



Dairy Pipeline

School of Animal Sciences

Volume 46, No. 4 • May 2025

Chasing the Elusive Hydraulic Leak

*Authored by Andy Overbay, Senior ANR Extension Agent—
Smyth County; Virginia Cooperative Extension;
aoverbay@vt.edu*

Everyone knows that “two heads are better than one”, but if you are trying to find a hydraulic leak on a modern tractor, you fully appreciate what an extra set of eyes can mean, especially if the leak is significant enough to leave an easy-to-see trail.

Sitting in the cab, working the controls that may or may not feed the leak puts you in no position to evaluate the situation. This was my experience just last week.

Adding to the confusion, my tractor’s leak turned out to be a pinhole in a 1 ½ inch line that painted everything on the right rear of the tractor, making every line a possible culprit. We finally found the source when my daughter noticed the leak.

It’s crucial to learn how to inspect a hose. To know if your hydraulic hose is about to fail, take note of the following: loose, broken or worn braid; deformations, including abrasions, cuts, dents and twists; traces of internal media of the hose coming out; cracked or dented couplings; indications of hose or braid corrosion; damaged, cracked loose hose guards or covers; loose fitting attachments, or hose assemblies rubbing against each other.

There are several motivations for repairing leaks quickly. First, leaks affect the use and life of valuable equipment. Let’s face it, as equipment ages, leaks are more likely to occur. Hoses wear out and metal lines crack or get worn from contact with other components.

You may also find that those lines and hoses are no longer available in their original form from the manufacturer, and you will have to have a replacement made. That said, trading older equipment for new, fresh equipment may solve one problem only to inherit another. Pre-DEF equipment sells at a premium, and rightly so; however, those tractors and trucks are getting older as well.

The second motivator is the cost of hydraulic fluid itself. At \$6.50 or more a quart, the cost of a pressurized leak can add up quickly.

In my case, the third motivator is the mess it can make on the tractor and shed floor. If being painted in fluid isn’t bad enough, add a dusty operating condition and the side of the tractor is powder-coated...literally...in dirt and grime.

While that might not seem so bad to some, that added layer of insulation means that heat can and will build up faster. More heat equals more wear and tear on your tractor’s components and more wear and tear leads to more leaks.

One thing you never want to do when chasing a hydraulic leak is to use your hands to feel for leaks. Fluids can not only be hot, but some lines are under thousands of pounds of pressure. Under certain circumstances, hydraulic fluid can be injected into your skin, causing serious injuries that may require surgery. Injections can occur at pressures as low as 100 psi and from as far away from the leak as 4 inches.

High-pressure injection injuries usually require emergency surgical treatment. When fluid enters the body, it begins to kill tissue. Gangrene, which is the result of a bacterial infection, can set in if injury is not treated promptly.

Surgery is usually required to remove the dead tissue and clean out the injected fluid from the wound. Failure to act quickly may result in the need to amputate fingers and limbs. Risk of amputation significantly increases if the wound is not treated within 10 hours.

Unfortunately, fluid injection is often painless, the point of entry through the skin is usually very small, and it appears harmless. Pain and swelling may not appear for several hours after injection. Sometimes, it can take a couple of days before pain and swelling are experienced.

Instead of sacrificing your hand, use a piece of paper, cardboard, or wood to pass along the lines while looking for leaks. Once the location is identified, the severity of the leak can be assessed. If the fluid drills a hole in your detection material, you can bet the situation needs immediate attention.

It may be surprising to learn how inexpensive some leak repairs can be. Many fittings use rubber O-rings to make the union of fittings seal properly. Over time, O-rings can flatten or tear, causing high-flow leaks, but many can be replaced for less than a dollar. Ensuring proper maintenance extends a hydraulic hose's lifespan and improves workplace safety. Prepare a maintenance routine. Preventive maintenance is an effective and efficient way to maintain equipment.

Hoses have a life expectancy. Keep records of replacements and inspect lines in high-risk areas.

Replace old and damaged assemblies. In addition to establishing consistent replacement intervals, check for breaks and damages regularly to prevent unexpected failures. Look for cracks, abrasions, twists, and bends and replace any damaged or old ones.

Hydraulic hoses have temperature, pressure rating, and chemical compatibility specifications. This ensures that the system operates safely at a high-performance level. Check the recommended temperature and psi ratings and comply with them.

Finally, be sure that your tractor is filled to the proper level with a hydraulic fluid that meets or exceeds the manufacturer's recommendations. Information about the fluid itself as well as the additives in the fluid will point out the fact that bargain-priced fluids are rarely the least cost option.

Copper Supplementation Sources: Which One to Choose for Dairy Cattle?

Authored by Prashant Ghimire, M.S. student with Gonzalo Ferreira, Associate Professor & Extension Dairy Scientist —Dairy Management, School of Animal Sciences, Virginia Tech; gonf@vt.edu

Minerals are essential for various physiological functions including growth, reproduction, and production. Based on dietary requirements of cattle, minerals are categorized into two groups: macro-minerals and micro-minerals. Macro-minerals, such as calcium and phosphorus, are required in relatively large amounts, whereas micro-minerals, like copper, are required in trace amounts, often measured in milligrams per dose. Copper is one of the most widely reported mineral deficiencies in cattle but also accounts for the greatest number of cases of mineral toxicity. With the increasing availability of different copper sources, farmers are often confused about effective supplementation sources. The objective of this article is to highlight the unique metabolism of copper in ruminants and compare the benefits of organic and inorganic copper sources in dairy cattle diets.

Why Is Copper Important for Dairy Cattle?

Copper is a crucial micromineral that supports proper growth, metabolism, immunity, and reproduction. Its deficiency can lead to poor fertility, poor growth, weakened immunity, and reduced performance. However, excessive copper intake can be toxic, resulting in severe health complications.

How is copper absorbed in the digestive tract?

Copper absorption in dairy cattle occurs in the small intestine. However, this process is complicated by interactions with other elements, such as sulfur and molybdenum, in the rumen. These elements are known as copper antagonists and vary in concentration based on the sources of feed and water. Forages grown in soils rich in sulfur and molybdenum are primary sources of these antagonists in dairy diets. In the rumen, these antagonists interact with copper and form insoluble compounds called thiomolybdates, which reduce the availability of copper for absorption through the small intestine.

Studies indicate that adult cattle can absorb only about 10% of the supplemented copper dose (Morgan et al., 2014). Interestingly, before proper rumen development, calves can absorb copper more efficiently than adult cows, with absorption rates reaching up to 70%. Thus, it is important to carefully manage copper supplementation in adult cattle for proper absorption.

Organic vs. Inorganic Copper Sources

Copper supplementation in dairy cattle is typically achieved by mixing copper into feed, primarily in inorganic and organic forms. Inorganic sources, such as copper sulfate and copper hydroxy chloride, are widely used due to their affordability. However, research suggests that copper sulfate is highly soluble in the rumen, making it more likely to bind with antagonists and become unavailable for absorption (Caldera et al., 2019). Furthermore, excessive soluble copper in the rumen is said to be toxic to beneficial rumen bacteria, potentially reducing nutrient digestibility and overall feed efficiency.

A study comparing sulfate and chloride copper found that neutral detergent fiber digestibility

Virginia Cooperative Extension

(NDFD) increased by up to 2.15%-unit in cattle supplemented with chloride sources (Faulkner and Weiss, 2017). This improvement is attributed to the lower solubility of chlorides, reducing their toxic effects on rumen microorganisms by bypassing rumen degradation. However, research findings are inconsistent, with some studies showing no significant differences in nutrient digestibility between sulfate and chloride copper sources (Miller et al., 2020). Additionally, some studies also demonstrate that copper sulfate is only toxic to rumen microorganisms when supplied at extremely high doses (over 50 mg/kg dry matter), while the recommended dose for dairy cattle ranges from 10-15 mg/kg dry matter (Sanchez et al., 2018).

Due to the unstable nature, lower bioavailability and discrepancy in results across inorganic copper sources, researchers have shifted towards organic sources as alternatives. Organic coppers are formulated by combining them with amino acids or proteins that make them more stable in the rumen and resistant to interaction with antagonists. Rather than relying solely on organic sources, which are expensive, they are often combined with inorganic sources in a certain ratio to enhance absorption in the small intestine. Some studies suggest that replacing a portion of inorganic copper with organic forms improves fiber digestibility and minimizes negative interactions with other minerals in the rumen (Daniels et al., 2020).

One study found that cows fed a diet containing 70% sulfate and 30% organic copper sources experienced a 4.4% increase in milk fat concentration compared to cows fed 100% sulfate sources (Formigoni et al., 2011). Additional studies report slight improvements in milk yield and fiber digestibility with organic copper supplementation, but the differences are minimal and not consistent (Siciliano et al., 2018). Other reported benefits of organic copper include improved fertility, reduced incidences of mastitis, foot lesions, and higher immunoglobulin in colostrum (Nocek, 2006). However, these benefits across studies are not consistent and come with a higher cost of organic mineral sources.

Research also indicates that when copper antagonists are present at low levels (<10mg/kg) in the diet, both organic and inorganic sources can be equally effective (Ward et al., 1995). This suggests

that the presence of antagonists in the diet, rather than the copper source itself, primarily determines copper bioavailability and associated improvement in performance.

Conclusion

To summarize, cows can develop copper deficiency if inorganic sources are used in conjunction with high levels of dietary antagonists. The main advantage of organic copper sources lies in their resistance to antagonists, ensuring better absorption and availability to animals. Therefore, choosing the right copper source depends on affordability, level of antagonist in diet, and herd's history of copper deficiency. Ongoing research comparing organic and inorganic sources will help refine the best practices for copper supplementation in dairy cattle nutrition.

Upcoming Events

May 3, 2025

[Youth Dairy Quiz Bowl](#)

May 10, 2025

Dairy Foods workshop w/Dr. Bob Horton

10:00 – 12:00: Orange, VA

2:00 – 4:00: Harrisonburg, VA

May 13-14, 2025

[VFGC Basic Grazing School](#)

Madison, VA

June 14, 2025

Franklin County Open Livestock Show

June 20, 2025

[Virginia Dairy Expo](#)

Dayton, VA

TBA

BQA Training & Certification

Open to all dairy and beef producers

BQA Training & Certification via

Southside Women in Ag

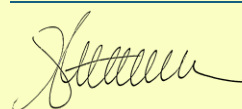
If you are a person with a disability and require any auxiliary aids, services, or other accommodations for any Extension event, please discuss your accommodation needs with the Extension staff at your local Extension office at least 1 week prior to the event.

Additional Notes:

▪ The dairy extension group is working with VDH to assist in distributing PPE to dairy farms. Request a kit online at <https://shorturl.at/ethov> or contact your local extension agent. Requests will be filled as supplies allow.

▪ Your input could guide future programming! Please complete the short survey at <https://tinyurl.com/dairy-extension>.

For more information on Dairy Extension or to learn more about our current programs, visit us at VTDairy—Home of the Dairy Extension Program online at www.sas.vt.edu/extension/vtdairy.html



Dr. Christina Petersson-Wolfe,
Dairy Extension Coordinator &
Extension Dairy Scientist,
Milk Quality & Milking Management

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2025

DASC-177NP