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Calf Note #84 – Accelerated feeding #1 – current feeding programs

Introduction. This Calf Note is the first in a series of Notes intended to evaluate current feeding programs for young dairy calves. Over the next several months, we'll look at methods of feeding calves from several perspectives – historical, managerial (including economics), nutritional and immunological. This (hopefully) will provide a reasonable review of why we do what we do today and options related to “new” management.

Accelerated feeding programs have been a “hot topic” of conversation in the calf raising industry. I have been surprised by the surprised pronouncements by people – “do you know that we’re not feeding enough milk to calves?” they say. Well, it should be no epiphany that we’re not feeding enough milk to calves to support their genetic potential for growth. We never have fed them enough nutrients for maximal growth. Feeding calves the limited milk or milk replacer does NOT provide enough energy or protein for maximal growth. Let’s look at an example.

- Assume that we’re dealing with a 45-kg (100 lb.) calf.
- We feed this calf 454 g/day of milk replacer powder that contains 20% crude protein and 20% crude fat. If we assume that the milk replacer is 95% dry matter, we are feeding $454 \times 0.95 = 431$ g/day.
- Let’s also assume that the milk replacer contains about 20.5 MJ (megajoules) of metabolizable energy per kg of DM. If we feed 0.431 kg of DM, then the calf will consume $0.431 \times 20.5 = 8.8$ MJ of ME per day. Of course, the actual amount of ME will vary on the overall quality of ingredients used in the formula, but let’s assume that we’re dealing with a reasonably good quality product. (Note that the ME content of whole milk is higher than a 20/20 milk replacer).
- If the calf needs 0.452 MJ/kg $BW^{0.75}$ for maintenance (this formula is based on NRC requirements), then a 45-kg calf needs $0.452 \times 45^{0.75} = 7.85$ MJ/day to maintain it’s own body weight. This leaves $8.8 - 7.9 = 0.9$ MJ of ME available for growth.
- Let’s now assume that the calf needs 13 MJ of ME for each kg of gain, then the calf will be able to grow at $0.9/13 = 69$ grams of BW gain per day.

Why do we feed calves this way? Well, that’s a good question. Certainly, feeding limited energy and protein is not typical for most young animals. Most young animals (pigs, lambs, etc.) are fed for maximum growth during this early period, because they are very efficient in depositing protein as lean tissue growth. There are several theories why we have traditionally fed 1 lb. (454 g) of milk replacer powder (or approximately the same amount of solids from whole milk) to dairy calves. Some include:

- Early milk replacers were poor quality and if you fed them any more than this, you’d have calves that developed diarrhea.

- Feeding ½ lb. per feeding (8 ounces or 227 grams) was easy to measure using the cup that was included in the milk replacer bag and you only needed to feed one two-quart (two-liter) bottle at each feeding.
- Early milk replacer formulas had to be cheaper than feeding whole milk and if you fed more, it would be cheaper to feed whole milk.
- People traditionally fed two quarts of whole milk at each feeding (even before milk replacers were developed) and changing people's habits is hard!
- Limited milk replacer allows early weaning and lower costs to raise dairy calves to two months of age without any permanent effect on performance

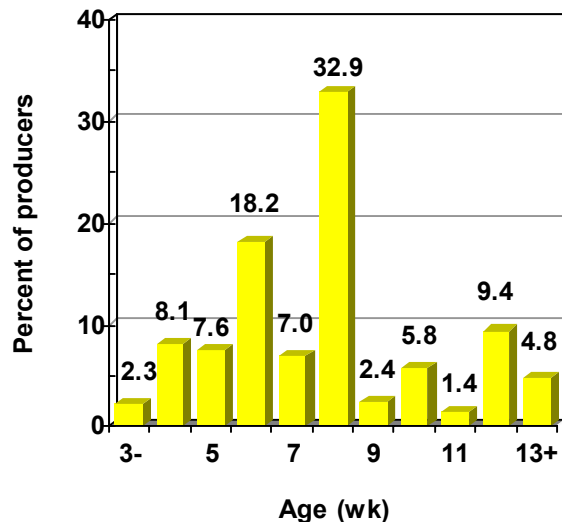
So, which of the above theories is most true? There's probably some validity to all of these theories and each probably played a part in our "traditional" milk replacer feeding recommendations. No doubt that early formulations were not nearly as high quality as today's mixtures. And, there's a lot of validity to the theory that 2 quarts of liquid is "tradition" and breaking tradition when you are introducing a new product (like a milk replacer) would not be accepted.

However, there's a lot of validity to the last theory. That is, if we limit the amount of milk or milk replacer that

- Calves are ready to be weaned when their rumens are sufficiently developed
- Rumen development is directly related to the consumption of fermentable carbohydrate, which promotes the production of volatile fatty acids in the rumen
- Fermentable carbohydrate is found in calf starters and calf prestarters
- There is a direct relationship between intake of energy from liquid feeds (e.g., milk replacer) and intake of energy from starters and prestarters – the more energy calves consume in liquid, the less they'll consume from starter
- Limiting the amount of energy that calves consume from milk replacer should encourage early, aggressive intake of calf starter, which leads to intake of fermentable carbohydrate, which produces VFA in the rumen, which causes the rumen to develop both physically and metabolically, which prepares the calf to be weaned.

There is a *tremendous* body of research that documents the value of early weaning programs for young dairy calves. Much of this work was done at places like Ohio State University, Penn State University, and Cornell University. Much of the work (done in the late 1950's and early 1960's) documents the calf's ability to eat dry feed and the physical and physiological changes associated with rumen development. Other research done at approximately the same time, documents management programs that evaluated early weaning programs, calf starter intake and calf growth when calves were managed to wean at 3 to 5 weeks of age. Almost without exception, these studies reported that the calf is physically prepared for weaning by 28 days of age, assuming that the animal had consumed a sufficient amount of dry feed for adequate rumen development. Commercial research by most of the major feed manufacturers also outline programs that will allow early weaning of young dairy calves. For example, a major feed company's web site identifies their product as the first feed that allows early weaning of young calves. It was introduced in 1935. Another company produces a product that is intended for use in a **two-week** weaning program. Indeed, most major feed manufactures – including milk replacer manufacturers – have recommend weaning calves at an early age for many years as the most economical method of rearing calves.

How early can calves be weaned? Probably the most definitive work was done by Dr. Jim Morrill from Kansas State University. Jim developed calf prestarters, based on pelleted milk products. These prestarters would be added to the milk bucket to induce the calf to begin eating dry feed to develop the rumen. His groundbreaking work indicated that calves could be weaned as early as 17 days of age. This program has been adopted by only a few producers, but some have been able to make this program work efficiently. According to USDA NAHMS data, about 2% of producers wean calves at 3 weeks of age or less. On the other hand, 56.7% of producers wean their calves at 8 weeks or later (see figure).



NAHMS, 1992

Current weaning practices. Although extension agents, feed company nutritionists, and even veterinarians have recommended early weaning, most people don't wean early. The most common age at weaning in the U.S. is eight weeks of age, based on USDA survey data (see figure). Why? I believe that management of calves on most farms is not intense enough (i.e., at a high enough level) to allow consistent early weaning of all calves. By this, I mean management of feed (both liquid and solid), availability of water, colostrum management during the first 24 hours of age (sick calves are unlikely to aggressively eat calf starter), and housing and management to minimize the risk of disease. Furthermore, it is quite common to manage calves in groups instead of individually. This is especially true of large calf ranches, where tens of thousands of calves are raised annually. In this situation, the 80/20 rule usually applies. That is, 80% or more of the calves will be ready to wean by 28 days, but 20% may not be ready, due to disease, slow acceptance of starter, etc. Because calves are treated as groups, the calves will be weaned only when the slowest 20% are ready, instead of the 80%. This leads to older ages at weaning even though many of the calves could and should be weaned earlier. Management by the lowest common denominator is not optimal, but it is labor efficient, which lowers the overall cost of calf raising.

The industry has recommended feeding calves to prepare them for weaning at 28 days by feeding limited milk replacer. For many different reasons (most of which are related to inadequate management), producers wean calves much later. Therefore, does it make sense to feed calves using a program that was originally intended to wean early but wean late? This may make accelerated feeding programs more attractive. Next time we'll look at some of the factors that appear to be responsible for delayed weaning.

**Written by Dr. Jim Quigley (18 May, 2002).
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