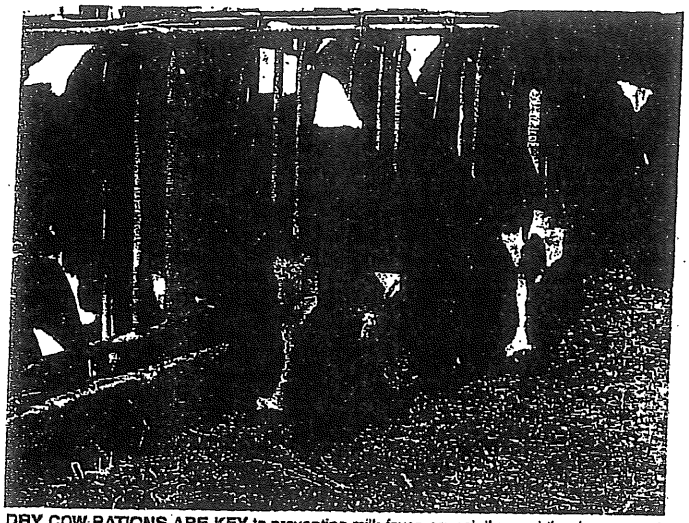
by Jesse P. Goff and Ronald L. Horst

To understand milk fever is to prevent it

MILK fever affects about 6 percent of the dairy cows in the U.S. each year. In these cows, blood calcium concentration is below 5 milligrams per 100 milliliters (mg/100 ml) of blood. This low calcium level does not permit muscles and nerves to function. This is why milk fever cows go "down."

Normally blood calcium concentration is between 9 and 10 mg/100ml. About 50 percent of dairy cows will have a blood calcium concentration below 7 mg/100 ml the day of calving. This level does not cause any noticeable symptoms.

But this drop in blood calcium, known as subclinical hypocalcemia, makes cows eat less which can result in other diseases such as ketosis, retained placenta, DA's and infections. Efforts made to raise the blood calcium concentration in fresh cows can have payoffs even in herds that do not seem to have a milk fever problem.



DRY COW RATIONS ARE KEY to preventing milk fever, especially providing low-potassium forages. We may be just as well off with carefully selected alfalfas fed with corn silage.

Colostrum has nearly twice the calcium of milk, and producing it removes large amounts of calcium from the cow's blood. This calcium must be replaced. The process involves removing calcium stored in bones and raising the amount of dietary calcium that is absorbed by the intestine.

The parathyroid glands in the cow's neck monitor blood calcium. Whenever blood calcium falls below normal, the gland releases parathyroid hormone. Parathyroid hormone causes certain bone cells known as osteoclasts to move calcium from the bones to the blood.

Parathyroid hormone also stimulates the cow's kidneys to produce a second hormone that is made from vitamin D. This hormone, 1,25-dihydroxyvitamin D, stimulates production of calcium pumps within the cells lining the intestine. These "pumps" move dietary calcium into the bloodstream, again raising blood calcium toward normal levels.

Usually, the system to maintain normal blood calcium levels works quite well. However, in those cows in which the system fails, the result is low blood calcium and, in some cases, milk fever.

Several factors determine which cows are at greatest risk. Jerseys and Guernseys are greater, in part, because they produce colostrum with a higher calcium content than Holsteins.

Age also is a factor. First-calf heifers almost never develop milk fever. Heifers generally produce less colostrum than older cows, but, more importantly, the bones of heifers are still growing. Growing bones have more osteoclasts so they can respond to the need to release calcium more readily.

Finally, ration can determine how well the system to replace calcium lost to colostrum will perform when needed.

Cows develop hypocalcemia and milk fever because their bones and kidneys do not respond to parathyroid hormone. This prevents calcium from being released by the bone and prevents 1,25-dihydroxyvitamin D from being formed in amounts necessary to prevent a severe decline in blood calcium. We believe this occurs whenever the blood pH is alkaline.

Proteins on the surface of bone and kidney cells which are supposed to recognize parathyroid hormone in the cow's blood lose their ability to recognize and respond to parathyroid hormone when the blood pH is high (less acid). The reason the cow's blood is alkaline is because of high dietary cations, especially potassium.

Cations are minerals with a positive charge and include potassium, sodium, calcium and magnesium. If the cations in the feed are absorbed into the blood, they cause the blood to become more alkaline (higher pH). If they are not absorbed, they do not affect blood acidity.

Nearly all of the potassium and sodium in the diet is absorbed by cows. This fact makes these two elements powerful alkalinizing cations. Calcium and magnesium are absorbed only poorly from dry cow rations so these cations are not strong alkalinizing agents. Dry cow diets high in potassium, sodium or both alkalinize the cow's blood and add to milk fever susceptibility.

The first step to preventing milk fever should be to remove potassium and sodium from close-up, dry cow rations. Sodium usually is not present in any great amount in the feeds commonly used. We just have to avoid adding sodium to the ration through sodium bicarbonate and sodium chloride. But, in some areas of the U.S. where continuous irrigation has raised the salinity of the soil, forages grown can be rather high in sodium.

Removing potassium from close-up rations presents a bigger problem. All plants must have access to a certain amount of potassium to obtain maximal growth. However, alfalfa, other legumes and at least some grasses accumulate potassium to concentrations well above that required for optimal growth.

Optimal growth of alfalfa occurs when plant potassium is 1.7 to 2.0 percent. Alfalfa often contains much higher levels. Lanyon reported that the potassium concentration of alfalfa samples submitted by Pennsylvania producers averaged 3.1 percent potassium, ranging from 1.42 to 4.05 percent.

Many people fertilize alfalfa heavily with potassium to boost resistance to winterkill. However, it is unlikely that any benefit is seen by raising plant potassium beyond 2.5 percent. Current practices may at times overfertilize alfalfa with potassium, resulting in high potassium plants which are detrimental to the health of fresh cows.

What can you do to obtain a low-potassium forage for the transition cow ration?

Our strategy is to use grasses, including corn which actually is a warm-season grass. Corn silage tends to be about 1.5 percent potassium. It is difficult to find any other forage this low in potassium. Some other warm-season grasses such as switchgrass, big bluestem and Indiangrass tend to be low in potassium, also, but they are low in protein and digestibility, too.

Cool-season grasses such as bluegrass, orchardgrass and brome tested lower in potassium than alfalfa did 20 years ago. At that time, these hayfields weren't likely to receive fertilizer.

The tremendous rise in the number of cows on each farm has not been accompanied by a rise in the amount of land available for spreading manure. As a result, hayfields not fertilized in the past are now being manured extensively.

Cool season grasses have a fibrous root system which makes them very efficient utilizers of soil potassium. They actually will outcompete alfalfa for potassium. This is why our alfalfa stands eventually become grassy. Research at the Miner Institute in New York (March 25, 1996, issue, page 224) indicates that timothy accumulates potassium to a lesser extent than other grasses. Also, the second cutting of grass hays generally contain less potassium than the first.

What about legumes?

In the past, alfalfa and other legumes were left out of dry cow rations because they were high in calcium. However, we now know that dietary calcium has little effect on the alkalinity of the cow's blood under practical conditions, so it does not induce milk fever.

By restricting potassium application to the soil, it is possible to grow alfalfa that is as low in potassium as many of the grass hays. But this eventually allows grasses to take over the stand and results in more winterkill. One option may be to withhold potassium fertilization from a field that is in its last year of production and harvest that field specifically for the dry cows.

Here are some other guidelines.

- Alfalfa potassium is highest in alfalfa harvested in the early vegetative stage. Full-bloom alfalfa may be more suitable for the dry cow.
- Potassium is released from wet soil more readily than from dry soil. Most years, the first cutting of alfalfa will have a higher potassium content than later cuttings.

The key to milk fever prevention is to find a low-potassium hay or hay silage source and combine it with corn silage. Try to formulate dry cow total ration with less than 2 percent potassium. Limit access to pasture which is a high potassium source not considered in most rations, and watch to see if cows eat their bedding. Oat straw especially is high in potassium.

Today, we have ways to control milk fever besides just feeding low-potassium forages. We'll cover that in a second article.

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