

DAIRY HEIFER NUTRITION: BASICS



BASICS

OVERVIEW

- Replacement heifers require special nutritional management practices that promote structural growth as well as reproductive and mammary development.
- Nutrition of replacement heifers is of critical importance because their growth rate affects the economic return on a dairy farm.
- To decrease the rearing cost of dairy heifers, the emphasis has been on reducing the age at first calving (AFC).
- To achieve reductions of AFC, heifers should be bred at an early age. This can be accomplished by feeding heifers a high plane of nutrition that supports rapid skeletal growth to achieve sexual maturity and proper frame size for breeding at an earlier age.

SIGNIFICANCE

- Replacement heifers not only are a substantial financial investment for a dairy farm but also represent the farm's profitable future.
- The economic importance of proper management of replacement heifers can be explained by the fact that the process requires the owner to incur cost with no economic returns until calving and initiation of lactation.
- Current research shows that increasing average daily gain (ADG) in pre-pubertal heifers increases first lactation milk performance. Farms that design facilities and a nutrition program to maximize heifer health will achieve a higher ADG.
- Because 40 to 70% of the total costs of raising replacement heifers are attributed to feed, a reduction in total feed consumption during the unproductive period (by shortening its length) would have a positive impact on dairy farm income.
- Proper nutrition of dairy heifers to achieve an early AFC can significantly improve the economic profitability of dairy farms.
- Current research would support feeding heifers at a full plane of nutrition throughout the pre-pubertal phase and that high energy diets do not reduce future milk output if the diets are balanced with adequate protein.

CRITICAL TIME PERIODS

Pre-weaning

- Starting at birth it is important that a calf receives 4 quarts of high quality colostrum.
- Calves should be fed a large volume (approximately 10% of body weight) of whole milk or high quality milk replacer during the first 45-60 days of life to maximize the growth potential of these young animals.
- Feed efficiency is greatest in calves during the first two months of life and slowly decreases as they age. Therefore, the most efficient time to achieve increased growth rates is during this time in life.

- Current research indicates that ADG during this phase is correlated with future milk production. Animals that experience stunted growth rates at this stage may never reach their full potential as lactating animals regardless of the nutritional program at later growth stages.

Post-weaning until puberty

- This encompasses animals from roughly 2-3 months of age until 9-11 months. These animals will be fairly efficient at using properly designed rations for growth and will still deposit lean muscle and skeletal mass at a higher proportion than adipose tissue.
- Animals should be introduced to forage at approximately 2-3 months of age. Calves will consume 5-6 pounds of an 18-20% CP grain at 2 months of age. As animal intake continues to increase, the amount of grain offered should be capped at 6 lbs and more forage slowly introduced. The type of forage will vary based on inventory and location. Ideally it should be highly digestible and chopped to prevent sorting. Examples include: grass hay, corn silage, alfalfa haylage, or triticale.
- The most important factor to stimulating rumen development is VFA production, driven by grain intake.
- When grain is formulated as a pellet excessive fines can limit intake.
- By-pass protein and protected amino acids are not needed in this age group. Because the rumen is still developing feeds such as soybean meal and canola will by-pass digestion in the rumen. Significant cost savings can be appreciated with no change in animal performance.
- Typically, around 5 months animals will no longer receive a separate grain mix, but will have 2-3 lbs of grain mixed into their diet as part of a TMR. The diet typically consists of 20% grain and 80% forages on a DM basis.

Typical Heifer Grain

Rolled oats	5-10%
Corn Grain	20-30%
Wheat Middlings	30-40%
Soybean Meal	15-20%
Other protein sources and mineral pack	5-10%

Breeding

- Many dairies begin breeding heifers at 12-14 months of age and have a AFC of 21-23 months.
- Hip height and body weight are better determining factors for when to begin breeding than age. An animal should be 55% of its mature (3rd lactation or greater) size at breeding. In Holsteins this usually equates to 51 inches tall and 825 lbs.
- Breeding animals before they are an appropriate weight mean they are smaller when they freshen and begin milking. They will be at a higher risk for certain metabolic diseases and they will produce less milk because a greater percentage of calories must be used for growth.
- Once animals reach puberty, the ration must have significantly reduced energy levels and BCS should be monitored closely in heifers that are kept within a barn because they will deposit adipose tissue at a much higher rate.

Pregnant Animals

- At this age animals will deposit large amounts of adipose tissue and become fat very quickly if ME levels are too high in the diet.

- Access to pasture or a dry lot can help reduce excessive BCS.
- Many farms will feed the lowest digestible forage to this animal group or deliberately delay harvest to reduce digestibility. These feeds work well in providing gut fill and help to keep animals satiated without becoming fat.

MAMMARY DEVELOPMENT

- Heifers have isometric mammary parenchymal development up to 3 months of age and after puberty until gestation begins.
- The heifer's mammary gland also undergoes accelerated growth (i.e., allometric phase) before (i.e., from about 3 to 9 months of age) and after puberty.
- Feeding heifers a high energy diet at this stage can result in reduced mammary gland mass in the pre-pubertal animal, however, there is no difference in the expression of mRNA within mammary glands of cattle fed high or low energy diets pre-puberty.
- Current research would support feeding heifers at a full plane of nutrition throughout the pre-pubertal phase and that high energy diets do not reduce future milk output if the diets are balanced with adequate protein.
- Approximately 45 days before giving birth mammary gland development will increase dramatically to prepare for lactation. At this point, roughly 235 days carried calf, the animal should be treated like a dry cow and fed a diet similar to the other dry cows. Specifically, they will have much higher requirements for MP.

NUTRIENT REQUIREMENTS

- Like other animals, dairy heifers require water, proteins, carbohydrates, fats, vitamins, and minerals.
- A fresh, abundant, and clean water supply should be available before, during, and after weaning of a replacement heifer. Deterioration of water supply or its quality will decrease feed intake significantly.
- The concentrate component of the diet can be as simple as a mixture of corn, soybean meal, and supplemental vitamins and minerals or it can be more complex. The composition of the concentrate portion of the diet depends on the quality and quantity of the forage used.
- The energy and protein requirements need to be balanced to maximize rumen production of VFA and microbial protein. When economically possible attempt to pair the rate of digestibility of both energy and protein sources, ie: steamed-flaked corn and alfalfa haylage are rapidly degradable sources of energy and protein respectively. Also, use multiple sources for both energy and protein, ie: a blend of soybean and canola will provide a more complete amino acid profile than using either feed alone.
- Calves will prefer the taste of soybean meal and other soy products over other protein sources such as distillers grain or canola, if intake is lower than expected remove less palatable feeds and replace with soybean meal.
- It is critical to meet all of the nutrient requirements for replacement heifers without overfeeding.
- The nutrient requirements of replacement heifers during their growth and development can be found in the seventh revised NRC publication on nutrient requirements of dairy cattle.
- Be sure to feed free choice mineral, or a trace mineral pack with the grain mix to meet all mineral and vitamin needs. Specifically, feeding 15-20 PPM of copper and 70 PPM of zinc has been shown to increase reproductive performance in certain situations and prevent infectious foot diseases, such as digital dermatitis.

- Feeding a trace mineral pack containing chelated (organic) minerals will increase bioavailability and may improve cattle health. Chelated minerals are typically 3-4 times as expensive and if used are fed as a percentage of total mineral supplied to control cost.

Example diet parameters and growth rates

	300 lb	850 lb (Breeding age)	1100 lb (Pregnant)
CP %	17-18	14-16	12-15
NDF %	30-35	35-40	40-45
ADF %	20-25	25-30	30-35
NE _g (Mcal/lb)	0.39-0.41	0.36-0.39	0.32-0.38
NFC %	32-38	30-34	30-34
Expected ADG (lbs/day)	2.0	1.8	1.5-2

PRACTICAL CONSIDERATIONS

- Accurate analysis of all feedstuff in the diet is needed before developing a ration. Especially important is the dry matter of forages which can vary greatly.
- Accurate BW of animals being fed is important because DMI will vary greatly as animals gain weight.
- There are several computer software programs which can help develop diets for dairy heifers. Experience with the specific program is important as energy requirements for older animals are often over-estimated.
- Be sure to monitor DMI as it changes with animal frame size and monitor BCS of all animals at least twice monthly to make sure results are adequate.
- Breeding age and pregnant heifers are often good candidates for the lowest quality forage in the farm inventories. They will be able to grow and thrive on forage not appropriate for lactating or dry cows.
- Compensatory growth nutrition programs can be used to improve feed efficiencies and maintain overall adequate growth rates. It is important to have high energy diets during the compensatory phase to achieve adequate gains and conversely restricting intake sufficiently during the limit feeding phase. Due to the extra management involved compensatory nutrition programs are not as common as 10-15 years ago.
- For Holstein cattle on average, breeding size is 825 lbs and birth weight is 90 lbs. In order to reach breeding weight by 12 months the average Holstein will gain 735 lbs in 365 days. This means that the animals must average 2 lbs ADG throughout its entire first year of life. Management and herd health must be exceptional to avoid any bottlenecks to growth at every stage of the animals' life.



MISCELLANEOUS

AGE-RELATED FACTORS

- Heifers will have better feed efficiency at younger ages.
- Calves become fully functioning ruminants around 4-5 months of age under most growing conditions.
- Use a combination of BW and hip height to determine age at breeding

- As animals age they will become progressively pre-disposed to depositing adipose tissue vs muscle.

BIOSECURITY

If young stock are raised at a separate location and co-mingled with animals from other farms there should be appropriate measures in place to assure infectious diseases such as BVD and digital dermatitis are not brought back with returning animals.

PRODUCTION MANAGEMENT

- Pre-pubertal and breeding age heifers should have 18-24 inches of feed bunk space and should have access to feed 24 hours a day.
- Once heifers are confirmed pregnant the amount of feedbunk space can be as low as 12-14 inches per animal per day if feed is available 24 hours a day. If these animals are precision fed, they should have 24 inches of feedbunk space per animal.
- The use of ionophores such as bovatec or rumenin is common to improve feed efficiency and reduce coccidiosis. Ionophores affect the sodium re-uptake in microbial bacteria reducing the maintenance costs and allowing the animal more energy out of each pound of DMI.
- Vaccination protocols should be designed so that all injections are given at least 1 week before or after any change in diet or group dynamic. Immediately following a move, animals will not eat aggressively for 5-7 days and they will not mount a proper immune response.

SEE ALSO

- Body Condition Scoring: Dairy Cattle (www.fiveminutevet.com/ruminant)
- Dairy Heifer Management Program (www.fiveminutevet.com/ruminant)
- Dairy Nutrition: Ration Guidelines for Milking and Dry Cows (www.fiveminutevet.com/ruminant)
- Nutritional Assessment (www.fiveminutevet.com/ruminant)
- Milk Cow Nutrition Monitoring (www.fiveminutevet.com/ruminant)

ABBREVIATIONS

ADG = average daily gain
 AFC = age at first calving
 BW = body weight
 CP = crude protein
 DMI= dry matter intake
 FE= feed efficiency
 ME = metabolizable energy
 MP=metabolizable protein
 NRC = National Research Council

Suggested Reading

Ford, J.A. Jr., Park, C.S. 2000. Nutritionally directed compensatory growth enhances heifer development and lactation potential. *J Dairy Sci* 84:1669–1678.
 Fox, D.G., Van Amburgh, M.E., Tylutki, T.P. 1999. Predicting requirements for growth, maturity, and body reserves in dairy cattle. *J Dairy Sci* 82:1968–1977.
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 M. J. Meyer, A. V. Capuco, D. A. Ross, L. M. Lintault, and M. E. Van Amburgh, Developmental and Nutritional Regulation of the Prepubertal Bovine Mammary Gland: II. Epithelial Cell

Proliferation, Parenchymal Accretion Rate, and Allometric Growth. Journal of Dairy Science, Volume 89 , Issue 11 , 4298 - 4304

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