Babcock Institute for International Dairy Research and Development

University of Wisconsin-Madison

Dairy Essentials

HEIFER RAISING—WEANING TO CALVING
34) GROWTH RATE

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IMPORTANCE OF GROWTH RATE

Heifer growth rate is an indicator of management level. Feeding, housing and other management needs are constantly changing between birth and first calving. Heifer growth should be monitored for multiple reasons:

- To avoid delays in sexual maturity and first calving due to slow growth;
- To determine whether heifers are overfed or underfed;
- To get "ideal" body weight at first calving, thereby minimizing calving problems.

DESIRABLE GROWTH RATE AND AGE AT FIRST CALVING

Figure 1 shows the desirable average daily weight gain and age at first calving under intensive management practices in temperate countries.

Short rearing periods are desirable primarily from economic and genetic standpoints. The advantages of an enhanced growth rate and an age at calving of 24 months (instead of 36 months for example), include:

- Quicker return on capital investment;
- Reduction in variable costs (labor);

Breed	Birth weight (kg)	Breeding		Calving		Average daily gain (kg)	Adult weight (kg)
		Weight (kg)	Age (mo.)	Weight (kg)	Age (mo.)		
Holstein, Brown Swiss	40-45	360-400	14-16	544-620	23-25	0.74	650-725
Guernsey, Ayrshire	35-40	275-310	13-15	450-500	22-24	0.60	525-580
Jersey	25-30	225-260	13-15	360-425	22-24	0.50	425-500

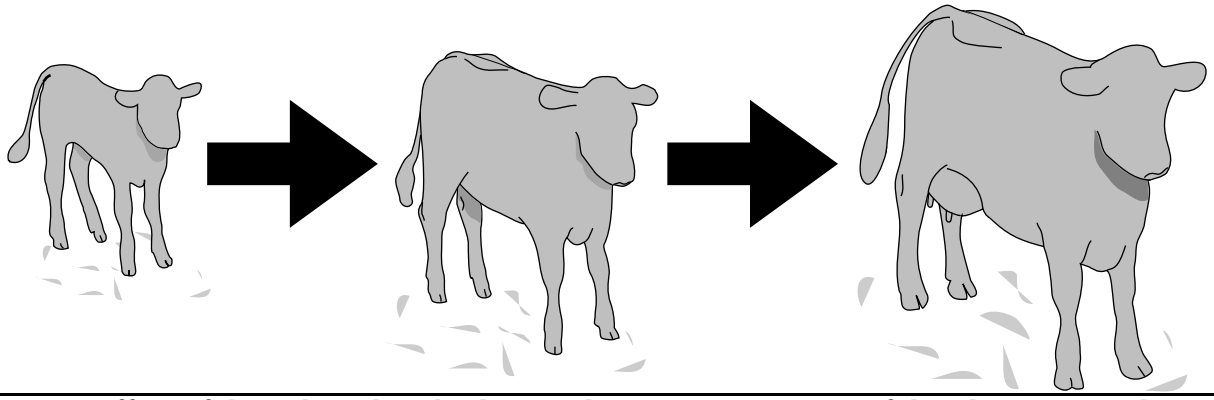

Figure 1: Effect of dairy breed on body weight at various stages of development and overall desirable growth rate of heifers

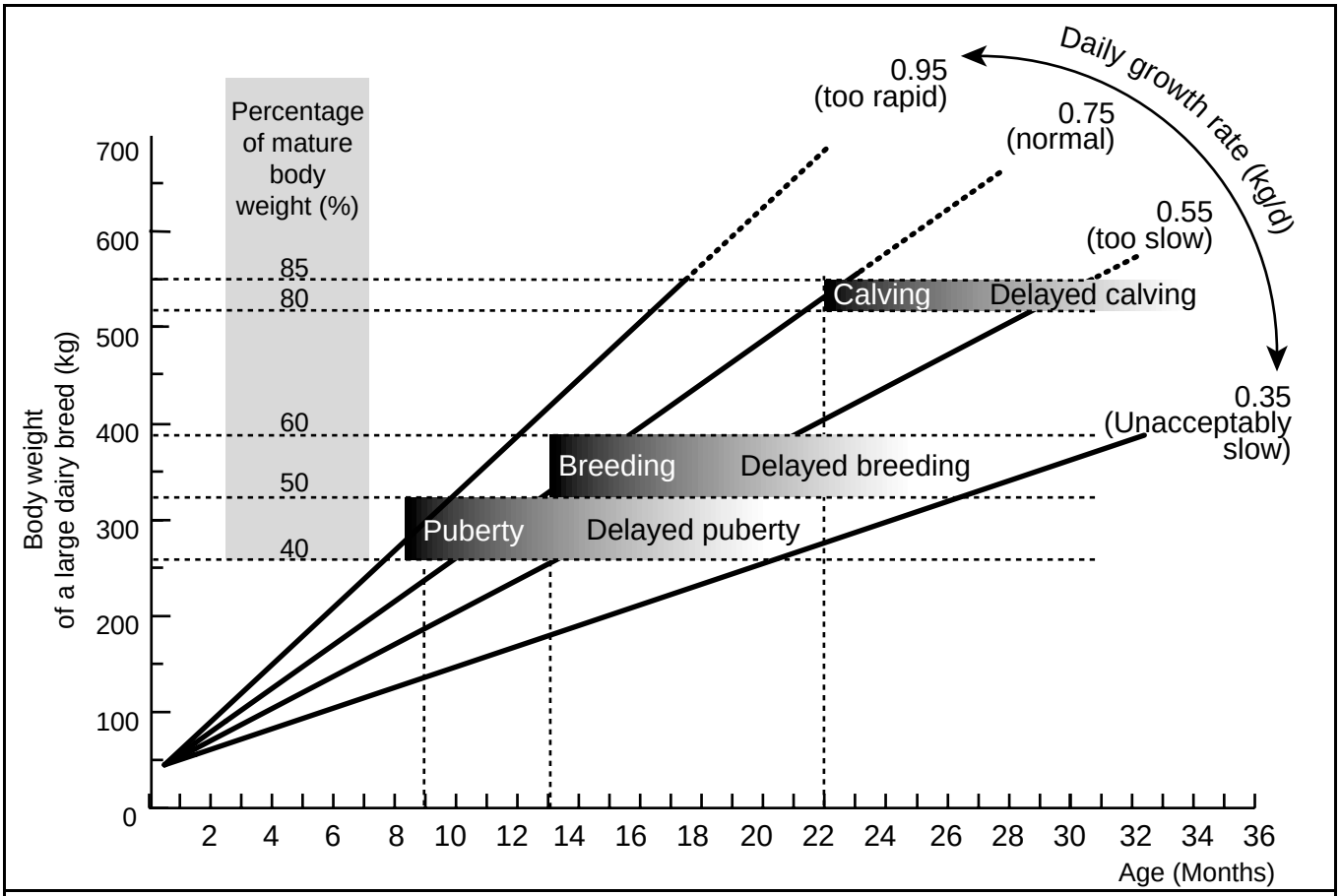

Figure 2: Heifer growth rate and reproductive performances

- Reduction in number of heifers required to maintain herd size;
- Increased lifetime production;
- Quicker genetic gain in the herd;
- Reduction in total amount of feed needed from birth to calving.

Difficulties or disadvantages associated with fast growth rates that reduce the number of months to first calving, from 24 months to 20 months for example, include:

- Need for higher quality forage and concentrate feed;
- Need for higher management skills;
- Greater risk of difficult calving if growth rate is not properly monitored;
- Greater risk of feeding a diet that may adversely affect milk production.

When high quality feeds are difficult to produce, rearing heifers with abundant, low quality feeds may result in slow growth rates and delayed first calving, but may still be the most economical rearing strategy.

Growth rate and sexual maturity

Sexual maturity of heifers depends more on body weight than on age. Thus growth rate considerably influences age at puberty and ultimately age at first calving. Heifers may not reach puberty before 18 or 20 months of age when they grow slowly (<0.35 kg/d). However, puberty may occur before nine months of age when heifer growth is accelerated (>0.9 kg/d). As depicted in Figure 2, puberty occurs when heifers weigh between 40 and 50% of mature body weight, regardless of age. Breeding should occur when heifers reach 50-60% of mature body weight (14-16 months of age). Growth rate should be sustained during pregnancy such that heifers weigh 80-85% of mature body weight at first calving.

Body weight and calving problems

Calving problems are more common at first calving than any other calving. First-calf heifers may have a difficult calving for many reasons that are related to their development or to the newborn's development. In general, difficult calving is due to one of, or a combination of, the following:

- The newborn calf is large:
  —Because of its genetics;
  —Because it is overdue;
- The heifer is underdeveloped and the pelvic area is too narrow relative to the size of the calf;
- The heifer is overweight and excessive adipose tissue interferes with normal calving.

To minimize calving difficulty of first-calf heifers, it is recommended that the producer:

- Choose artificial insemination sires that present only a small percentage of calving difficulty (< 8%);
- Adjust heifer growth rates to achieve 80 to 85% of adult body weight at the time of first calving;
- Avoid obesity (fat heifers) or emaciation (thin heifers) at calving.

Body weight and first lactation yield

There is a strong positive relation between body weight at first calving and first lactation milk yield. This relationship does not necessarily mean that genetically larger heifers are more desirable—what is desirable is that heifers are sufficiently developed at calving.

In the United States, Holstein heifers should weigh, on the average, 620 kg (weight of the cow within the first month after calving) to maximize first lactation milk yield. These first-calf heifers will continue to grow and reach mature body weight (> 700 kg) during the fourth or fifth lactation.

CONSTANT VERSUS VARIABLE GROWTH RATE

Heifer growth rate need not be constant. In fact, most often heifer growth is characterized by periods of slow growth and periods of more rapid growth. Heifers actually show a great ability to compensate for periods of slow growth with periods of more rapid growth. The variability in the growth rate of heifers may reflect:

- Seasonal availability of forages (quantity and quality);
- Management decisions to adjust heifer growth to a desired rate.

Growth rates before and after puberty

Current knowledge indicates that a moderate growth rate before puberty followed by more rapid growth to achieve target body weight at calving appears to be the best rearing strategy to maximize future milk production. This concept appears to be true for all dairy breeds, although the actual rate of growth will vary substantially across breeds (Figure 1).

Effects of overfeeding and rapid growth before puberty

Some research has shown that feeding high energy rations to accelerate body growth before puberty may affect the development of the mammary gland and limit milk production later in life. This research remains controversial, however. Surveys of high-producing dairy herds in the United States indicate that growth rates of heifers vary between 0.8 and 0.95 kg/day. These rapid growth rates are not incompatible with high milk yields of first-calf heifers.

Effects of underfeeding and slow growth before puberty

Age at puberty may range from nine to 20 months of age, depending on growth rate. To ensure calving at 24 months of age, puberty should occur when heifers are 12 to

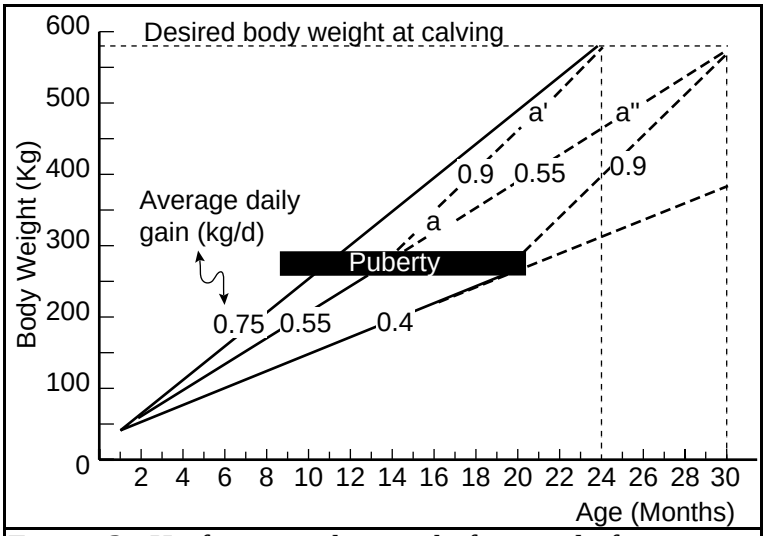

Figure 3: Heifer growth rates before and after puberty may be adjusted—within a certain range—to reach "ideal" body weight at 24 months of age at first calving (body weight on the y axis refers to heifers of a large dairy breed).

13 months of age.[1] When the growth rate before puberty is slow, the desired body weight at calving cannot be achieved without:

- Accelerated growth during pregnancy (line aa^{I} in Figure 3);
- Delayed breeding and calving (line aa^{II} in Figure 3);
- A combination of the above.

For example, when average body weight gain is 0.55 kg/day, puberty is expected to occur at 12-13 months of age. Assuming that pregnancy begins at 15 months of age, growth rate must be then be adjusted to 0.9 kg/day to ensure adequate body weight at calving (line aa^{I} Figure 3). If growth rate is not adjusted, heifer may calve at 24 months of age, but in a state of underdevelopment. Risk of difficult calving will be high and first lactation performance will be poor.

When growth is expected to remain slow during pregnancy, breeding should be delayed to avoid underdevelopment at calving. For example, when the growth rate of a large breed heifer is 0.55 kg/day throughout the entire rearing period, then breeding should be delayed until 19-20 months of age. Calving will also be delayed, but it is more important that heifers reach the desired body weight at calving.

Effects of overfeeding after puberty

Feeding a high energy, balanced diet that promotes rapid growth during pregnancy is usually desirable because it ensures:

- Good nutrition for the fetus;
- Adequate heifer development at calving.

However, fattening is undesirable. Obese heifers have a higher risk of calving difficulty and metabolic problems after calving. Feeding a balanced ration is a good way to avoid obesity. Body condition score is also a good tool to help adjust the feeding levels of pregnant heifers.

Effects of underfeeding after puberty

Conception rate may be reduced when heifers are not gaining weight at breeding time. A slow growth rate after puberty causes no harm as long as the heifer is not pregnant (except for the likelihood of delayed first calving). However, once a heifer is pregnant, insufficient growth may have harmful effects:

- Poor fetal nutrition;
- Difficult calving due to sub-optimal skeletal growth;
- Lower first lactation milk yield.

If availability of feed (or other resources) does not permit higher growth rates after conception, it may be better to delay conception until heifers have a higher body weight. The first lactation record will then be satisfactory, but the productive life of the cow will be shortened and the cost of rearing increased.

[1] This is because pregnancy lasts nine months, and success rate of insemination in heifers is about 66% (in other words, it takes 2-3 heat cycles to obtain a pregnancy).