



Feeding and Managing Dairy Calves and Heifers

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If improved breeding and management practices are followed heifers will most likely be better than the cows in the dairy herd today. Costs of raising a heifer to 24 months of age may range between \$800 and \$1,500 depending on the farm. If heifers calve at more than 24 months of age, \$2 per day are lost in feed, herd replacements and lifetime production. Although reducing the calving age may have a positive impact on profitability, heifers must grow at an optimal rate to avoid calving problems and to have a successful first lactation. Some practices recommended for raising heifers are discussed below.

The Newborn Calf

A clean, dry, draft-free environment at calving is essential for the health of the cow and calf. Immediately after birth:

- Remove any mucus from around the mouth and nose area.
- Insure that the calf is dry and away from drafts.
- Feed calf colostrum.
- Treat the navel with a suitable disinfectant.

Calves are unable to produce antibodies (immunoglobulins) for the first few weeks after birth and must acquire them through colostrum. A newborn calf can absorb these antibodies through the intestinal wall, but this ability rapidly diminishes during the first 24 hours after birth. Thereafter, the calf digests these antibodies as it would digest other proteins, but it receives no immunization. It is critical that the calf receive colostrum as soon after birth as possible, preferably within one hour. Apart from the antibodies that help fight disease, colostrum is also a rich source of proteins, minerals, and vitamins (Table 1).

Table 1. Typical composition of first colostrum and normal Holstein milk.

Constituent	Colostrum	Milk
Total solids, %	23.0	12.4
Protein, %	14.2	3.2
Casein, %	4.8	2.4
Immunoglobulins	6.6	0.1
Fat, %	5.2	3.7
Lactose, %	2.9	4.8
Minerals, %	1.4	0.7
Calcium, %	0.26	0.13
Phosphorus, %	0.24	0.11
Vitamins		
A, mg/g fat	45	8
E, mg/g fat	125	20
Thiamin, mg/100 g	80	40
Riboflavin, mg/100 g	450	150

Research has shown that less than 1 % of the calves that received colostrum died within one-half hour after birth. After birth, chances of death steadily increase with time before first feeding of colostrum. Sixteen to 20% of the calves, which did not receive any colostrum died before one month of age.

Newborn calves should be fed 3 quarts of colostrum from a second lactation or older cow within an hour after birth. Feed again in 12 hours in order to maximize the chances of obtaining sufficient immunoglobulins. In general, colostrum from older, healthy cows has more immunoglobulins; therefore, it has higher specific gravity. Continue feeding Colostrum for at least three days.

Hand feed the calf to insure adequate consumption of colostrum rather than assuming adequate consumption by nursing. Commercially available colostrum substitutes are marketed, but at the present time, none can completely replace colostrum in providing a complete immunity. However, these products may be used to "boost" the immune response of colostrum that is deficient in immunoglobulins. These products are being developed mainly as an aid to prevent disease transmission (e.g. Johne's). Results of current research suggest that batch pasteurization of waste milk contaminated with the Johne's disease organism was effective at generating a clean product to feed to young calves. The effects of farm pasteurization on colostrum's immunological effectiveness is currently under study.

Vaccines are now available against some causes of calf scours such as *E. coli*, rota, and corona viruses. Two types of products are available:

- Vaccines for the dry cow, to increase antibody titers in her colostrum.
- Vaccines for the newborn calf.

Birth to Weaning

Milk or milk replacer

Feed calves milk, milk replacer, or fermented transitional milk during the first month or two until their digestive systems are sufficiently developed to utilize grains and forages. Whole milk is the standard for comparison; however, milk replacers are usually cheaper.

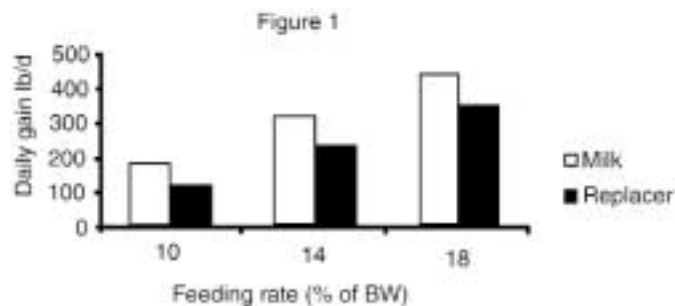
Feed milk at the rate of 10 % body weight per day (i.e., 10 lb per 100 lb calf). This amount can be fed in one or two feedings a day; however, feeding twice a day will encourage one to check for health problems more frequently and may give higher rates of gain. During extremely cold weather, feeding more milk or milk replacer and delaying weaning by a few days improves health and rates of gain. Provide fresh water to calves daily, especially if they are fed milk only once a day.

When feeding milk replacers, follow manufacturer's directions. Milk replacers containing all milk products generally are better than those containing vegetable proteins, vegetable oil, or fish proteins. If milk replacers containing non-milk protein sources are going to be fed, it is recommended not to start before 3 weeks of age. After the third week, calves should be able to better digest formulations with non-milk protein sources.

Milk replacers should contain a minimum of (air dry basis) 20 % protein (22 to 24 % protein if it contains non-milk proteins such as soy protein or fish meal) and at least 15 % fat. Fat sources such as tallow, choice white grease or lard are preferred over vegetable oils, which are poorly utilized by calves. Replacers containing 15 to 20 % fat are preferred, especially for calves housed in colder environments and for vealers. Even though there are good milk replacers in the market, they usually cannot outperform whole milk. Their main advantages of use are convenience and disease prevention. The growth rate predicted with the NRC 2001 for an 88 lb calf fed whole milk or

milk replacer at 10, 14, or 18 % of body weight is shown in Figure 1.

Recent research suggests that calves fed milk replacer containing 28% protein from milk sources and 20% fat can grow faster than those fed a traditional program, with no adverse impact on calf health (scours). Powder intake was also twice as much with the new formulation (2.5 vs. 1.25 lb/day). There is no current research on the lactation performance of cows raised on this intensive calf and heifer management system.



Antibiotic (e.g. oxytetracycline and neomycin) addition to milk replacer consistently improves growth rates and feed efficiency and usually reduces scouring and respiratory problems. However, do not feed antibiotics to calves to be sold for slaughter because of possible antibiotic contamination of meat.

Excess transitional milk produced during the first few days postpartum can be saved for later feeding in place of milk or milk replacer. Store it fresh by refrigerating it until needed or freezing. A more common practice is to store it at room temperature in clean, non-metal containers. It will soon ferment, hence the names fermented, pickled, or sour colostrum. Because of its high lactic acid content, it can be kept for several weeks. Preservatives such as propionic acid or formaldehyde may be needed during the summer months, but these usually are unnecessary during cooler weather.

Since this "un-saleable" milk is like a mixture of first colostrum and normal milk, it contains more solids than normal milk and can be diluted slightly with water before feeding. Research at SDSU showed that 6 lb of fermented transitional milk plus 2 lb of water contained the same amount of solids as 8 lb of whole milk, and supported similar weight gains when calves were fed whole milk.

Calves also can be fed mastitis/antibiotic milk if it appears wholesome and if it is not from a cow with staphylococcal and/or coliform mastitis.

Calf Starters and Hay

In addition to milk or milk replacer, give calves free access to a calf starter grain mixture a few days after birth. Top quality hay should also be offered starting around weaning time. The calf starter should contain 18 % protein and be palatable to

encourage the calf to begin eating at an early age. This is critical, as it will stimulate the development of rumen papillae, essential to the development of a fully functional rumen. Physical form of the starter is also important; coarse and/or pelleted are better than finely ground starters. By two weeks of age the calf should be eating approximately one-half pounds of starter. Fresh, clean water should also be available to calves, as it will encourage starter intake and rumen development. During cold weather, offering lukewarm drinking water 2 to 3 times a day can encourage feed consumption and counteract the effects of cold stress.

Good quality hay can be offered free choice to young calves starting a few weeks after birth. Poor quality forages such as mature hays are not recommended because the calf's rumen is not developed sufficiently to utilize these forages. Likewise, silages and pasture are not recommended for calves under six months of age because these feeds contain too much bulk (60 to 80 % water) for the calf's small rumen. And silages don't stay fresh in the manger.

Calves can be weaned from milk or milk replacer as soon as they are eating 1.5 lb of dry feed daily for three consecutive days. This might happen as early as by four weeks of age. With a milk price of \$13/CWT one lb of dry matter from milk costs close to \$1. Grains and forages are thus less expensive than milk or milk replacers on a dry matter basis, so it is economically advantageous to get calves eating dry feeds as soon as possible.

Calf Housing

Keep calves in an environment that is clean, dry, and free of drafts. Adequate ventilation is important when housing calves indoors. Keep calves in individual pens or stalls during the milk-feeding period to minimize spread of disease. Try to house them away from other cows and older animals, as they are highly susceptible to contract disease (e.g. Johne's) at this early stage in life.

The SDSU Dairy Science Dept. has successfully raised calves in outdoor calf hutches for more than 40 years with minimal calf losses, even during times in winter when temperatures may drop to as low as -30 degrees F. Always remember to increase their feed intake accordingly to account for their greater maintenance energy requirements during cold weather.

Feeding the Weaned and Growing Heifer

Feed for maximum growth without fattening.

The objective of a feeding program for replacement heifers is to produce large, growthy heifers that can be bred at an early age. This allows the heifer to calve at an earlier age so she can start returning a profit sooner. Inadequate size at first calving may limit milk production and conception rates during the first lactation. On the other hand, overfeeding energy between three and 10 months of age can have negative effects on mammary gland development, which impairs subsequent lactation.

Holstein and Brown Swiss heifers should weigh 750 to 900 lb at breeding age. Heifers of smaller breeds should weigh 550 to

700 lb. To reach these weights by a breeding age of 13 to 15 months, large breed heifers should gain 1.3 to 1.8 lb daily and smaller breeds should gain 1.0 to 1.3 lb daily. Growth of the bred heifer should continue so that larger and smaller breed heifers weigh 1,200 lb and 1,000 lb at calving, respectively. Recent research suggests Holstein heifers can be pushed to gain up to a 1.9 lb daily average with a target weight of 775 lb at conception and 1,230 lb after calving.

As with calves, growing heifers require extra feed when exposed to cold weather. The energy that is available for growth depends on dry matter intake, climatic conditions and animal insulation. Puberty can be delayed due to cold weather, which will in turn also increase age at first calving (Table 2).

Table 2. Predicted effects of four environments on heifer performance.

	Neutral ^a		North-central US ^b		
	1	1	2	3	4
ADG ^c , lb/d	2.07	1.94	1.32	1.17	1.5
Calving age, mo	20.3	21.1	28.5	28.5	25.9
Calving weight, lb	1,327	1,294	1,232	1,102	1,263

^aSame maintenance requirement as in NRC 1989.
^bMean monthly temperatures. Situations: 1 = clean and dry; 2 = moderately matted hair coat; 3 = 2 + 10 cm mud from November through March; 4 = 1 + 10 mph wind velocity.
^cAverage daily gain.
Modified from Fox and Tylutki, 1998. As cited by NRC, 2001.

Meet Nutritional requirements.

Protein, energy, mineral, and vitamin requirements must be met to achieve maximum growth rates. Recommended nutrient content of diets are listed in Table 3. As a guideline, heifers will consume 2.5 to 3 lb of dry matter feed per 100 lb of body weight. Provide iodized trace mineralized salt as well as vitamins A, D, and E to animals of all ages.

- Basic guidelines for a heifer-feeding program include:
- Use a feeding program that best fits into your farm program.
 - Make forages the foundation of a feeding program. Good quality forage reduces the requirements for supplementation.
 - The amount of grain and protein percentage in the grain mix depends on quality of forages and age of calves.

Younger heifers need some grain, but let them become more dependent on forages as they get older and their rumen becomes more fully developed.

Calves under six months of age usually need four to six lbs of grain mix per day plus good quality forage. The amount of grain can be reduced as they get older. By the time they are one year old, they usually can grow at acceptable rates while consuming good quality forage alone. Some grain will likely be needed during the last few months of gestation.

Liberal supplement poor quality forages with a grain mix which provides both protein and energy. Heifers outside during cold weather need additional grain because they require 20 to 40% more energy to maintain body warmth under cold conditions.

Table 3. Recommended nutrient content of diets for calves and heifers.^{1,2}

Nutrient	Calf starter	Growing heifers		
		3-6 mo.	6-12 mo.	>12 mo.
	(% of dry matter).....			
Total digestible nutrients	80	69	66	61
Crude protein	18	16	12	12
Fiber (minimum)				
ADF	-	16	19	19
NDF	-	23	25	25
Calcium	0.70	0.52	0.41	0.29
Phosphorus	0.45	0.31	0.30	0.23

¹National Research Council. 2001. Nutrient requirements of dairy cattle.

²Vitamin recommendations are: 1,800 IU of vitamin A, 272 IU of vitamin D, and 22 IU of vitamin E/lb.

Feeds

Corn silage provides adequate energy for older heifers, but additional protein is usually needed. An all-corn silage forage program may cause excessive fattening.

Pasture alone may not meet the nutritional needs of growing heifers, especially those less than a year old. Even excellent pastures may be short on energy, and mature pastures may require additional supplementation of both protein and energy.

Grain mixtures containing urea or other nonprotein nitrogen sources should not be fed to young calves, but these mixtures can be fed to heifers once they are ruminating. Precautions for urea feeding are the same as for the milking herd. That is, urea can supply up to 1 % of the total ration dry matter, and should be well mixed with other feeds.

Ionophores such as monensin, lasalocid, and other similar additives may improve the efficiency of feed utilization by growing heifers. In a Pennsylvania State University study, heifers fed monensin calved 38 days sooner because faster growth rates allowed earlier breeding. This saved more than \$60 per head at an additive cost of \$5 (1.2 cents/day). However, if heifers are not bred earlier most of the economic advantages of more rapid growth rates are lost. It is recommended to feed 50 to 200 mg of lasalocid with no minimum weight restriction.

Health care

Health care for calves and heifers starts with maintaining sanitary conditions, but it can be supplemented with vaccines and other treatments to prevent certain problems. Sanitary programs include vaccinating all heifer calves and bulls to be kept for breeding against brucellosis plus other diseases considered to be potential problems in your particular area of the country.

Under some herd conditions it is beneficial to treat calves and heifers with coccidiostats. Coccidiosis is more likely to occur in young calves (although not exclusively), especially during periods of stress, and/or high moisture conditions. Lasalocid, an ionophore used to improve feed efficiency, is also effective as a coccidiostat in cattle.

Deworming also improves weight gains of heifers, especially when subjected to muddy pasture conditions.

Summary and Recommendations

- Get the newborn calf off to a good start by providing a clean, dry environment, and by feeding colostrum within one hour after birth.
- Feed a good quality milk replacer, whole milk, or fermented transitional milk during the liquid feeding period.
- Provide the calf with a palatable starter a few days after birth and good quality hay starting closer to weaning time.
- Wean calves as soon as they consume 1.5 lb of dry feed daily or more, and if housed in cold environments during the winter.
- Feed older heifers enough for optimum growth rates without fattening.
- Make excellent quality forage the basis for economical heifer growing rations. Supplement as necessary with a grain mix to avoid nutrient shortages.
- Pasture or silage should not be the only forage fed to heifers. Also provide some grain up to a year of age.
- Older heifers may only need grain when forages are not excellent quality or when they are under cold stress.
- Expect to provide bred heifers with some grain in the three to four months before calving.



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