

Heifer Fundamentals

The primary focus of rearing heifers is to grow and develop heifers as quickly and cost effectively as possible without negatively influencing animal health and lifetime productivity. When developing heifer management plans, it is important to understand key management concepts such as heifer growth, mammary development, puberty, calving age, and body weight at calving.

How Heifers Grow

Heifer raisers commonly think of animal growth in terms of live body weight gain. Biologically speaking, five things contribute to an animal's weight gain: water, mineral, protein, fat and gut fill.

The heifer regulates the amount of water and mineral deposited in the body; therefore, it is not easily affected by management. Gut fill is simply the amount of feed and urine in the heifer's body at any given point in time and its weight does not represent the heifer's true weight gain or growth. Variations in gut fill between two weighing times, especially if measured too close in time, can misrepresent the growth of a heifer. This leaves two factors of growth—protein



and fat deposition—where the management of a heifer influences growth and ultimately the body composition of the heifer.

Protein is the principal component of lean tissue such as muscle, organs, brain, etc. In a typical dairy replacement, body protein deposition is higher in young heifers (around 100 to 200 pounds) and decreases as the heifer grows and matures (around 1,200 to 1,300 pounds). The relationship between body protein deposition and the body weight of Holstein heifers is presented in Figure 6-1. At approximately three years of age the dairy heifer (cow) reaches chemical maturity and protein can no longer be deposited in the body for growth. In contrast, young heifers deposit less fat but, as the heifer grows and matures, body fat deposition increases. The relationship between body fat deposition and the body weight of Holstein heifers is presented in Figure 6-2.

This relationship between body protein and fat deposition plays an important role in the nutritional management of heifers. For example, heifers fed diets containing enough energy to support 2.2 pounds of growth per day will actually deposit body protein at a faster rate when compared to heifers growing at 1.75 pounds per day. However, the heifers grown at 2.2 pounds per day will deposit body fat at an even faster rate than the heifers gaining 1.75 pounds per day (See Figures 6-1 and 6-2). This is a key management concept of growing heifers because, in general, heifers raised at higher rates of gain will contain more body fat at any given body weight than heifers raised at slower rates of gain (Figure 6-3). Because body fat can have negative and positive effects on lactation performance, raising heifers at proper growth rates assures not only proper body weights at first calving, but also proper body condition.

Mammary Development

The mammary gland (udder) continuously develops during a heifer's growth and development. However, during two key periods the rate of growth of the heifer's mammary gland increases. These more critical periods of mammary development occur prior to puberty (three to eight months of age) and immediately prior to calving. Hormones associated with calving regulate mammary development immediately prior to calving, thereby limiting the effects of management. In contrast, numerous research studies have demonstrated that high-

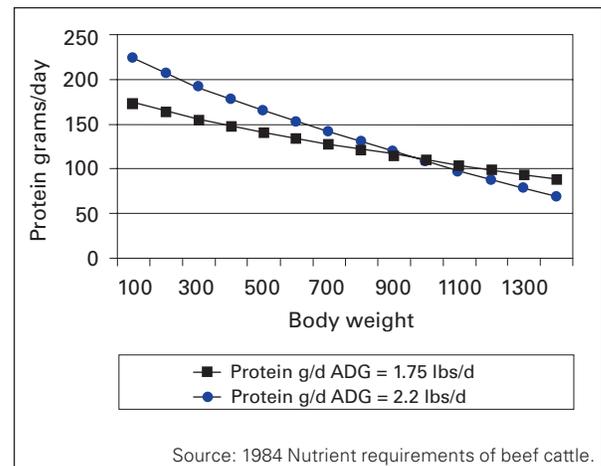


Figure 6.1. Body protein deposition.

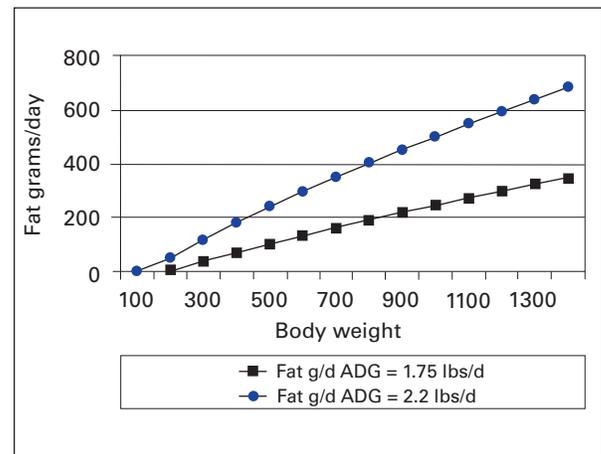


Figure 6.2. Body fat deposition.

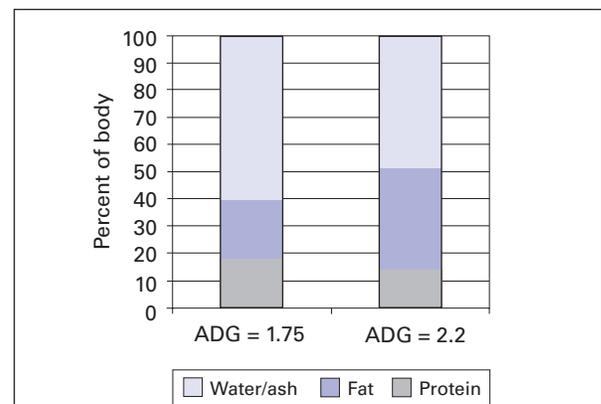


Figure 6.3. Heifer body composition. A heifer's percent body fat increases with average daily gain.

energy diets and accelerated growth prior to puberty may impair mammary development, resulting in reduced first lactation milk yields and sometimes reduced lifetime milk yields.

While some basic concepts and biological mechanisms of pre-pubertal mammary development are known, specific heifer management programs that maximize mammary development do not exist. To date, only general guidelines regarding pre-puberty growth rates for heifers are available. Recent research suggests pre-pubertal Holstein heifers can grow at rates of up to 1.9 to 2.0 pounds per day without major negative effects on mammary development or future milk yield. Unfortunately, little information exists for other dairy breeds.

It should be noted that, while excessive pre-puberty growth rates have been demonstrated to reduce mammary development and future milk yield, the pre-pubertal growth rate of any individual heifer poorly predicts the effect on her mammary development and her future performance. Therefore, pre-puberty management programs and concerns apply to groups of heifers rather than individual heifers.

Body Weight Defines Puberty

Puberty occurs when heifers start their reproductive cycle and biologically can become pregnant. The onset of puberty occurs when heifers reach 50 to 55 percent of their mature weight. In Holstein and Brown Swiss heifers this occurs at approximately 700 pounds. Smaller dairy breeds may reach puberty at 500 to 600 pounds.

For management purposes, body weight is used to define the onset of puberty. However, first estrous cycles often occur at different body weights for individual heifers. Because heifers are not of sufficient size to breed until they reach 60 to 65 percent of their mature weight, size variation at the onset of puberty is usually not a major concern. Most heifers reach puberty by 10 months of age and have gone through three to five estrous cycles prior to their first breeding.

Calving Age

Extensive research, based on biological and economic factors, has defined proper calving ages for dairy replacement. For large-breed heifers, the optimum calving age is 22 to 24 months. Smaller breeds that mature faster, such as Jerseys, Ayrshires

| Calving Age (months) | Percent of First Lactation Milk Production Expected |
|----------------------|---|
| 20 | 87 |
| 21 | 93 |
| 22 | 96 |
| 23 | 98 |
| 24 | 100 |
| 25 | 101 |
| 26 | 101 |
| 27 | 100 |
| 28 | 100 |
| 29 | 98 |
| 30 | 97 |

Source: Compiled by P.C. Hoffman, University of Wisconsin, 2003.

and Guernseys, can successfully calve at 22 to 23 months of age.

Production data research (Table 6-1) suggests calving heifers at 23 to 24 months of age is optimal for first lactation milk yields. Dairy replacement heifers do have the potential to calve at 19 to 21 months of age, which can lower rearing costs. However, heifers calving at young ages may experience dystocia, metabolic disorders, and inconsistent lactation performance, which can limit lifetime profit. Calving dairy heifers at ages younger than 22 to 24 months is possible but requires intensive management programs.

Body Weight at Calving

Hitting target body weights at calving is important as it helps reduce dystocia and supports high levels of feed intake and milk production after calving. For Holsteins, a post-calving weight of 1,250 pounds is ideal. The effect of calving body weight on Holstein heifers' first lactation milk yield is presented in Figure 6-4. Body weight at first calving of replacement heifers can be defined in one of three ways:

1. Body weight prior to calving
2. Body weight after calving
3. First lactation body weight

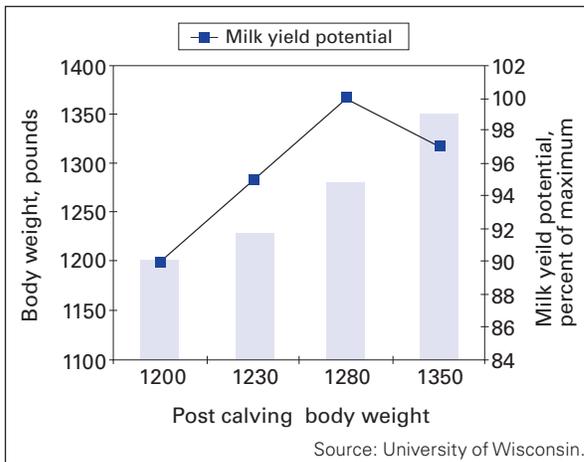


Figure 6.4. Effects of calving weight on first lactation milk yield. Post-calving weights of approximately 1,280 pounds optimize milk yield potential.

A listing of desired body weights of heifers prior to calving, after calving and during first lactation is presented in Table 6-2.

It should be remembered that genetics plays a role in body weight of heifers at first calving. For the Holstein breed it is estimated that genetics accounts for 75 pounds of variation of body weight at first calving. A more detailed discussion of heifer body weights and skeletal measurements by age can be found in Chapter 12 Heifer Management.

| Breed | Desired body weights at first calving. | | |
|-------------------|--|------|-----------|
| | Time of Measurement | | |
| | Prior | Post | Lactation |
| | pounds | | |
| Holstein | 1400 | 1260 | 1200 |
| Brown Swiss | 1375 | 1240 | 1180 |
| Ayrshire | 1240 | 1120 | 1070 |
| Guernsey | 1175 | 1050 | 1010 |
| Jersey | 900 | 810 | 775 |
| Milking Shorthorn | 1300 | 1170 | 1120 |

Source: Compiled by P.C. Hoffman, 2003.