

Colorado Dairy News

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Copper in Dairy Footbaths: Is It A Problem for Crops and Cows?

Jessica Davis and Bill Wailes

CSU Soils and Dairy Specialists

Most dairies in Colorado use copper sulfate in footbaths to control hoof infections. After use, the footbaths are usually channeled into the wastewater lagoons along with the runoff water and flush water from the milking parlors. The lagoon effluent is then usually applied to forage crops being grown to feed the cows. E.D. Thomas in the July 2001 Hoard's Dairyman expressed concern that these procedures may cause copper accumulation in forage crops and subsequent toxicity to dairy cows .

Regulations

At this time, there are no regulations that pertain to copper applications to crops in the form of dairy effluent. However, both the biosolids and hog regulations require regular soil sampling and analysis for copper. In addition, The Colorado Department of Health and Environment limits the annual and cumulative application of metals in biosolids, including copper. The annual limit for copper application in this form is 67 lbs/acre, and the cumulative or lifetime loading limit is 1340 lbs copper per acre. Officially, these limitations do not apply to dairies, unless they use biosolids. However, the wise milk producer will pay attention to these regulations as possible precedents for dairy regulation in the future.

Copper Quantities

We calculated typical copper usage by Colorado dairies and found a range from about 1000 lbs Cu/year up to over 10,000 lbs Cu/year. This calculation is based on the following information: 5-10 lbs copper sulfate is dissolved in 25 gallons of water, copper sulfate is 25% copper, footbaths hold 25-75 gallons of water and are changed about nine times per day and used two to three times per week. So is 1000-10,000 lbs Cu/yr a problem? Obviously, the answer will depend on how much acreage the effluent is spread on. If the effluent is all applied through one center pivot onto 125 acres, this is equivalent to 9 to 84 lbs Cu/acre/yr. The high end of the range is over the biosolids annual loading limit, so these values are high enough to warrant further consideration.

Toxicity to Bacteria in Lagoons

The first potential hazard of the copper could be to bacteria in the wastewater lagoons. Some copper may re-precipitate or settle out into the lagoon sludge, thus reducing the copper levels in the effluent itself. However, effluent copper levels may still be toxic to bacteria, and this is important because most lagoons are sites for either aerobic or

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Colorado 4-H Judging Team Stars at World Dairy Expo

Joshua Docheff

Our Colorado 4-H Dairy Cattle Judging Team recently participated in the 80th National 4-H Dairy Cattle Judging Contest in Madison, Wisconsin held in conjunction with the World Dairy Expo. Our team consisted of Tyler Maxey of Greeley, Raeann Carpio of Kersey, Andrea Milan of Eaton and me, Joshua Docheff of Mead. Our coaches were Keith Maxey and Debbie Carpio.

Our team did an excellent job in Madison. We were 7th team overall out of 31 teams and 10th overall in reasons. Tyler Maxey and I received All-American Honors with Tyler placing 13th overall and I was 10th overall. We were very pleased since our team was selected from a pool of 8 contestants and we competed against teams that were selected from hundreds of contestants!

Our season started in June with weekly workouts followed by a mid-summer contest in June and our state contest in

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Important Dates:
Mark Your Calendar

January 29, 2002: Colorado Dairy Nutrition Conference, Greeley, CO. Speakers include Drs. Bob Corbett, Mike Allen, Mike Hutjens, Keith Bolson and Jessie Goff. Union Colony civic center, Phips Auditorium, 8:30 am-4:30 pm. For more information contact WR Wailes, Extension Dairy Specialist, CSU 970/491-5390.

January 30-31, 2002: Colorado Dairy Days/Farm Show, Greeley, CO. For more information contact WR Wailes, Extension Dairy Specialist, CSU 970/491-5390 or Keith Maxey, Weld County Extension, 970/356-4000, ext 4465.



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A Message From Your Extension Dairy Specialist.....

The **Colorado Dairy Nutrition** conference on January 29th will feature the best speaker line-up we have ever had: Dr Bob Corbett will discuss accelerated growth rates in heifers; Dr Mike Allen will talk about fiber issues in forages; Dr Mike Hutchins will give an overview of nutritional benchmarks as they relate to dairy profitability; Dr Keith Bolson will speak on corn and hay silage, and Dr Jesse Goff will review the important issues surrounding the transition cow.

Dairy Days, 2002 follows the nutrition conference on January 30th and 31st; The headline speakers, Dr Wendy Powers (Iowa State) and Dr Theo van Kempen (North Carolina State) will speak on odor issues from a scientific perspective. David Jones from Dairyfarmers of America will talk about marketing issues for the mountain area. Dr John Smith (Kansas State) will discuss parlor efficiencies emphasizing why and how more cows can be milked per hour in your facility. Dr Jerry Olson will cover pregnancy rates and a California veterinarian will describe the Milk Quality Laboratory operating in Southern California. Dr. Sam Barrington will explain hemorrhagic bowel syndrome or "bloody gut", a problem that has plagued our industry in the past few years. Dr Chris Ashworth of Monsanto will speak on composting of dead animals on the farm. This is a very important topic for us regionally since I just found out that one of the largest rendering companies in northern Colorado will be closing its doors at the end of the year. Each dairy will now have to make plans for proper animal disposal.

CSU Dairy Resource List: Included as our insert this month is an updated list of resources at CSU helpful to dairy producers. We are proud that the list has grown considerably in the last 5 years!

Happy Holidays to you and yours,

Commodity Price Quotes

By-Product Feeds	Price/Ton Spot Loads	Price/Ton Future Months
Bakery Waste	\$95.00 (Tight)	NA
Blood Meal	\$360.00	NA
Corn Gluten Feed	\$95.00	\$100.00 (Dec-Mar)
Corn Gluten Meal	\$305.00	NA
Corn Hominy	\$85.00	\$85.00 (clock)
Flaked Corn	\$4.90/cwt	\$5.07/cwt (JFM)
Cottonseed Meal	\$175.00	\$175.00 (JFM)
Whole Cottonseed	\$148.00	\$163.00 (Jan-Sept)
Distillers Grains	\$115.00	\$118.00 (JFM)
Pork - Meat & Bone Meal	\$195.00	NA
Tallow	\$0.13/lb edible \$0.11/lb inedible	NA
SBM - 48%	\$182.00	\$175.00 (JFM)
Wheat Middlings	\$90.00 (Nov-Dec)	\$95.00 (JFM)
Soybean Hulls	\$95.00	\$95.00
Canola Meal	\$150.00 (Limited)	NA

These price quotes are delivery at Greeley, Co

Johne's Disease Testing on Colorado Dairies

Heather Hirst, DVM, MS, CSU-ILM,

In 1998 Dr. Frank Garry, ILM Coordinator, spoke at the Large Western Dairy Conference in Las Vegas, on Johne's Disease (JD) and encouraged producers to test their herds for JD. Interest in this topic was sufficient that he also traveled the state of Colorado the following year discussing JD with small groups of producers. As a result of these educational meetings, the ILM research group on infectious diseases headed by myself has been able to test 16 dairies in Colorado for JD.

The aim of this project is to estimate the occurrence of JD in Colorado and calculate some risk factor(s) that might lead one to suspect that a dairy has JD infected cattle. The test used at Colorado State Diagnostic Laboratory was the IDEXX ELISA. This test is a good screening test because it is inexpensive, results are quick and the sample can be run on blood (plasma). But the test also has its limitations: It does not provide accurate results in cows less than 2 years of age. In cows greater than 2 years of age the ELISA will only detect approximately half of the infected animals on any one day. This will occur when cows that are actually infected do not have a positive test result (ie false negatives). Also the ELISA test may be positive erroneously for 2-3% of the cows tested on any one day. This result is classified as a "false positive". Producers should be aware that some test positive cows are not infected. For culling purposes cows that are test positive and show clinical signs of JD are the most likely truly infected animals.

Herd testing involved collection of a single blood tube from the tail vein of cows. At each participating dairy we tried to test all cows over 2 years of age in one day. Larger herds required up to 3 days for testing every animal over 2 years of age.

Approximately 10,000 cows were tested during 1999 and 2000. When evaluated as a large group, less than 5% of these cows were tested positive and more than 85 % were clearly test negative. The remaining (<10%) fell into a suspect range. Individually, the dairies had between 0 and 8% test positive cows on their dairies with most dairies having less than 3% of their cows test positive.

Herd size, cow environment, calving management, young stock management, source of herd replacements, varied in the 16 dairies we tested. To enable the dairy producer to use this data practically, we evaluated the test results against two variables: herd size and presence of cows with clinical JD on the dairy within the past 5 years. Clinical JD was defined as cows with weight loss, decreased milk production, diarrhea (intermittent or constant) that does not respond well to treatment, lack of fever, and good appetite until severe weight loss leads to anorexia. Producers were asked if they had had cows that showed these clinical signs. Of the dairies tested about half had cows with symptoms of JD while the other half of the dairies did not.

Using statistical analysis of the data collected from 16 Colorado dairies, we found that **larger herds** were associated with a **greater percentage of test positive cows** in comparison to smaller herds. We also found that dairies who reported to have had cows with clinical signs of JD had a **greater percentage of test positive cows** in comparison to herds that had NOT reported seeing cows with clinical signs of JD.

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July. At our state contest the top four contestants were chosen to make up the team that attended the National contest. In September we began weekly live animal evaluation and reason workouts. We held this schedule until we left for Madison. This gave us plenty of time together to develop lasting friendships.

This experience had been a great opportunity for each of us.

Tyler Maxey: "I realize that I will never judge again with my teammates or for 4-H, and I can't describe how much I will miss it and how much fun it was for me. I couldn't have realized my achievements without the support of my coaches and teammates."

Raenn Carpio: "Dairy judging is one very long and exciting chapter in my life. I have given hundreds of sets of reasons, seen hundreds of cows, and I have had so much fun doing it. I met some awesome people and I wouldn't have changed it for anything."

Andrea Milne: "I have learned so much about dairy judging in the past few years. Not only about dairy animals, but also about life. I have made tons of good friends. Dairy judging has improved my public speaking ability and reasoning skills."

Joshua Docheff: "What an opportunity of a lifetime I just had! While participating in dairy judging, I have learned a variety of skills ranging from how to analyze cattle to better communication. Not only do I take from this program the ability to judge cattle, but I take a world of little things that will help me as I head down the road of life."

We all feel we owe a great deal to our coaches. They had so much faith and confidence in us. They were not only our coaches, but they always will be our friends. We would all like to extend our appreciation to everyone who donated to our team. We will each be an asset to the agricultural industry in our own way. To my teammates, "Thank you, it was a lot of fun."

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anaerobic treatment of waste by bacteria. One large Colorado dairy recently had difficulty with low bacterial populations and determined that this was probably due to the copper sulfate footbaths.

Copper sulfate use leads to soil copper buildup.

Toxicity to Crops

When copper is applied to our soils, it is strongly bound. Exchangeable copper is held much more tightly than other cations, and is not readily available to plants. Organic matter also binds copper, so the more organic matter and clay that a soil has, the greater the potential for copper adsorption will be. In addition, increasing soil pH reduces copper availability to plants, allowing greater soil copper accumulation without subsequent plant toxicity in our high pH soils. Because of its strong binding, copper leaches very little, and accumulates in the soil surface.

Copper is not readily mobile in plants, resulting in higher copper levels in roots than in shoots. Therefore, copper toxicity often results in decreased root growth and damage to root cell membranes. Researchers have found that high levels of calcium can alleviate copper's toxic effects on membranes, which is fortunate for Coloradans who generally have high soil calcium levels. Copper toxicity may also induce iron deficiencies or general chlorosis in plants.

There is tremendous variability in plants' ability to tolerate high copper levels. In general, a level of 20-30 ppm in the leaves may be considered toxic, but this is a broad generality across all plant species and should not be applied to specific crops without additional information. Some researchers have noted that legumes, such as alfalfa, are more sensitive to copper toxicity than grasses, so care should be taken when growing alfalfa on soils that receive Cu-enriched effluent.

Toxicity to Livestock

The maximum tolerable level of copper in diets of lactating dairy cows is 100 ppm, while the minimum is 10 ppm. Therefore, when copper sulfate is being used in footbaths and the waste is channeled to the lagoon and applied to land, producers should have copper analyzed in their forages before feeding them, as part of their normal forage testing program. Be aware that other types of livestock have different critical levels; for example, 20 ppm copper can be toxic to sheep.

Actions to Consider

1. Calculate your copper use and land application rate.
2. Consider alternatives to copper sulfate (tetracycline or more soluble coppers that allow lower copper use rates).
3. Divert the footbath water, so it does not enter the lagoons.
4. Analyze the copper content of forage grown on land that receives effluent with copper in it. Monitor forage copper levels annually to see if they are increasing.
5. Increase the acreage of crops receiving the lagoon effluent, in order to dilute the copper over more area.

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Following the whole herd test, we returned to dairies to collect fecal samples from positive and suspect ELISA animals. The fecal test can be used to confirm infection in cattle because a positive is always a TRUE positive (no false positives). However, we have found that the majority of ELISA positive animals will be negative with a single fecal culture (unless they have outward symptoms of the disease). This is because the fecal culture can only detect 50% of infected animals on a single test (same as the ELISA). We used fecal culture on many of the 16 dairies to confirm whether we could detect cows infected with the JD bacteria or not. Since the fecal culture costs about \$15/cow, we had to select a small population of cows for this purpose and felt that the ELISA positive and suspect animals might be more likely to be shedding the JD bacteria in feces versus ELISA negative animals. Over 50% of herds that submitted fecal cultures had at least one positive result.

In summary, we have confirmed evidence of JD on many of the 16 Colorado dairies. These dairies have been offered advice on management procedures to reduce the spread of JD in their herds. To be effective these suggestions must fit into business goals of the dairy. A few of the herds are retesting cows at dry off with the purpose of identifying new positives at a convenient management point. A few of the herds have culled ELISA positive cows when they drop in milk production instead of breeding them back ("do not breed" status). Dairies that did not confirm positive fecal shedders are not confirmed "free" of JD but would be considered "low risk herds". We expect the Colorado Johne's Advisory Committee and the State Veterinarian's office to announce an official voluntary control program in the near future.

We would like to thank the dairy producers who participated in this study. Any questions about testing your herd for JD or revising your JD control program can be addressed to Heather Hirst or Frank Garry of the ILM program.