Pasteurized Waste Milk Feeding Program

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Introduction

The amount of waste milk available for pasteurization and feeding to calves varies throughout the year. It also varies from farm to farm. The average US dairy farm produces about 60% of the waste milk needed to feed their replacement heifers, assuming calves receive 1 gallon of milk per day and are weaned at 8 weeks of age. The actual amount of waste milk on hand at any one time varies depending on a variety of factors such as calving and mastitis patterns.

Making up for this deficit can be a challenge. Saleable milk can be removed from the tank and fed directly to calves, or various forms of milk replacers can be used. A 20-20 milk replacer formula and water are often blended with waste milk to extend the milk supply. The amount of milk replacer and water used each day varies depending on calf numbers and volume of available waste milk. This approach maintains the protein-to-fat ratio of the waste milk, but the actual protein and fat in the final mixture are diluted in proportion to the amount of milk replacer and water used each day.

Another approach is to use a special milk replacer designed to extend waste milk volume while adjusting the final mixture to specific protein and fat percentages. Reference tables are required for appropriate mixing. Although protein and fat variability are minimized with this approach, the solids level of the mixture can vary widely and can drop to nearly ½ the solids level of the waste milk.

Waste milk itself is another source of nutrient variability. A recent study of Wisconsin farms with pasteurizers found that protein percentages of pasteurized waste milk ranged from 23.1 to 40.8% while fat percentages ranged from 22.3 to 37.6% (1). The protein and fat percentages of whole milk defined in the Nutrient Requirements of Dairy Cattle (2001) are 24.5 and 30.8%, respectively. Although the nutrient fluctuation of waste milk within farms has not been described, sources of variability are similar to those among farms and include the number of fresh cows, mastitis cows, and other cows with unsaleable milk.

Since young calves are typically the most susceptible to health and nutritional challenges, it is important to provide a high level of nutrition while minimizing variability. This is especially true in the first three weeks of life. One of the advantages of milk replacer is that it is a consistent feed source with a measured nutrient profile. A milk replacer with a 25-15 formula fed at 1 ½ times the rate of a standard 20-20 formula is an excellent compliment to the nutrient level in waste milk. With this feeding program, the 25-15 milk replacer is fed for the first three weeks, followed by transition to pasteurized waste milk. This provides a high plane of nutrition and reduces variability. Waste milk is fed to the older calves which can meet a greater portion of their nutrient needs with calf starter feed. Any variability should be better tolerated by these older calves.

(1) Jorgensen, M., Hoffman, P., Nytes A.J., 4-State Management Seminar, 2005

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Program Overview

The Pasteurized Waste Milk Feeding Program begins with a 25-15 milk replacer. This milk replacer is fed for the first 3 weeks. At the beginning of week 4, calves are transitioned to pasteurized waste milk. To facilitate an easy transition, calves should receive a 50-50 mix of milk replacer and waste milk for 2-3 days before switching completely to waste milk. Calves receive pasteurized waste milk until weaning. Actual transition and weaning times can be adjusted to accommodate waste milk supply. Calves have access to fresh clean water and high quality calf starter throughout the program.

Program Description

25-15 Milk Replacer Phase

Table 1 summarizes the components of the pasteurized waste milk feeding program. After colostrum feeding, calves begin the milk replacer feeding phase. The 25-15 formula is designed to be mixed at the rate of 1.5 lb/gallon of water. At 18% solids, this is a more concentrated solution than is typical for a 20-20 milk replacer. Calves receive 2 quarts twice daily.

Starter and Water. By the end of the Week 1, a calf weighing 95 lb at birth will weigh about 100 lb. Although calves should receive free choice water and a high quality calf starter as soon as they start on milk replacer, there is usually no appreciable consumption of starter during the first week. Easy access to clean water and high quality starter throughout the program is required for adequate rumen development and desired growth rate. Research on commercial calf starters with similar nutrient profiles showed a 20 lb weight gain difference by 6 weeks of age due to quality differences between starters. Starter quality has a major impact on the growth rate of pre-weaned calves.

Nutrient Intake & Calf Growth Rate. Calf weights and starter consumption data shown in Table 1 are derived from Merrick's Calf Research Facility data and are reasonable approximations for a 25-15 milk replacer feeding program. The numbers presented are from measurement taken at the end of the respective week.

As shown in the table, Energy Allowable ADG is the maximum average daily gain that can be supported by the energy in the diet. ADP Allowable Gain, on the other hand, is the maximum daily gain that can be supported by the apparently digestible protein in the diet. The lower of the two values is the limiting factor for gain. In Week 1, for example, Energy Allowable ADG is 1.08 lb. The ADP Allowable Gain is 1.21 lb. Being the smaller value, Energy Allowable ADG is the limiting factor and limits gain to 1.08 lb/day. These values are for a calf housed at a comfortable temperature within its thermoneutral zone, free from stress, and represent theoretical maximum growth rates.

Crude Protein Balance provides another view of the relationship between protein and energy relative to gain. A positive value indicates there is more protein in the diet than energy. This is the situation during weeks 1-3. A positive Crude Protein Balance indicates a diet that supports lean tissue gain, resulting in taller, bigger frame calves. If Crude Protein Balance is negative, such as during weeks 4-6, there is more energy relative to protein. In this situation excess energy is converted to fat, increasing what is commonly referred to as body condition. Crude Protein Balance is a quick indicator of the nature of calf weight gain. Large values indicate excessive feeding of either protein or energy.

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Table 1. Pasteurized Waste Milk Feeding Program Profile

	Week	Calf Weight (lbs)	Milk/Milk Replacer Volume (qt/day)	Dry Matter Intake (lb/day)		Energy Allowable ADG (lb)	ADP Allowable Gain (lb)	Crude Protein Balance (g)
				Milk/Milk Replacer	Calf Starter			
25-15 Milk Replacer	1	100	4	1.5	--	1.08	1.21	15
	2	105	4	1.5	0.16	1.15	1.27	14
	3	115	4	1.5	0.50	1.30	1.41	13
Pasteurized Waste Milk	4	126	6	1.5	0.67	1.61	1.49	-14
	5	139	6	1.5	1.10	1.76	1.67	-12
	6	155	6	1.5	1.60	1.93	1.87	-7

Energy Allowable ADG, ADP Allowable Gain and Crude Protein Balance values were generated using the 2001 NRC Nutrient Requirements of Dairy Cattle Simulation program

Week. Calves receive a 25% protein, 15% fat milk replacer for the first three weeks. Pasteurized waste milk is fed from the 4th week through weaning. If waste milk is in short supply, the transition to waste milk can be delayed until week 5.

Calf Weight reflects the typical growth of each calf as it progresses through each week of the feeding schedule.

Milk/Milk Replacer Volume is the total amount of milk or milk replacer each calf receives each day. This is usually divided into two equal feedings per day. The six quarts fed from weeks 4 -6 can be divided into 3 equal feedings per day. To facilitate an easy transition to whole milk, calves should receive a 50/50 mix of milk replacer and pasteurized waste milk for 2-3 days during transition.

Dry Matter Intake, Milk/Milk Replacer is the amount of milk replacer powder or the amount of solids in the pasteurized waste milk that each calf receives each day.

Dry Matter Intake, Calf Starter is the estimated daily starter consumption of each calf during that week. The values are based on starter consumption data observed at Merrick's Calf Research Facility. The starter is 18% crude protein, 3% fat, 5% ash, 90% DM.

Energy Allowable ADG is the average daily gain supported by the energy level of the feed. This estimate is for a calf that is housed at a comfortable temperature within its thermoneutral zone and is free from any stress.

ADP Allowable Gain is the amount of gain supported by the apparently digestible protein provided by the feed. This estimate is for a calf that is housed at a comfortable temperature within its thermoneutral zone and is free from any stress.

Crude Protein Balance shows the relationship between protein and energy. If this value is positive, there is more protein in the diet than there is energy available to convert protein to gain. In other words, energy limits gain, and the Energy Allowable Gain value is the theoretical maximum growth rate. If Crude Protein Balance is negative, there is more energy than there is protein in the diet for gain. In this case, protein limits gain and the ADP Allowable Gain is the theoretical maximum growth rate.

As a point of comparison, the growth rate of calves receiving a 25-15 formula will be higher than calves receiving and equal volume of whole milk. This difference has to do with the 18% solids of the milk replacer solution compared to the 12.5 % solids of whole milk. As shown in Table 2, the Energy Allowable ADG for 4 qt of whole milk fed to a 100 lb calf is 0.78 lb/day. The ADP Allowable Gain is 0.84 lb/day and the Crude Protein Balance is 7 g/day. The 25-15 values are 1.08 lb/day, 1.21 lb/day and 15 g/day, respective

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Table 2. Comparison Of Whole Milk To 25-15 Milk Replacer

	Wk	Calf Weight (lbs)	Milk/Milk Replacer Volume (qt/day)	Dry Matter Intake (lb/day)		Energy Allowable ADG (lb)	ADP Allowable Gain (lb)	Crude Protein Balance (g)
				Milk/Milk Replacer	Calf Starter			
Milk	1	100	4	1.0	--	0.78	0.84	7
25-15	1	100	4	1.5	--	1.08	1.21	15

The protein and fat percentages of the whole milk used in this analysis are 24.5 and 30.8% respectively, compared to 25 and 15% for the milk replacer. A pound of the whole milk provides about twice as much fat as a pound of milk replacer on a dry matter basis. However, this does not mean that whole milk has twice the energy. The lactose content of milk replacer is higher than it is in whole milk. The energy from lactose leads to a much smaller difference in the total energy provided by either a 25-25 milk replacer or whole milk.

Pasteurized Waste Milk Phase

At the start of Week 4 calves begin their transition to pasteurized waste milk. A 50/50 mix of 25-15 milk replacer and pasteurized waste milk for 2-3 days will ease the diet change. After this transition period, calves can be switched entirely to pasteurized waste milk.

Waste Milk Variability. Natural variability of waste milk means substantial nutritional differences in this feed source from farm to farm as well as fluctuations within farms. Transition milk from fresh cows is higher in protein, fat and solids than normal whole milk, while mastitic milk is typically lower in fat and solids. Due to this variability whole milk was used in the profiles presented in Tables 1 and 2. The protein, fat and solids percentages used were 24.5, 30.8 and 12.5% respectively.

Feeding Rate. A six quart per day feeding rate of waste milk is used to maintain the 1.5 lb/day intake of solids that calves receive during the milk replacer phase. A five quart feeding rate corresponds to about 1.25 lb of solids. Feeding 4qt per day of whole milk drops the solids level to about 1.0 lb/day. Table 2 provides a relative comparison of nutrient intake between 4 qt of whole milk per day and 4 qt of 25-15. Switching from 4 qt of 25-15 milk replacer to 4 qt of whole milk causes a reduction in nutrient intake which may cause calves to stall in Week 4 and lead to other undesirable effects. Therefore, a 5-6 qt feeding level of pasteurized waste milk is recommended.

Transition and Weaning. If waste milk is in short supply, the time of transition from milk replacer can be delayed or the length of the transition period can be extended to reduce the use of waste milk. If waste milk is more plentiful, weaning time can be postponed for more complete utilization of available waste milk. Calves should remain on the 25-15 milk replacer for a minimum of three weeks. From a disease standpoint, the first three weeks of a calf's can be the most challenging. Maintaining a good, consistent nutrition plan during this critical phase is what this program is all about. In general, calves can be weaned when they are eating between 1.5 to 3.0 lb of starter for at least 3 consecutive days

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