

DAIRY HUSBANDRY NO. 10-1973
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Milk Replacers in Raising Dairy Calves

Successful calf rearing depends on high-quality feed products. Some milk replacers yield better results than others and the lower-quality milk replacer frequently results in a poorer feeding program that makes the calf more susceptible to fatal intestinal or respiratory diseases.

Successful calf rearing can be accomplished with milk replacers; but choose a milk replacer based on quality rather than price.

Before you decide to use milk replacers, check your present management scheme. Are your new-born calves getting that all-important first-colostrum? Are you feeding the other non-saleable milk from treated cows? Are you feeding a liquid diet longer than necessary to produce thrifty calves? See the fact sheet entitled "Using Colostrum to Raise Dairy Calves," Dairy Husbandry No. 9-1973, for a more complete discussion on feeding colostrum.

Economic Considerations

High-quality milk replacers usually cost more but are a good investment. The money saved on a lesser-quality product can be very costly. For example, 100 pounds of a high quality product may cost \$30 while a lesser-quality product costs \$23. This difference is \$7 or 7 cents per pound.

Can you afford to feed ten calves the cheaper replacer at a savings of 8½ cents per calf per day until weaning at 28 days of age? This calculates to be about \$24.

$$1.2 \text{ lb} \times \$0.07 \times 28 \text{ days} \times 10 \text{ calves} = \$23.52$$

For this \$24 economy feeding program, you may have three additional sick calves and one of these dying. Thus your costs will be:

- 5 rather than 2 calves to treat @ \$15 each = \$ 45.00
 - 2 rather than 1 death loss @ \$100 = 100.00
 - lost investment in feed, labor, building, etc. @ \$15 = 15.00
- Total loss \$160.00

You may be trading a \$24 savings in feed costs for a \$160 loss in healthy calves capable of rearing more profit later as milk cows, selling as surplus breeding stock, or supplying dairy beef feeders.

What Is In a Good Milk Replacer?

Study the feed tag. The best milk replacer contains at least 20 percent protein, all of it derived from milk. The protein level should be 22 percent when specially-manufactured soy flours or soy concentrates are used. This is because plant proteins are less digestible than milk protein. The various sources of protein are listed in table 1 according to their acceptability in milk replacers. Compare the protein sources listed on your milk replacer feed tag with this list.

Table 1. Protein sources, characterized by their suitability in milk replacers

A. Optimum	B. Acceptable	C. Inferior
Skim milk powder	Specially manufactured	Meat solubles
Buttermilk powder	soy flour	Fish protein concentrate
Dried whole whey	Soy concentrate	Soy isolate
Delactosed whey		Common soy flour
Casein		Distillers dried solubles
Milk albumin		Brewers dried yeast
		Oat flour
		Wheat flour

The fat level in a good milk replacer powder should be at least 10 percent and may run as high as 20 percent. The higher fat level tends to reduce the severity of diarrhea and provides additional energy for growth. Good-quality animal fats are preferable to most plant fat sources. Soy lecithin, especially when homogenized, is one very acceptable fat source.

Carbohydrate sources that the calf can use properly include lactose (milk sugar) and dextrose. Two common carbohydrate sources that should be excluded from milk replacers are starch and sucrose (table sugar).

Compare the milk replacers illustrated in table 2. Which one appears to be the superior product?

Table 2. Example of two milk replacers

FEED TAG A	FEED TAG B
Guaranteed Analysis	Guaranteed Analysis
Crude protein, min. ----- 24.0 %	Crude protein, min. ----- 21.0 %
Crude fat, min. ----- 20.0 %	Crude fat, min. ----- 10.0 %
Crude fiber, max. ----- .25%	Crude fiber, max. ----- 1.00%
Ingredients	Ingredients
Skim milk powder, dried whey casein, animal fat, soy lecithin	Skim milk powder, buttermilk powder, dried whey, animal fat, vegetable fat, soy flour, distillers dried solubles, wheat flour, dried meat solubles, brewers dried yeast

*Both feed tags also include a list of comparable drug ingredients, vitamins and minerals not illustrated here.

Replacer A is the superior product. It contains more protein and more fat. All protein sources are in the optimum (group A) classification while Replacer B contains five protein sources that are in the inferior (group C) classification and a vegetable fat that may not be soy lecithin. Replacer A also has a lower crude fiber content, which is desirable since the very young calf cannot use fiber.

How To Mix Replacer Powder

Most milk replacers are formulated to be mixed and fed like normal whole milk. It is generally desirable to follow the

manufacturer's directions in mixing the liquid diet from the dry powder. A complete liquid solution is usually obtained easiest by placing the dry powder on top of the water, then mixing. Many milk replacers dissolve easier in hot water. Consistency in the dry matter content (same proportion of dry replacer and water each feeding) is important. Table 3 provides guidelines to help you maintain the proper concentration regardless of the amount needed. Remember that normal Holstein milk contains about 12 percent total solids (dry matter).

Table 3. Suggested ratios for mixing regular milk replacer powder

Volume of Powder ¹ (cups)	Volume of Water (pints)	Amount Available For Feeding (pounds)	Dry Matter Content (percent)
2	5 (10 cups)	5.6	10.7
2	4½ (9 cups)	5.1	11.8
2	3½ (7 cups)	4.1	14.6
3	7½ (15 cups)	8.4	10.7
3	6½ (13 cups)	7.4	12.2
4	7½ (15 cups)	8.7	13.8
4½	8 (1 gallon)	9.9	13.7
9	16 (2 gallons)	19.7	13.7
14 (3¾ qt)	24 (3 gallons)	29.7	14.1
18 (4½ qt)	32 (4 gallons)	39.4	13.7

¹1 cup contains .3 lb regular powder; 1 cup holds .5 lb water. Instant milk replacer powder is more bulky than regular replacer powder. If instant powder is used, increase the volume by 50 percent. For example, if 2 cups of regular powder is indicated, then 3 cups of instant powder will supply equivalent dry matter.

How Much Milk Replacer Should Be Fed?

Nearly all nutrients the calf consumes in the first 2 weeks must come from the liquid diet. After that, an increasing proportion of the calf's total needs may be met by dry starter feed. In the critical first 2 weeks, a reasonable growth rate of ½ pound per day requires about 8 pounds of whole milk daily (table 4). This provides adequate protein and water and more than enough energy (TDN). Such a diet is slightly short of dry matter and this encourages the calf to eat dry starter feed at an early age.

Table 4. Comparison of a 90 pound Holstein calf's nutrient requirement with that supplied by milk or milk replacer.

Component	Requirement (pounds)	Daily Intake from 8 lb Milk (pounds)	Daily Intake from 1.2 lb Dry Milk Replacer ^a (pounds)
Dry matter	1.1	.96	1.20
Protein	.25	.25	.26
TDN	1.10	1.25	1.14
Water	6.1	7.2	7.5 to 10.0 ^b

^aBased on an all-milk protein milk replacer containing 20% protein and 10% fat.

^bDepends on powder:water ratio. Two cups of regular powder and 5 pints of water fed twice daily (10.7% DM) supplies 10.0 lb water. Four cups of powder and 7½ pints water fed once daily (13.8% DM) supplies 7.5 lb water.

If 1.2 pound of all-milk dry replacer is consumed daily, the young calf will obtain a desirable combination of dry matter, protein, energy, and water. Remember, however, that no milk replacer is quite as good as whole milk. Weight gains are frequently slightly lower when replacer ingredients are used. Whether the incidence of scours and calf mortality differs depends on the quality, amounts, and concentration of milk replacer consumed.

Twice-A-Day Feeding

A very young calf probably will not consume 1.2 pounds of dry matter, regardless of how the replacer is mixed. Colostrum should be fed for at least three days, then as the availability of colostrum disappears, offer the calf 2 cups of regular powder mixed in 5 pints of water twice daily. Don't force the baby calf (four to seven days) to consume more replacer liquid than it readily consumes in 3 to 5 minutes. If the calf should scour, cut the amount offered in half and gradually bring the calf back on full feed.

Once-A-Day Feeding

Calf replacer must be of high quality if the liquid replacer diet is to be offered only once daily. Ideally, a milk replacer fed once daily should contain 24 percent protein and 20 percent fat. The carbohydrate portion should be milk sugar (lactose) with no sucrose, starch, or fiber-containing ingredients.

This extra-good quality product helps supply the necessary nutrition since the amount of replacer fed must be limited to control scours. Levels of dry milk replacer beyond 1 pound daily frequently cause diarrhea. Research suggests that only .8 pound of dry replacer in 7 pounds of water should be offered in a once-daily feeding program to the larger breeds. Smaller breeds will need proportionately less.

For Best Results

- Get 3 to 4 pounds undiluted colostrum milk into the calf in the first few hours after birth. The unborn calf gets no immunity from the cow before birth. Furthermore, the calf absorbs these disease-protecting antibodies only from the first-milk colostrum and only for a few hours after birth.
- For best results, the calf should nurse the dam or be fed colostrum by nipple or open pail twice daily for at least 3 days.
- Do not force the young calf to consume more liquid replacer than it voluntarily and quickly consumes. Forced feeding increases the incidence of scours.
- Fresh water is desirable, but not required in the first 3 weeks unless the milk replacer is quite concentrated (more than 14 percent dry matter).
- Offer calf starter feed at or before 2 weeks. With limited milk replacer intake, many calves will eat considerable dry feed at 3 weeks of age.
- Early weaning from 3 to 4 weeks of age has been successful on many farms. When this practice is followed, feed a palatable and high-quality starter grain mix containing about 20 percent protein.
- It makes little difference whether the replacer milk is fed in an open pail or nipple bucket, but remember to clean either thoroughly after each feeding. Bucket feeding is recommended for vealer calves where they are drinking large amounts of replacer liquid.
- You may feed replacer liquids without warming (40 to 50°F) unless the calf is stressed by a cold, damp climate, or disease. Warm the milk if: (a) the dry replacer is difficult to mix thoroughly, (b) the calves are kept in below-freezing temperatures, or (c) the calves are fed unlimited amounts (veal production).

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