Ask the Vet

When Mixing Milk Replacer, Water Temperature Matters

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In the children's book *Goldilocks and the Three Bears*, a little girl named Goldilocks wanders into the forest home of a family of bears and while they are out, she eats from three different bowls of porridge. The first one is too hot and the second one is too cold, but the third one was "just right". When mixing milk replacer it's important that the water used to mix is not too hot or too cold. So what temperature is "just right" when mixing calf milk replacer?

Mixing Temperature

Depending on the formulation, fat sources and manufacturing style, mixing instructions may vary. However, most milk replacer manufacturers recommend a water temperature of 110° F to 140° F to achieve proper fat dispersion while also protecting the integrity of the proteins.

If the temperature of the mixing water is too hot (typically over 160° F), the proteins in the powder can be degraded and their digestibility will be reduced. If the temperature is too cold (typically under 110° F), the fats will not achieve proper dispersion within the solution. This reduced fat dispersion decreases the fat's digestibility and can lead to suboptimal weight gain and increase the risk of scours.

As a rule of thumb, the higher the percentage of fat in a milk replacer formulation, the more it could benefit from warmer water temperatures during mixing.

It's Harder Than It Looks

Dairy Management students at Penn State University participated in an assignment where the class was asked to mix two quarts of milk replacer according to the manufacturer's label. How hard could it be? The goal was to create two quarts of milk replacer with a total solids percentage of 13% and a temperature during mixing between 110° F and 115° F. Of the 41 students, only two of them created a milk replacer solution with the correct total solids percentage within the correct temperature range. That means that 39 out of the 41 students (over 95% of participants) mixed the milk replacer that delivered incorrect total solids and/or an incorrect temperature.

Are your employees consistently mixing milk replacer correctly? When is the last time anyone checked their mixing temperature? If you feed the calves yourself, when is the last time you checked your mixes with a thermometer?

Understanding Fat Dispersion

Milk replacer solutions are often high in fat and getting a fat to dissolve in water can be challenging. Fat, by its very nature is hydrophobic, meaning that it does not like to dissolve in water. The fats used in milk replacer formulations typically have melting points between 95° F and 115° F. If the water temperature during mixing is not warm enough to melt the fat in the formula, the fat will have reduced solubility within the solution; leading to poor fat digestibility in the calf's GI tract.

Tips and Tricks to Create Consistency

1. **Stop using your finger as a thermometer.** Consistent water temperatures are a function of good feeding discipline. Thermometers are inexpensive to buy and only require discipline to consistently use. Mix your hot and cold knobs and allow the water to run and reach a steady temperature and then check that temperature with a thermometer before starting the mix. Achieving the correct water temperature requires discipline to do it every feeding, day in and day out.

2. **Seasonally adjust your water temperatures higher during cold weather and cooler during warm weather.** The mass of the milk replacer powder will cool the water when its added. Using hotter water during the winter will provide a

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buffer so when cold powder is added to the solution, the temperature stays above the desired mixing temperature. I've seen clients successfully start with water at 130° F during the winter and transition to 123° F during the summer, to accommodate for the drop in temperature when adding the milk replacer powder.

3. **Measure the temperature drop.** Your milk mixing room can be like a science lab. Measure the temperature of the water before and immediately after adding the milk replacer powder. By doing this over different seasons you will develop a fairly accurate gauge of how much the milk replacer powder will make the water temperature drop based on the temperature of the powder when its added. Knowing this rule of thumb will provide a good gauge to create consistency in the mixing process.

4. **Use an on-demand water heater.** If your tank water heater is old, consider replacing it with a digital on demand water heater. Many models will allow you to set the water temperature with a digital dial. These systems are very accurate and help create consistency when multiple feeders on a farm may mix the milk replacer. Many of the self-propelled milk delivery systems now come with integrated thermometers that show temperature on a digital display.

In summary, mixing milk replacer at the correct temperature is very important, and as the students at Penn State displayed, not as easy as one would initially think. The correct water temperature helps disperse the fats in the milk replacer solution and optimizes the nutritional digestibility of the feed. Adjusting mix water temperatures as the seasons change can help keep the overall mix consistent which leads to happy, healthy calves. To discuss your calf feeding program in more detail, please call Crystal Creek® and ask to speak with one of our livestock specialists.

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