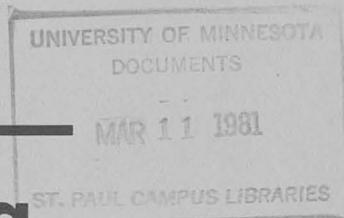


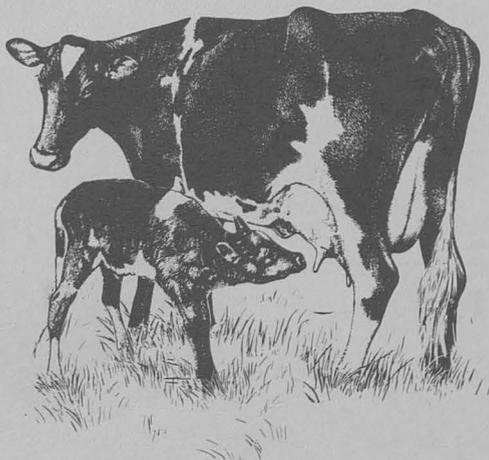
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DAIRY CALF AND HEIFER
CORRESPONDENCE COURSE



Unit 3— Feeding the Dairy Calf (four days to weaning)

Purposes

- Understand the digestive changes occurring in calves.
- Determine the nutritive requirements of calves and how to meet them.
- Outline the advantages and disadvantages of various feeding programs.



RUMEN DEVELOPMENT

A calf is essentially a nonruminant or simple stomach animal from birth through the first few weeks of life. In contrast to an adult cow, the rumen, reticulum, and omasum of a calf are undeveloped, and the abomasum (true stomach) is the largest compartment of the stomach (see drawing on p. 2). Milk fed either by nursing or by bucket, bypasses the rumen and goes directly from the mouth to the abomasum via the esophageal groove. The esophageal groove is a tube like structure that prevents milk or milk substitutes from entering the rumen.

The rumen will remain relatively undeveloped until grain or forages are introduced to the calf's diet. The end products of bacterial digestion of feedstuffs are the stimulators of rumen development. This occurs spontaneously and as early as three weeks if starter is offered the first week of life. Cud inoculation is not necessary. The rumen will be fully functional by three months of age if calves are fed forages and grains from the first week on.

NUTRIENT REQUIREMENTS

Calves require the same nutrients as adult cows, but because of an undeveloped rumen, a calf cannot utilize urea or synthesize B or water soluble vitamins. Milk and colostrum are excellent sources of B vitamins, so supplementation is not necessary. Milk replacers should contain B vitamins. The daily nutrient requirements for calves in the first two months of life are listed in table 1. Meeting these requirements is essential to a calf's health and growth.

LIQUID DIETS

There are basically four diet choices: (1) whole milk, (2) fermented colostrum, (3) waste milk, or (4) milk replacer. The diet choice depends on the calf feeder's preference, supply and quality of diet, cost of diet, and the degree of fatness or sleekness desired on the calf.

Method of feeding (bucket, nipple bottle, or nipple pail) also is up to the calf raiser; each has advantages and disadvantages. Important points for all feeding methods include:

1. Always feed with clean utensils. Separate pails or nipples should be provided for each calf. After feeding, thoroughly wash, disinfect, and dry utensils. A nutritious diet for calves is also an excellent source of nutrients for bacteria and other disease organisms.
2. Feed at regular intervals. Establish a schedule and follow it.
3. Weigh or measure the liquid diet carefully so that the calf receives the same amount each day.
4. Extreme temperature (too cold or too hot) in liquid diets should be avoided. Regularity in temperature is probably more important than the actual temperature. Lukewarm temperatures are easiest for mixing milk replacers and are often most acceptable to calves.
5. The main goal of the calf feeding program is to provide adequate nutrients for growth. The nutrient content of feeds or liquids is contained in the dry matter, which is the substance remaining after all water has been removed. For example, 100 pounds of milk contains 12

Table 1. Daily Nutrient Requirements of Calves (birth to 200 lb)

Body weight (lb)	Crude protein (lb)	Energy			Minerals		Vitamins	
		Net		TDN (lb)	Calcium (lb)	Phosphorus (lb)	A (IU)	D (IU)
		maintenance (meal)	gain (meal)					
Small breeds								
55	.25	.8	.5	1.2	.013	.009	1000	165
65	.28	.9	.6	1.4	.014	.010	1200	200
100	.36	1.4	.7	2.2	.020	.013	1900	300
150	.59	1.8	1.1	3.3	.028	.016	2900	450
200	.75	2.3	1.1	3.9	.034	.018	3800	600
Large breeds								
90	.33	1.2	.7	1.7	.018	.011	1800	280
100	.44	1.4	1.0	2.5	.018	.013	1900	300
125	.52	1.8	1.1	2.9	.026	.015	2400	375
150	.64	1.9	1.2	3.4	.031	.017	2900	450
200	.85	2.3	1.5	4.3	.038	.020	3800	600

pounds of dry matter (powdered milk) and 88 pounds of water. In liquid diets, dry matter and solids content are synonymous.

Holstein calves require approximately 1.1 pounds of dry matter in the liquid diet from birth to weaning. Small breeds require approximately .9 pound of dry matter. Dry matter percentages of liquid diets are shown in table 2. The amount of liquid diet and the water dilution necessary to achieve acceptable dry matter intakes are listed. Notice that the total amount offered is similar among diets (diet + water); however, the amount of liquid diet differs according

to solids or dry matter content. Excessive amounts of liquid diet and/or dry matter intake can cause scours. Cases of scours developing suddenly after diet changes are usually a result of calves receiving increased amounts of diet and/or amounts of dry matter.

WHOLE MILK

Milk is a highly nutritious feed for calves and is usually fed in amounts between 8 and 10 percent of the calf's birth weight. The more liberal milk feeding programs produce fatter calves and generally require less management than do other systems; however, feeding salable milk to calves is the most costly liquid diet. Examples of costs are listed in the following table.

Table 2. Dry Matter and Volumes of Liquid Diets^a

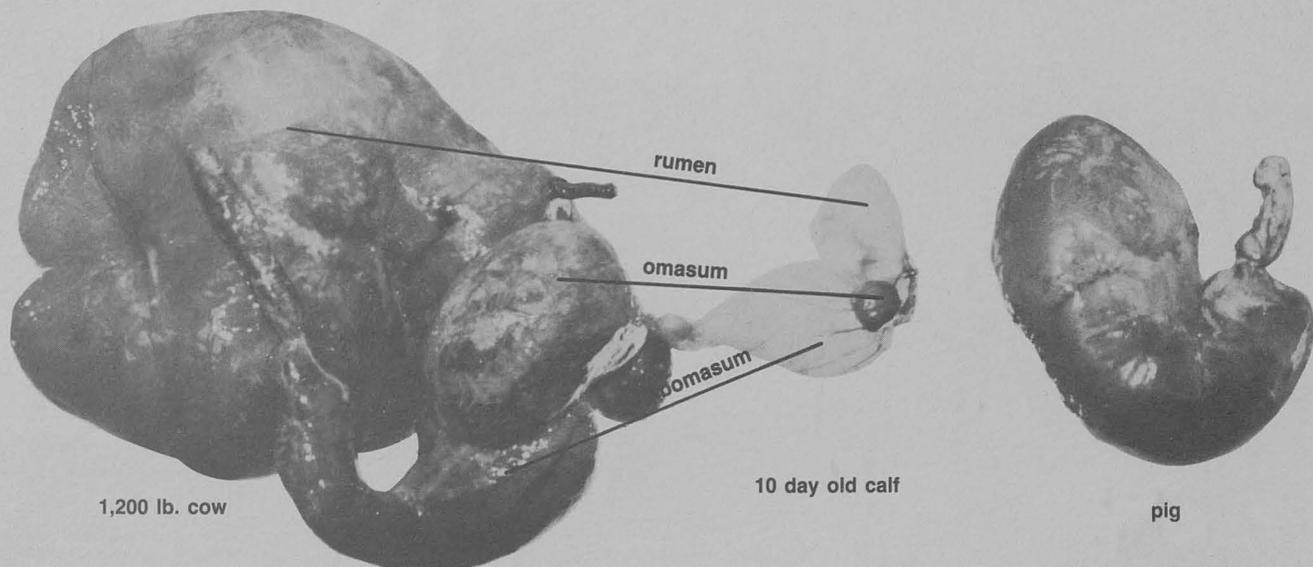
Diet	Dry matter %	Diet amount (lb)	+	water (lb)	Dry matter (lb)
1st milk colostrum	28	4	+	4	1.1
Pooled excess colostrum	16	7	+	1	1.1
Whole milk or waste milk	12	9			1.1
Milk replacer	88	1.2	+	8	1.1

^aUse 75 to 80 percent of these amounts for Guernsey and Jersey calves.

Costs of Liquid Diets (days 4-28)

- 1. Milk—9 lb/day @ 25 days = 225 lb
cost \$12.00 per 100/lb = \$27.00
- 2. Milk Replacer—1.2 lb/day @ 25 days = 30 lb
cost \$25.00 per 50/lb = \$15.00
- 3. Fermented Colostrum or Waste Milk
cost FREE

Comparison of a fully developed ruminant stomach, an undeveloped ruminant stomach, and a simple stomach.



MILK REPLACERS

Milk replacers vary in quality. Study the feed tag. The best milk replacer contains at least 20 percent protein, all derived from milk products. The protein level should be 22-24 percent when chemically modified soy protein, soy isolates, or soy concentrates are used because plant proteins are less digestible than milk protein. Table 3 lists various sources of protein in milk replacers according to their desirability. Compare the protein sources listed on your milk replacer feed tag with this list.

The fat level in a good milk replacer powder should be at least 10 percent and may run as high as 30 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 another acceptable fat source and improves mixing properties of the replacer.

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

Table 3. Protein Sources in Milk Replacers

A. Highly Desirable	B. Acceptable	C. Undesirable
Skim milk powder	Chemically modified soy protein	Meat solubles
Buttermilk powder	Soy concentrate	Fish protein concentrate
Dried whole whey	Soy isolates	Distillers' dried solubles
Delactosed whey		Brewer's dried yeast
Casein		Oat flour
Milk albumin		Wheat flour

SOUR COLOSTRUM

The colostrum produced on the second and third day after calving can be fed in a number of different forms, including: fresh, frozen and thawed as needed, soured or fermented, preserved. The main advantages for use of surplus colostrum are: (1) excellent nutritional value, (2) dollar savings, and (3) possibly improved weight gain and reduced scour incidences.

Because of the higher solids content of the second and third day colostrum, it should not be fed at the same rate as whole milk. Table 2 shows a suggested feeding rate for surplus colostrum. Water can be added, but dilution of colostrum is not necessary; avoid overdiluting and reducing nutrient concentrations. If the supply of surplus colostrum is depleted before the calf is weaned, whole milk or milk replacer can be fed. Mix the old and new diet (50:50) for the first few days for better acceptance of the new diet.

MANAGEMENT TIPS FOR USE OF SOUR COLOSTRUM

1. Make sure the first milk colostrum is given directly to the calf. Combine the second through sixth milkings in a plastic lined, covered container. A 30 gallon trash can or similar size container works well. Plastic liners make cleaning before reuse easier and also prevent corrosion of metal containers. Soured or fermented colostrum can become acidic enough to corrode metal, thereby causing poisoning from zinc or other metals.

2. Mixing the second through sixth milkings will provide enough sour colostrum to feed one calf approximately 30 days. If two or more cows freshen on the same day or a day apart, their milkings can be combined; however, the number of calves fed from the combined container should not exceed the number of cows contributing to the container.

3. Most dairymen allow the fresh colostrum to ferment naturally. There is a possibility, however, of the wrong kind of fermentation. Some dairymen inoculate the fresh batch with three to five tablespoons of fermented colostrum from a previous batch to help start proper fermentation.

4. Don't hold the fermented colostrum for longer than three to four weeks, especially in summer. Research has shown that over time this product becomes very acid and much of the protein is destroyed.

5. Stir the fermenting colostrum daily, preferably twice daily, during storage and prior to feeding. Stirring helps prevent scum from forming and minimizes large lumps.

6. Whether or not the sour colostrum should be diluted before feeding depends on its consistency. If it is quite concentrated, similar to first-milk colostrum, a dilution might be desirable. Dilute two or three parts of colostrum with one part of water. For example, four, five, or six pounds of colostrum, depending on the size of the calf, can be mixed with two pounds of water. Using hot water will warm the colostrum and make it more acceptable to the calf.

7. Start feeding the fermenting colostrum on the fourth day after birth (after feeding the fresh undiluted colostrum directly from the cow the first three days). The colostrum hasn't yet completed its fermenting process and won't be as acid tasting to the calf. This helps teach the calf to consume the soured product.

8. If two or more batches of soured colostrum have been collected for at least a week and have fully fermented, they may be mixed together to save space and shorten the time spent mixing; however, do not feed more calves than there are cows contributing to this mixture.

WASTE MILK

Milk from cows treated with antibiotics for mastitis is unsalable, but fortunately it can be used as a calf feed. Research has indicated that calves fed mastitic milk have similar rates of gain and no more health disorders than calves fed other diets. Waste milk should be handled similar to surplus colostrum. Fermented waste milk has been reported to be more acceptable to calves than unfermented. The guidelines for souring colostrum apply to fermenting waste milk. The first milking after antibiotic treatment probably should not be used. Calves fed antibiotic treated milk will have drug residues in the meat and should be held several days before slaughtering following consumption of such milk. *Mastitic milk fed calves should not be allowed to suckle one another as this can lead to mastitis problems at freshening.*

continued on page 4

Feeding the Dairy Calf (four days to weaning)

Please Fill Out and Return

Name _____

Address _____ County _____

1. Describe your calf feeding program from birth to weaning as completely as possible. Identify the liquid diet(s) used, solid feeds offered and ages at which each is fed.

Diet

Days fed

2. List the ingredients used in your calf starter. Does it provide necessary nutrients and adequate fiber for rumen development?

How much starter do the calves consume during:

Days of age

Average lb of starter/day

0-7

8-21

21 to weaning

3. How much does it cost you to raise the calf from birth to weaning?

	Semen cost × services/conception		\$ Costs
	lbs	× price/lb	_____
Semen costs			
Feed costs			
Milk	_____	_____	_____
Milk replacer	_____	_____	_____
Calf starter	_____	_____	_____
Hay	_____	_____	_____
Veterinary costs			
Medicine			_____
Veterinary trips			_____
Miscellaneous costs			
Non-vet health supplies			_____
Total			_____

Additional costs for housing, bedding, supplies, utilities, equipment, insurance, and maintenance and repair of facilities and equipment should be added to each calf. For each calf that dies, the costs for feed, veterinary service, etc., associated with that calf until his death should be equally divided among all living calves.

The following material is also available on request. Please check those publications you would like to receive.

- Feeding the Dairy Herd*, Extension Bulletin 218
- Using Colostrum to Raise Dairy Calves*, Dairy Husbandry Fact Sheet 9
- Milk Replacers in Raising Dairy Calves*, Dairy Husbandry Fact Sheet 10



CALF STARTERS

A good quality, palatable calf starter should be offered on the third day of life. The best starters are high in energy, readily acceptable to calves, and contain approximately 16-18 percent crude protein. The most palatable starters will be whole, coarsely ground, cracked, or rolled grains. Fine ground grains become "pasty" and undesirable to calves. Calf starters should be fed until calves are approximately 12 weeks old. Intakes of three or four pounds of calf starter plus free choice high quality hay should provide adequate nutrients for calves. Examples of some home-made calf starters are given in table 4.

Table 4. Calf Starter Rations

Ingredients	Ration		
	A	B	C
Corn, coarse grind	50	54	34
Oats, rolled or crushed	35	12	34
Corn cobs, ground			15
Wheat bran		11	
Soybean meal	13	8	15
Linseed meal		8	
Molasses		5	
Dicalcium phosphate	1	1	1
Trace mineral salt	1	1	1
Vitamin A (I.U.)	200,000	200,000	200,000
Vitamin D (I.U.)	50,000	50,000	50,000
Total (lbs)	100	100	100
Protein (% of D.M.)	16	16	16
Fiber (% of D.M.)	6	5	11

FORAGES

Calves may begin to nibble on good quality hay as early as five days of age; however, forages are not necessary before 8 to 10 weeks of age. Incorporating a roughage factor into the starter ration (calf starter ration C) may be more convenient because of housing and management systems. Fine stemmed, leafy alfalfa or fine, good quality grass hays are the best forages for calves. Corn silages or other high moisture forages should be avoided before three months of age, because the high moisture content will limit intake and growth. Good starter rations

will provide the best balance of nutrients and more energy for growth than even the best quality forages. Forage consumption should not replace starter intake during the first three months of life.

WATER

Calves should have free access to fresh, clean water beginning at one week of age. Research has indicated calves gain faster and do better when free choice water is available. Some calves do overconsume, however, and suffer digestive upsets. These calves should be limited in amount of water while consuming liquid diets. Season of the year is also a factor to consider in water availability, with more water required in summer.

FEEDING PROGRAMS

Once vs. twice a day feeding—Once a day feeding of liquid diets after the fourth day of age is an acceptable practice. Calves fed good quality liquid diets once a day will gain as well as calves fed the same diets twice a day. The biggest advantage to once a day feeding is in time and labor savings. Any advantage can be lost, however, if calves are not closely observed to detect sickness early. Care in feeding adequate nutrient amounts and in following feeding schedules is also vital. The total liquid diet offered should be reduced approximately 20 percent from twice a day feeding amounts. Calves housed in extremely cold environments or under stressful situations should not be fed once a day. *Keen observation* is the prime factor in once a day feeding.

EARLY WEANING

Early weaning reduces the cost of rearing herd replacements. Many calves can be weaned by four weeks of age. The criteria for early weaning is *healthy calves eating one pound or more of good quality starter per day*. Consumption of starters can be encouraged by reducing amounts of liquid diet offered three to four days before weaning. Calves fed a good starter and weaned early make the transition to a true ruminant earlier and possibly with fewer digestive upsets.

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