

If a little's good, is more better?

Mixing milk replacers for winter feeding of dairy calves

Dale Moore, Helen Floren and William Sischo for *Progressive Dairyman*

The total nutrients consumed by pre-weaned calves affects their average daily gain (ADG). What is even more intriguing is some evidence that the calf's ADG before weaning impacts its first-lactation milk yield. At Cornell, calves on two farms in New York were studied. For every 1-pound increase in ADG, the heifers, on average, produced 841 pounds more milk in their first lactation. Those born during winter produced about 1,200 pounds less milk in their first lactation compared to calves born during the summer. Increasing calves' nutrient intake in the winter not only gives them additional energy for their higher maintenance needs, it also improves their future milk production.

Most producers are aware that in cold climates, calves need more nutrients in the winter. Adding more milk replacer powder to the same amount of water is one method dairy producers and calf feeders use to meet this need. But what happens when too much powder is put into the same amount of water?

Milk replacer powder feeding

There are quite a number of different kinds of milk replacers in the marketplace. Knowing what you have and what the mixing requirements are is the first step. However, it is important to evaluate the calves' requirements. This tells you what kinds of daily weight gains you can achieve with the replacer. As an example, we'll look at the feeding programs of three dairy farmers who donated some milk replacer powder and samples of their calf milk mixes.

Farm A was feeding a 22 percent crude protein, 20 percent fat (22-20) standard milk replacer at a rate of 2 quarts two times per day. They were mixing at a rate of 1.25 pounds per

gallon, which gave them about 13 percent total solids. Using the National Research Council Requirements for Dairy Cattle for a 100-pound calf, the energy allowable daily gain was about 0.8 pounds per day, and the protein allowable gain was about 0.82 pounds per day in mild temperatures.

Maintenance requirements on Farm A used about 0.81 pounds of the powder. If the temperature was about 32°F, the calf would be using most of their nutrients for maintenance with not much left to gain any weight. If they increased the total dry matter intake to 1.5 pounds of replacer, they would have enough energy for about a half-pound of gain per day with about 15.4 percent total solids in the

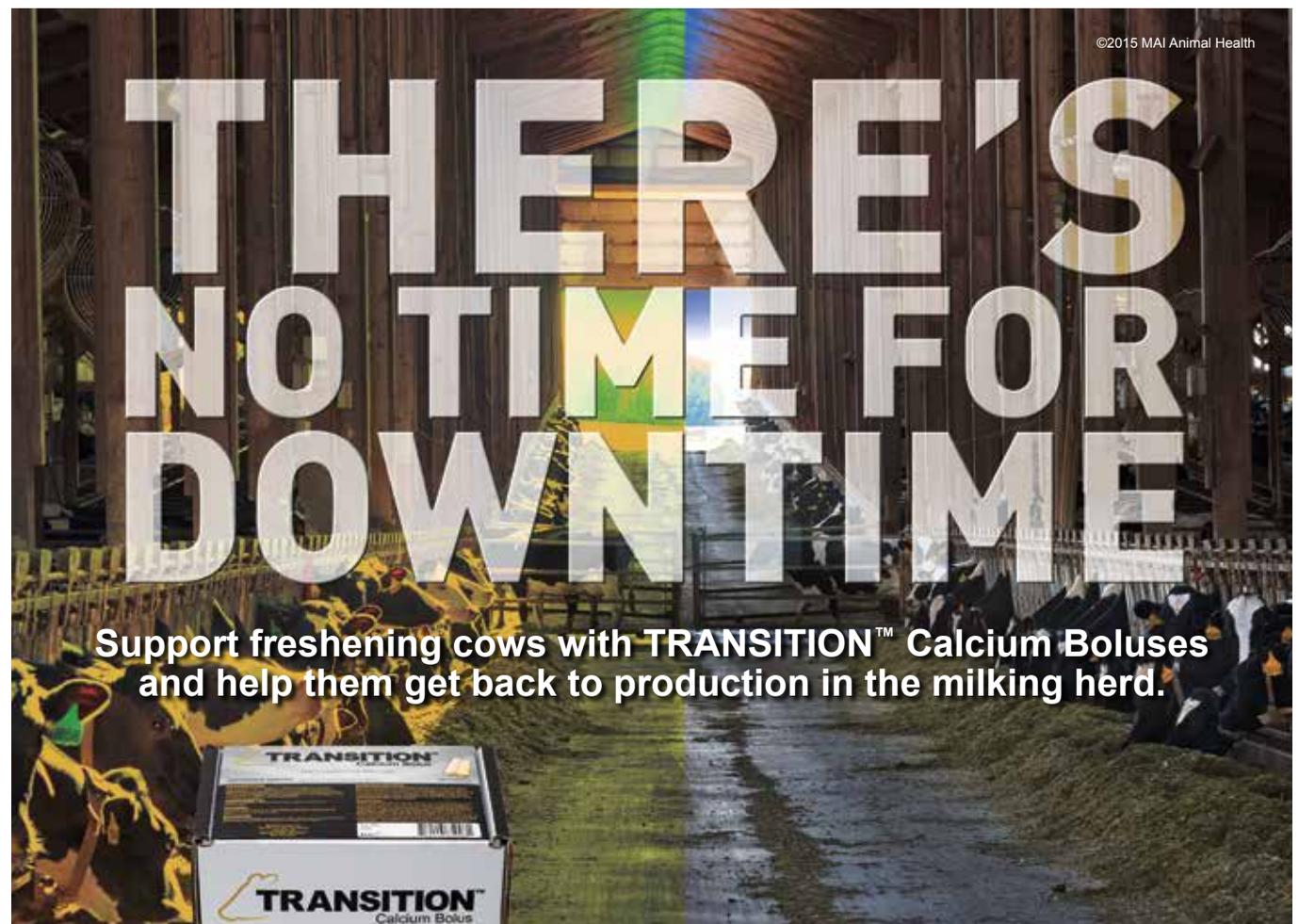
mix. If they increased the powder to 1.8 pounds per gallon per day, they would have enough energy to grow 1 pound per day, but the mix would be at 18 percent total solids. (In these calculations, we are assuming they are not eating much in the way of calf starter).

Farm B fed a 28-25 milk replacer, 2 quarts two times daily. They mixed at a rate of 1.8 pounds of powder per gallon. At this rate, on paper, a 100-pound calf could gain about 1.7 pounds per day in the summer and about 1.2 pounds in the winter. However, the total solids were about 18 percent.

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Winter calf feeding checklist

- Check with your nutritionist or veterinarian on the nutrient requirements for your calves in winter.
- If adding milk replacer powder to milk, increasing the powder in the same amount of water or putting additives into the milk or milk replacer, check the solids content and the osmolality to make sure you do not exceed 16 percent total solids or 600 mOsm per kg.
- Increase the total solids in the milk replacer slowly, 1 to 2 percentage points at a time.
- Do not add electrolyte powders to milk or milk replacers.
- Provide free-choice water.
- Add the milk replacer powder before the final volume is reached for the batch.
- Mix all milk replacers thoroughly to ensure consistency in feeding.
- Follow water temperatures recommended on the milk replacer mixing instructions.



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Farm C fed hospital milk plus a milk replacer “booster.” Their liquid calf feed was more than 18 percent total solids.

Total solids and osmolality of calf liquid feeds

The measure of total solids includes all of the components in the milk or milk replacer. We can think of it as the total dry matter in the liquid calf feed. The total solids of whole milk ranges from about 12.5 to 14 percent, depending upon the cow breed. Many of the feeding suggestions on milk replacers suggest mixing to 12.5 percent total solids to mimic what calves might see from the cow. The exact limit of percent total solids that can be fed differs among nutritionists – more than 15 or more than 18 percent.

Osmolality is the concentration of solute particles in a solution. The osmolality of whole cows' milk is less than 300 mOsm per kg, the same as it is in calves' blood. For Farm A, feeding their replacer at 13 percent total solids (1.25 pounds per gallon) led to an osmolality of that specific replacer of about 440 mOsm per kg. At 1.5 pounds per gallon (15 percent solids), the osmolality was about 530, and at 1.8 pounds per gallon, the osmolality rose to 660. For Farm B, feeding 1.8 pounds per gallon of the 28-25 replacer resulted in 18 percent

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total solids and an osmolality of 466. The Farm C solution of milk and replacer had an osmolality of 701.

Although there is somewhat of a relationship between total solids and osmolality, it really depends on what is in the solution. For example, in colostrum samples we have evaluated, we could see 26 percent total solids but an osmolality of only 440 mOsm per kg. Different milk replacers, when mixed at the same concentrations, may yield different osmolalities.

Osmolality and its consequences

Sodium is a major driver of osmolality in fluids. In an outbreak investigation of sick and dying calves due to salt poisoning, researchers at the University of Wisconsin discovered that the use of high-salinity water, adding electrolyte powder to the liquid feed and adding additional milk replacer powder for winter feeding contributed to the outbreak. Really, anything

that is added to the calf liquid feed could result in higher sodium or higher osmolality. Because the calf's blood wants to maintain a specific osmolality, having high osmolality in calf milk replacer or milk could cause diarrhea because fluids want to follow the high concentration of solutes in the milk replacer. In this case, that means they come out of the calf's blood and go into the intestine.

Another potential consequence of high-osmolality fluids fed to calves (greater than 600 mOsm per kg) is a delayed abomasal emptying rate. A delay in abomasal emptying could increase a calf's risk for bloat or abomasitis.

Conclusions

It is vitally important to feed additional nutrients to calves in winter to cover their extra body maintenance requirements. However, increasing the amount of milk replacer powder needs to be done carefully to avoid the consequences of

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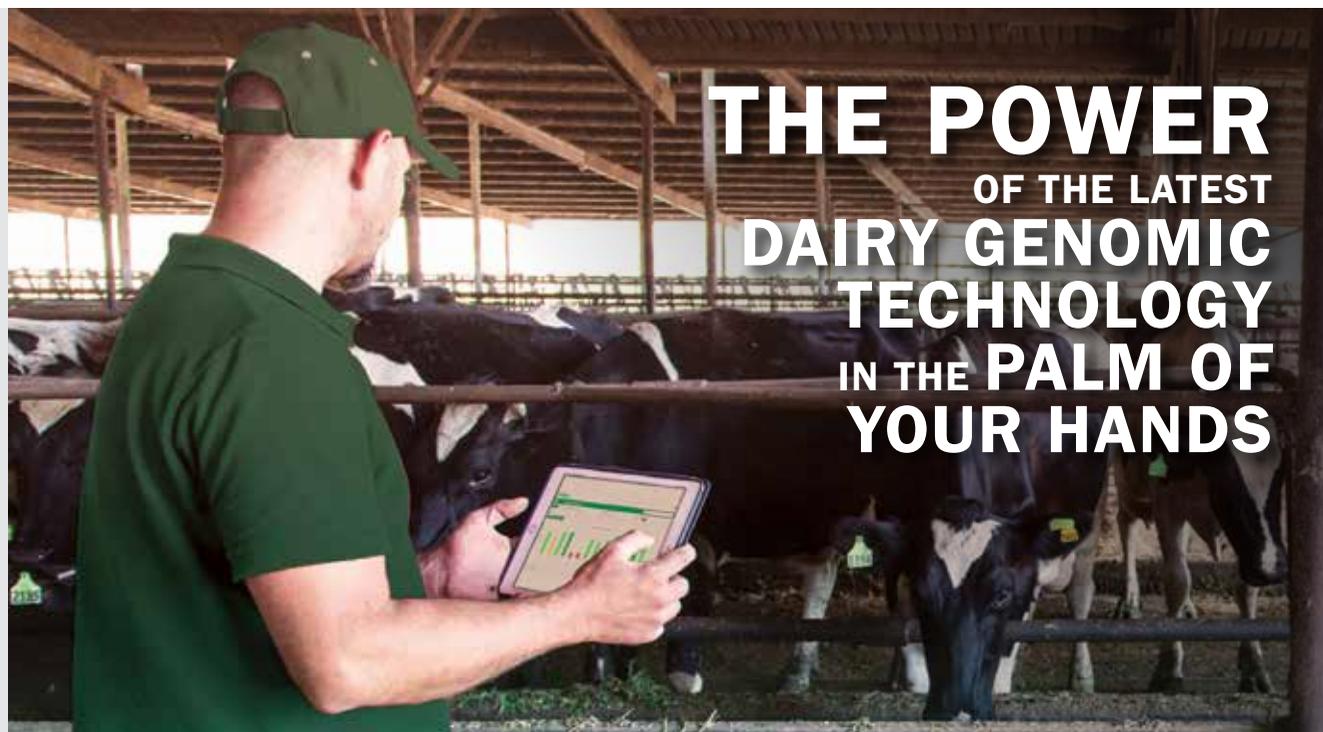
ingesting high-osmolality liquid feeds, such as diarrhea, bloat or abomasitis. Different milk replacers may result in different osmolalities, and adding a milk replacer booster to milk could potentially increase the salt concentration and osmolality. Check the consistency of the liquid feeding program and evaluate the total solids and osmolality of those winter calf feeds to make sure the calves get the feed that is “just right.” **PD**

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References omitted due to space but are available upon request.

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