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Nutrition For The Early Developing Heifer

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Several factors can dramatically reduce replacementrearing cost and increase potential profits for the producer: (1) maximizing immunity from colostrum to minimize mortality and sickness, (2) formulating rations for specific weight gains during strategic periods of development and avoiding over-fattening prior to puberty because it impairs mammary development, (3) formulating rations for an average daily gain of 1.8 lb. for Holstein heifers, (4) using AI sires ranking in the top 20% for (PTA$) to optimize genetic improvement, (5) monitoring age, body weight, wither height, body condition score as well as peak milk and ME milk yield of first lactation heifers to evaluate management at first calving, and (5) controlling the size of the replacement herd by calving heifers at 24 months and raising no more than needed.

Calf Milk and Supplementation

Calves should be maintained on whole milk or a high quality milk replacer until calves are eating adequate amounts of grain to sustain rapid growth and rumen development. Whole milk, in general, can be found in one of three forms on the average dairy farm: Extra colostrum or transition milk, nonsaleable milk (eg, mastitic/ antibiotic tainted) and saleable milk. Of these, extra colostrum/transition milk is preferred because of its superior nutritional value, and because it cannot be sold. This milk can be preserved via fermentation (propionic acid) or freezing.

Mastitic milk is an area of controversy in relation to safety and the "seeding" of mastitis causing organisms, especially relative to Staphylococcus aureus. Mastitic milk should only be fed if it has the appearance of normal milk. Milk containing visual signs of yellow material (pus), clots or blood should not be fed to calves. Since milk containing antibiotics has been associated with slower growth and higher rejection rates, it is the least preferred form of supplementation, including milk replacer with antibiotics.

Milk replacers should be of the highest quality so as to mimic whole milk as closely as possible. To maintain growth levels, replacers should contain 20% protein, a minimum of 15% fat (dependent on environmental temperatures) and less than 0.25% crude fiber (Table 1). In colder climates, producers may want to increase the fat level to 20% or higher for adequate energy intake. Periods of heat stress may be another time to increase the fat level of the milk replacer. Calves will decrease intake during times of extreme heat, and feeding higher levels of fat will make a more energy-dense ration. The higher the crude fiber levels, the higher the plant origin ingredients, and the cheaper the milk replacer. Calves less than one month of age are incapable of digesting or breaking-down a high amount of crude fiber and can have digestive upsets leading to diarrhea and dehydration. These higher crude fiber rates (cheaper milk replacer) lead to an increased rate of passage through the gut (diarrhea), but just as important, they are a large reason for poor weight gains during the early development period.

Table 1: Feed Tag Recommendations for Milk

Replacer	Nutrient Percent on feed tag
Protein	20 to 24%
Fat*	15%*
Crude Fiber	0.25%

** Elevate to 20% or higher during cold or hot environmental temperatures.*

The feed tag (Table 1) provides important information on the quality of a milk replacer. Protein, fat, and fiber levels as well as the sources of protein and energy should be scrutinized. Protein sources such as dried skim milk,

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whey products, and modified soy products are preferred, whereas other sources such as wheat flour, fish by-products, and meat solubles are consid- ered to be inferior. Ideally, protein sources should be listed specifically and not defined in collective terms such as "animal protein products" or "plant protein products," because these terms may include many dif- ferent ingredients. While either animal or vegetable fat can be used, carbohydrate content should consist almost exclusively of lactose. Many milk replacers are med- icated with antibiotics, but this often proves to be of lit- tle benefit because of the extremely low levels that are fed. Medicated feeds may improve performance and a specific coccidiostat like Decoquinate, Rumensin ® ,or Bovatec ® can aid in the prevention of coccidiosis. Milk replacer powder should have a pleasant odor and should be cream to light tan in color, as well as free of lumps and foreign material. The powder should mix into so- lution easily and, once reconstituted, should remain cream to light tan in color. Calves should initially be fed 8-10% of their body weight, divided into two feed- ings per day. It is important to remember that this will vary depending on ambient temperature and stress level. For instance, as temperatures fall below freezing, high energy milk replacer quantity should be increased by 30 to 50%, whereas calves that have been shipped for long distances should be started on lower quantities for the first few feedings. As the calf grows, the same absolute volume of milk replacer (8 to 10% of the birth weight) should be maintained to encourage calf starter (grain) consumption and clean, fresh water should be available at all times. Free access to fresh water encourages more grain intake, leading to an earlier weaning. In several surveys of dairies, age at freshening is often extended by one or two months because nutrition- al programs for nursing calves are below optimum.

Weaning and feed supplementation

Weaning should depend on the individual calf's eating habits and not on some preset weaning age. Generally, calves should be eating approximately 1.5% of their body weight in grain at the time of weaning. The feeding of high quality calf starter is a critical factor in successful weaning. It should be palatable, containing coarsely ground or crimped grains, with molasses added to improve taste and control dust. It should contain 18 to 20% crude protein, 72% TDN, 0.6% Calcium, 0.45% Phosphorous, 0.24% Magnesium, 0.24% Sulfur, and 0.70% Potassium. Researchers are debating the value of feeding hay to nursing calves. Hay and grain are both important in the production of rumen volatile fatty acids (VFAs). These VFA's are by-products of diges- tion which are utilized for energy and growth. Howev- er, grains (concentrate) have been shown to play a more critical role in the formation of rumen papillae, which are finger-like projections in the rumen designed for ab- sorption of nutrients. Diets high in energy value (grains) result in the formation

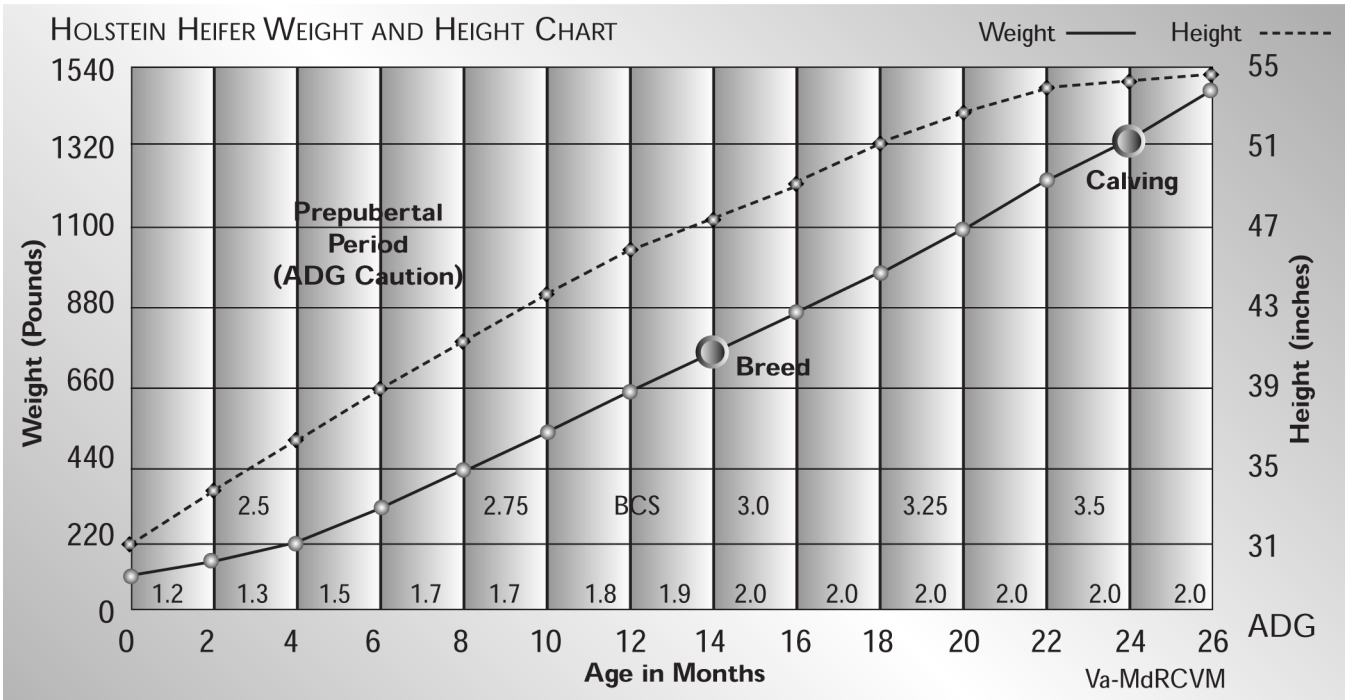

Figure 1: Heifer chart demonstrating optimal weight, height, ADG, and BCS by months of age.

*ADG (average daily gain) stratified by months of age.

^BCS (body condition score) stratified by growth periods.

of greater concentrations of butyric and propionic acids. These VFAs have a considerably greater effect than acetate, a by-product of the digestion of hay, on the formation of rumen papillae by stimulating blood flow to the rumen, resulting in increased rumen growth and activity. As a calf's rumen size increases (eight times its birth size) by the eighth week of life, optimum levels of calf starter should be at 2 to 3 pounds/calf/day prior to weaning. If hay is fed to nursing calves, it should be of the highest quality. The problem with feeding hay is that it contains much less energy than grain and can delay weaning due to lower energy intake from rain sources. Studies at the Virginia Tech Dairy Center have found no benefit in feeding hay before weaning. (See Figure 1, page 2)

If a Holstein heifer weighs 80 lbs at birth and our goal is a 1350 lb heifer 24 months later at calving, she must gain an average of 1.8 lbs per day. However, this is only an average gain over the entire 24-month development period. Gains will be less earlier in life and will increase to 2 lbs per day after 11 to 12 months of age (see Figure 1). Breeding age heifers are often overlooked, receiving the refusal from the lactating cows, or inadequately designed heifer rations. Rations must be tailored to meet the needs of partitioned age groups of heifers. Heifers should be grouped according to age and body weight to accommodate their competitive nature for feedstuff. Formulation of heifer rations should be based on nutritional analysis of feed components. This is the single most important way to guarantee that heifers are fed for optimal weight gain as well as skeletal (bone) development. Calves should be individually housed for two weeks after weaning. For one to two months subsequent to this, they should be housed in groups of 4-5, acclimating them to feedbunk competition. Further groupings should be matched by age and weight of the heifers (Table 2).

Table 2: Age and weight groupings of heifers

Age of heifers:	Weight range
6 to 10 months	300 to 525 lbs
11 to 14 months	525 to 750 lbs
Breeding age (14 to 15 months)	750 to 850 lbs
Bred heifers	850 to 1200 lbs.
Springing heifers	1100 to 1350 lbs

Bunk management is essential for adequate growth and development. Bunk space is allocated according to the weight and size of the pen of heifers. Each calf requires up to 12 to 18 inches of linear bunk space up to approximately 900 lbs. At approximately 1000 lbs, bunk space should be increased to 2 linear feet of bunk space if feed is not available at all times. Bunk space requirements are also dependent on the number of feedings per day, with once a day feeding requiring more linear feet of bunk space.

Typical rations using forages common to the Mid-AtlanticStates are shown below:

Typical nutrient values for forages and feeds used in sample rations.*

Feed	DM%	CP%	TDN%	ADF%	Price/ton
1st cut O. grass	87	10.4	55	45	55
2nd cut O. grass	87	15	60	38	70
Alfalfa silage	35	17	62	33	45
Corn silage	38	7.5	67	28	30
16% CP Conc.	89	18	81	10	165
20% CP Conc.	89	22.5	81	10	175

Sample rations using typical forages grown and harvested in the Mid-Atlantic States. (lb./day /heifer) See chart below.*

Body weight	1st cut O. Grass	2nd cut O. Grass	Alfalfa Silage	Corn Silage	16% CP Conc.	20% CP Conc.	Conc. Cost/ day
400 lb.		8			4		$.33
			11	11	3.5		$.29
600 lb.	8			10		5	$.44
			18	18	2.5		$.21
800 lb.	11			10		5.5	$.48
			22	22	3.0		$.25
1000 lb.	12			15		7.0	$.61
			30	20	4		$.33

** O. grass = Orchard Grass*

Rations for 400-lb heifers were based on either second cutting orchardgrass hay or alfalfa and corn silage. Due to the higher forage quality of second cut grass, there are only small differences in concentrate costs between the two alternatives. As heifers gained weight, increasing quantities of concentrates were necessary to meet requirements for energy and protein. These result in high concentrate costs per heifer. Note that the substitution of average quality alfalfa silage for 1st cutting orchardgrass allowed using fewer lb. of a 16% concentrate and substantial cost savings. Forage quality has a significant influence on supplemental feed costs.

Bibliography

Bailey TL: Economic Considerations of dairy heifers. Proc of the Society for Therio. San Antonio, Tx., pp 56-59, 1992.

Braun RK, et al: Body condition scoring dairy cows as a herd management tool. Comp on Cont Ed Pract Vet9:F192-F200, 1987.

Donovan GA, et al: Evaluation of dairy heifer replacement-rearing programs. Comp on Cont Ed Pract Vet Vol 9 No 4:F133-F138. 1987. Fiez E: Sizing up heifer age. Dairy. pp. 6-8, January, 1989.

Gardner CE: Dairy practice management. Vet Clin-North Am [Food Anim Pract] 5,1989.

Gardner RW, et al: Accelerated growth and early-breeding of Holstein heifers. J Dairy Sci 60:1941-1948, 1977.

Head HH. Heifer Performance Standards: Rearing-Systems, Growth Rates and Lactation. In H. Van Horn and C. Wilcox, (eds.): In Large Dairy Herd Management. Dairy Science Association, American Dairy Science Association, Champaign, Ill., 1992, pp. 422-433.

Heinrichs AJ. Opportunities in replacement heifer growth. Dairy Session III. Proc Am Assoc Bov Pract. pp 73-75, 1991.

Heinrichs AJ, et al: Standards of weight and height for Holstein heifers. J Dairy Sci. 70:653-660, 1987.

Hoard's Dairyman, Raising Dairy Heifers, A supplement. Nutrition is the key to breeding age size. W. D. Hoard and Sons Co., Fort Atkinson, Wisconsin. 1990.

Hoffman, PC, et al: Growth rate of Holstein replacement heifers in selected Wisconsin herds. Univ. WI Coll. Ag. and Life Sci Res. Rept. R3551. 1992.

James RE, et al: Heifer feeding and management systems. In H. Van Horn and C. Wilcox, (eds): Large Dairy Herd Management. Dairy Science Association, American Dairy Science Association, Champaign, Ill.1992, pp. 411-421.

Kirking GA, et al: AI: Easy and Profitable. Dairy Herd Workshop. May, pp. 34-36, 1991.

LeBlanc MM. Management of calf herd programs. The Vet Clinics of North America, Vol 3 No 2::435-445, 1981.

Reid JT, et al: Effect of plane of nutrition during early life on growth, reproduction, production, health and longevity of Holstein cows. 1. Birth to fifth calving. Cornell Univ. Agr. Exp. Sta. Bull. No. 987. 1964.

Serjsen K, et al: Influence of Nutrition on mammary development in pre and postpubertal heifers. J Dairy Sci. 65:793-800, 1982.

Sinha YN, et al: Mammary development and pituitary prolactin level of heifers from birth through puberty and during the estrous cycle. J Dairy Sci 52:507-512, 1969.

Stobo, IJF, et al: Rumen development in the calf, the effects of diets containing different proportions of concentrates to hay on rumen development. Br. J. Nutr. 20:171-188, 1966.

Van Der Leek, ML, et al: Dairy Replacement Rearing Programs. In J. L. Howard and M. F. Spire (eds): Current Veterinary Therapy, 3rd. Philadelphia, W. B. Saunders, 1993, pp 147-153.