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Water quality in the Mid-South

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WATER is the most essential nutrient dairy cattle consume. Most dairies frequently analyze feed samples to determine nutrient content, yet the chemical composition and quality of water is sometimes ignored.

Recently we collected and analyzed water samples from 17 dairies in east Texas, central Texas, west Texas, New Mexico, and Oklahoma. Laboratory results were evaluated to determine some of the potential problems that might be encountered in the Mid-South region of the country (see Table 1 on next page).

Each state had one or more samples identified as potentially causing production and health problems. One of the herds had switched to city water, while another had treated the water they used in their parlor and for fresh and hospital cows.

The most common indicator of potential problems was total dissolved solids (TDS). The four worst samples had TDS values of 1,339, 1,788, 2,178 and 3,432 parts per million. These samples were from east Texas, New Mexico, SW Oklahoma, and New Mexico, respectively.

TDS indicates the salinity of water and is generally considered undesirable. However, TDS by itself does not identify what is causing the problem or what symptoms might be expected. High TDS can be an indicator of poor quality water.

Although not always the case, high sulfates contributed to the high TDS levels found in these samples. Reduced feed intake and milk yield typically are symptoms first observed in cows with high sulfates in their drinking water. High levels of sulfate also can decrease water consumption. In addition, more retained placentas and displaced abomasums were noted.

High sulfates were not the only contributor to the high TDS levels identified. One sample also was high in sodium and chloride. Another was high in calcium and was marginally high in iron. The sample with the highest TDS was also high in sodium, magnesium, iron and chloride.High TDS was not just a problem in arid regions. One of the samples was from an area receiving over 50 inches of rainfall annually.

One sample from east Texas had an exceptionally high concentration of iron at 7.79 ppm, which greatly exceeds the caution level of 0.3 ppm. Without treatment to remove the iron, levels at these concentrations in drinking water can cause problems. First, high levels of iron might reduce palatability and, consequently, decrease water consumption. Obviously with cows producing milk which is 87% water, decreased water intake is not desirable.

The next area of concern is the slime that is formed by iron-loving bacteria in the plumbing and waterers. This slime actually can reduce the rate and volume of water flow through pipes, which also could limit water availability.

When cows do consume the water, the high levels of iron actually can interfere

with copper and zinc absorption, resulting in a deficiency of these mineral elements. Because most of the iron in water is in the water-soluble and very absorbable state, it may cause oxidative stress in the tissues of cows. The consequences of oxidative stress are particularly noticeable in fresh and transition cows. Symptoms may include compromised immune function, increased fresh cow mastitis and metritis, more retained placentas, as well as diarrhea, depressed feed intake, reduced growth and decreased milk production.

Chlorination and ozonation followed by mechanical filtration, cation or anion ex-

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change, and oxidizing filters can be used to remove iron. The dairy producer on this facility currently treats water used in the parlor and for the fresh and sick cows. However, the remaining animals receive untreated water. All other constituents analyzed in the treated water on this dairy were below guideline levels in Table 1.

Two of the dairies sampled had high levels of coliform present. These facilities should be re-sampled and re-tested to verify the problem. If it is confirmed, action should be taken to eliminate the microorganism from the system. Chlorination, ultraviolet radiation and ozonation have been shown as effective treatments for coliform bacteria.

Only one of the samples was marginally high in nitrate-N (NO_3-N). Nitrate-N can fluctuate with time based upon how close the well is to cropland and how much rain the area has had. High levels of NO_3-N can result in reduced reproductive performance. Thus, well water should be sampled and tested periodically (quarterly) for NO_3-N.

Producers need to be aware of any water quality issues they might have on their dairies. Of course the place to start is by taking a sample of the water and having it analyzed. Most nutrition consultants can help producers find a lab to send their samples to and, more importantly, help producers interpret the results.

If it is determined by water analysis that unwanted constituents are present and a concern exists for dairy animal health and(or) performance, the question becomes, "What can and should be done about it?" In many cases this may involve finding an alternate water source (e.g., new well or perhaps a municipal water source).

The other main consideration is whether or not to treat to remove anti-quality factors. This has been accomplished successfully and economically on some dairies, but it may not be cost-effective in every case.

Careful evaluation of the magnitude of the problem, how much potential benefit can be derived from removing unwanted constituents, and at what cost for the expected improvement in animal performance and health are key considerations. Most dairies use relatively large volumes of water and treatment systems must be sized accordingly.

Specific water quality problems must be addressed with specific water treatment companies in the local area. It is highly encouraged that dairy producers compare effectiveness, life expectancy, volume capacity, maintenance time, and initial and maintenance costs of each type of method with several commercial companies before making any significant financial investments. Extensive investigation is highly recommended.

The complete article on water quality includes a detailed description of the water samples analyzed, potential water problems, sampling guidelines, and treatment methods. If you would like a copy of the proceedings from the conference it is available by sending a check for $15 ($U.S. residents) to Texas Animal Nutrition Council, 17360 Coit Road, Dallas, TX 75252.

Table 1. Drinking water quality guidelines and range identified in 17 dairy water samples from Texas, New Mexico and Oklahoma, with the number of water samples above the upper limit of the guidelines.

item	guidelines[1]	range identified	# of samples above guidelines[2]
Na (ppm)	>150	16.4 - 479	3
Ca (ppm)	>500	0.96 - 588	1
Mg (ppm)	>125	0.79 - 341	1
pH	7.0-9.0	6.83 - 7.96	1
No_3-N (ppm)	>20	n.d. to 22	1
SO_4 (ppm)	>250-500	8 - 2,330	5
conductivity (mmhos/cm)	>1.5	0.339 - 5.280	4
total dissolved solids (ppm)	>500-1000	103 - 3,432	9
total coliforms (cfu/100 ml)	calves – >1 mature – >15-50	n.d. to 87	2
Fe (ppm)	>0.3	n.d. to 7.79	3
Cl (ppm)	>250-500	13 - 668	2
Cu (ppm)	>0.3	n.d. to 0.1	0

[1]: Guidelines are reference values of Beede's, based upon field experience on commercial dairies and research literature about drinking water quality for livestock and humans.

[2]: The lower limit of the range in the guideline column was used for determining the number of samples above guidelines.

Pressed sugar beet pulp for dairy cattle rations

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BEET pulp is the solid residue after extracting sugar from sugar beets. Although dried beet pulp is a popular component of many dairy rations, the drying process is costly as it consumes large quantities of fossil fuels. As an alternative to drying beet pulp, Western sugar processors are evaluating the option to sell pressed pulp to dairy and other livestock producers.

Pressed beet pulp contains 20 to 25% dry matter, limiting the distance it can be transported economically. Nevertheless, pressed beet pulp is a valuable feed, high in energy (85% of the energy value of corn), and low in protein (7 to 10% crude protein).

Pressed beet pulp is considered a nonforage fiber source and may be used to partially replace forage in dairy cattle rations at a rate of 10 to 20% of the ration dry matter. Higher levels may reduce dry matter intake. According to Utah State University research, dairy cattle fed a total mixed ration with either pressed beet pulp or dried beet pulp exhibited no difference in milk yield or composition.

A recent University of Idaho study compared total mixed rations both with and without pressed beet pulp on a commercial dairy. Pressed beet pulp replaced corn silage in the test total mixed ration. Milk yield and composition data are currently being analyzed.

After mechanical processing, pressed beet pulp is warm. If stacked in piles, pressed beet pulp quickly begins to ferment unevenly, becoming unstable and unpalatable for livestock. However, pressed beet pulp can be successfully ensiled in silage bags or bunker silos. For best results, French researchers suggest ensiling should be completed within 24 hours of processing, and bunker silos should not be greater than 6.5' in height and 26' in width.

Why is it necessary to ensile pressed beet pulp quickly after processing? Because warm temperatures (104 to 122 degrees F), coupled with an anaerobic environment, favor the development of lactic acid bacteria. Lactic acid bacteria ferment soluble sugar, resulting in acidification and decreased pH, thus inhibiting further growth of microorganisms and preserving the silage.

According to the French researchers, the dimensions of the bunker silo should allow for sufficient cooling of the silage mass after fermentation and daily removal of 4 to 7 inches from the silage face. When bunker silos larger than 6.5' in height and 26' in width are used, cooling of the pressed pulp is slowed, causing decreased silage quality. Furthermore, crumbling of the face occurs, allowing growth of undesirable bacteria.

The future of pressed beet pulp in dairy rations is promising for some producers, but uncertain for others. The low dry matter of pressed beet pulp limits the distance it can be transported, thus restricting use to dairies in the proximity of sugar beet processing plants. Limited availability of dried beet pulp in the future from Western sugar processors may cause significant ration challenges to nutritionists and producers on dairies located long distances from sugar beet processing plants.

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