross sectional rib eye image (Image 2), and a longitudinal percent intramuscular fat image (Image 3).

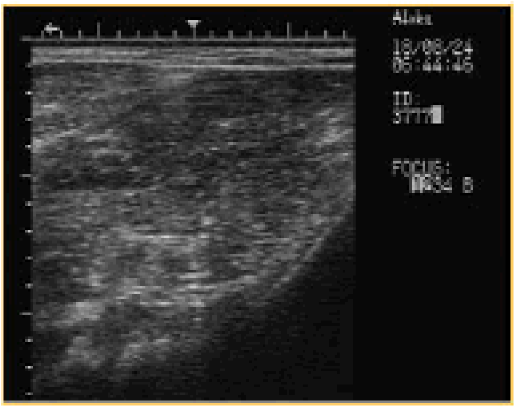



**Image 1**

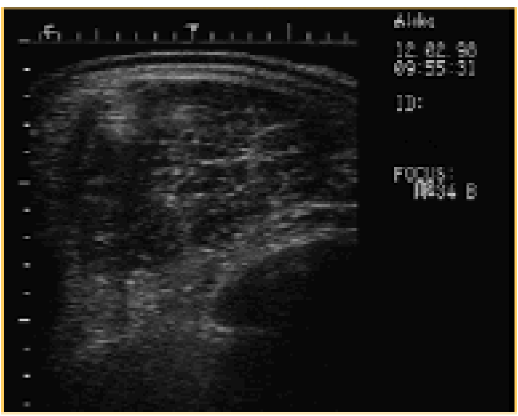



**Image 2**

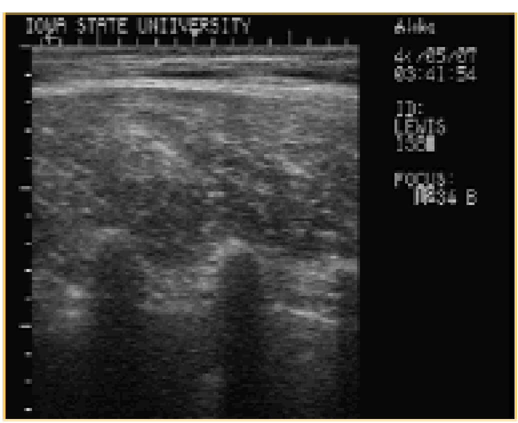



**Image 3**

**Results and Discussion**

Figure 1 indicates the increase in weight from weaning (600) to yearling (1175) for 315 bull calves. Weight gain per day is shown in Figure 2. Mean gain from weaning to 320 days of age was over 3.5 lbs/day, then declined as bulls were fed to 400 days of age.

**Figure 1. Age-weight relationship r = 0.92.**

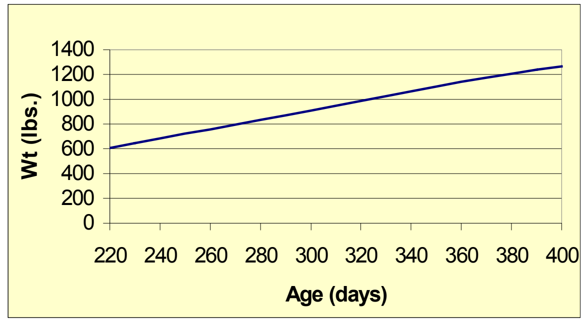
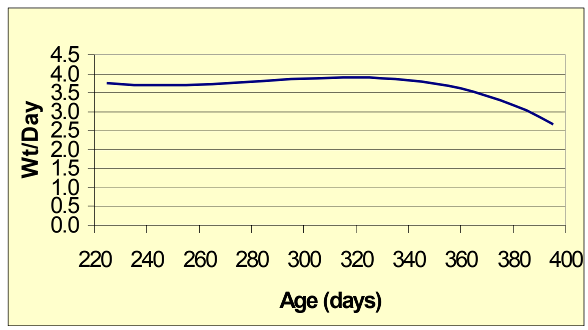
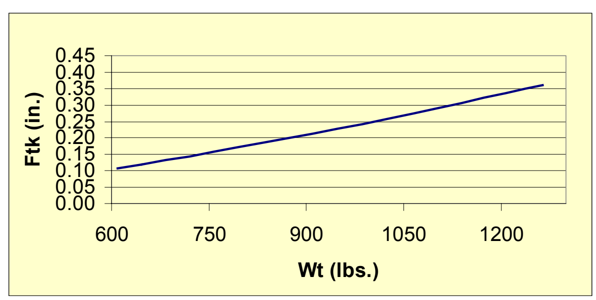



**Figure 2. Average Daily Gain.**




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.

**Figure 3. Mean 12th-13th Rib Fat Thickness.**




Rib eye area (Figure 6) increased from weaning 7.5 inches$^2$ to 12.5 inches$^2$ at yearling time. The rate increase in rib eye area, however, declined as bulls increased in weight (Figure 7). This response compared to the increased rate of

**Figure 4. Fat thickness rate of change per pound of gain.**

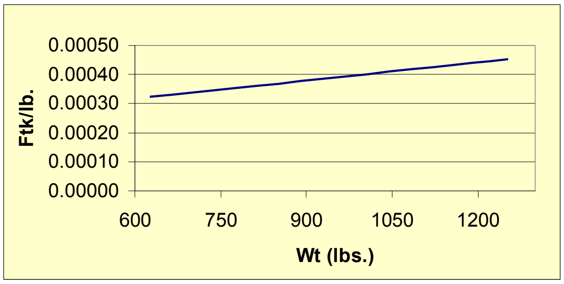
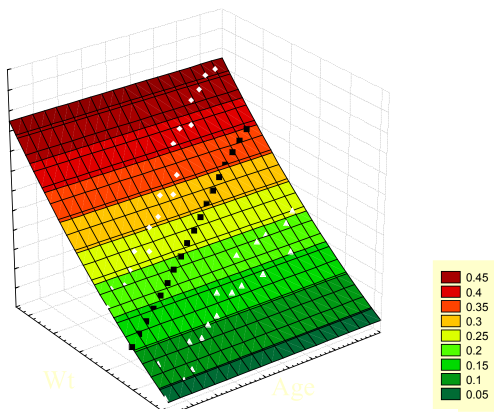
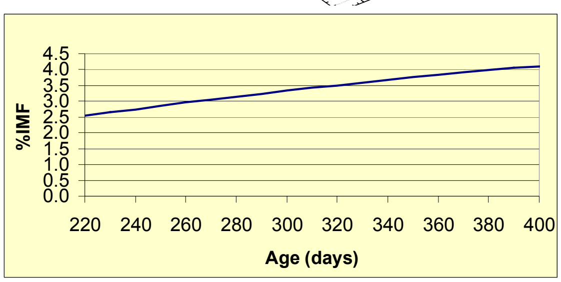



**Figure 5. Fat thickness three dimensional surface plot as a function of age and weight.**

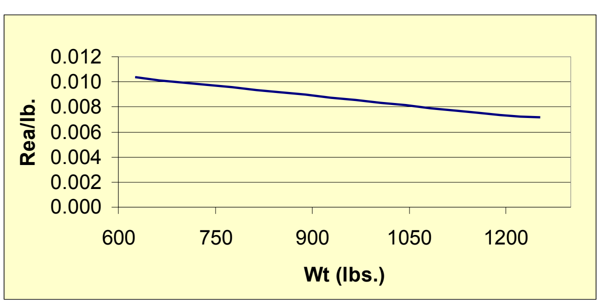



***Mean Percent Intramuscular Fat***

***Mean Rib Eye Area***

**Figure 7. Rib eye area rate of change per pound of gain.**




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 8. Rib eye area three dimensional surface plot as a funciton of age and weight.**

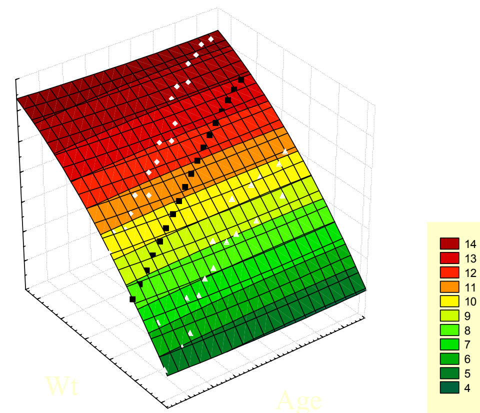
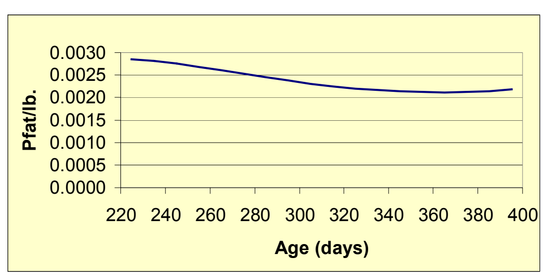



Figure 9 relates the increases in percent intramuscular fat, taste fat, from weaning 2.5% to 3.8% at yearling time for the 315 bull calves. The rate of change per pound of gain for percent intramuscular fat was very similar from weaning to yearling age (Figure 10). The line is nearly flat from 280 days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

**Figure 9. Mean percent intramuscular fat.**

**Figure 10. Percent intramuscular fat rate of change per pound of gain.**



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 to subcutaneous fat would suggest that waste and taste fat are independent traits.

**Figure 11.  Percent intramuscular three dimensional surface plot as a function of age and weight.**