

# Copper Sulfate

## Alternative Dewormer Against the Barber Pole Worm?

—Ulf Kintzel

The height of summer during the months of July and August is also the peak season for the deadly Barber Pole worm (*Haemonchus contortus*). While various parasitic roundworms (*nematodes*) can cause various problems, none is as deadly as the Barber Pole worm. It sits in the fourth compartment of a sheep's stomach, the "true stomach" (*abomasum*). There, it sucks blood, which leads to anemia. It usually does not cause diarrhea like other roundworms that are found in the intestines. That makes it a little harder to detect a Barber Pole worm infestation *before* it causes death because many sheep owners expect and associate diarrhea with any worm infestation. Anemia can easily be determined by checking the mucous membranes of the lower eyelid. If the "eyelid" color is white, pale, or barely pink as opposed to showing a deep pink or even red color, the sheep likely has a Barber Pole infestation, which may cause death. Sluggish and "sad" behavior and a lack of appetite can also be signs of a sheep dealing with these blood-sucking worms. The bottle jaw, a liquid-filled swelling under the lower jaw, is also a good way to identify the infestation. However, when that occurs, the infestation has been ongoing, and the sheep may already be close to death. Besides, not all sheep with a Barber Pole infestation will develop a bottle jaw. Likewise, the bottle jaw can have causes other than a Barber Pole infestation.

Treatment is necessary if you don't want to lose these affected sheep. Commercial dewormers can be the solution, although there is widespread worm resistance to many dewormers. In many cases, the dewormer of choice that is apparently still recommended by some vets is ivermectin, known under the brand name Ivomec but also available in many generic forms. It is likely an ineffective dewormer in most flocks. I highly recommend



not using ivermectin at all if you wish to tackle a Barber Pole worm infestation. "White" dewormers like Valbazen (albendazole) or Safe-Guard (fenbendazole) are likely not going to be effective either. The resistance of *Haemonchus contortus* against these dewormers is highly probable. Of course, testing the efficacy of certain dewormers for a specific flock would be the right way to determine that, but that is unfortunately not a real possibility for the great majority of sheep farmers. Prohibit or LevaMed (levamisole) and Cydectin (moxidectin) tend to still be effective at many farms. You want to be aware that levamisole is not effective against the stage four (L4) larvae of the Barber Pole worm if it is arrested in its development. It is effective against the developing stage four larvae. The stage four larvae (L4) are the larvae that develop into the adult worms inside the sheep after the stage three (L3) larvae was ingested by the sheep while grazing.

Great planning needs to take place to keep the dewormers that still work effective. Routinely deworming all sheep is a sure way to cause resistance to any dewormer. Targeted dewormer of affected sheep is a better way to keep dewormers effective for longer. However, what if commercial dewormers don't work at

Photos by Author

your sheep farm anymore? Or, what if you don't want to use chemical dewormers?

Allow me to introduce copper sulfate. Better said, allow me to REintroduce this dewormer that was once the dewormer of choice both in the New and the Old World.

First, I will weave in a little anecdote: Shortly after my apprenticeship, the year was probably 1986, my supervisor Schäfermeister Rudolf Hirsch, put a handful of copper sulfate in the drinking water when the flock returned from pasture for the night. I asked him what this was for, and he explained to me that this was an old deworming method that he learned when he was a young shepherd. In fact, copper sulfate was the most widely used dewormer in the U.S. as well in the early to mid-1900s. The USDA approved it as a dewormer in 1932. In the late 1940s and early 1950s, commercial dewormers entered the market and subsequently more and more chemical dewormers were introduced. Initially, they were very effective and made the use of copper sulfate obsolete.

Simultaneously to commercial dewormers entering the market, the potential toxicity of copper to sheep became increasingly known. There are two forms of copper poisoning, acute and chronic. If a sheep receives too high a dose of copper or consumes too much copper, for instance in an orchard where a copper-containing fungicide was sprayed, as documented in a field observation in 1932, then it is called an acute case of copper poisoning.

Chronic copper poisoning is the greater potential problem. It is a two-phased process. Sheep, unlike other domestic animals, cannot rid themselves easily of excess copper, and instead of excreting it, they store it in the liver. If a sheep is stressed, it may release the stored copper into the bloodstream and it gets poisoned. The exact process is called hemolysis. The released copper causes red blood cells to rupture. In such cases there is little hope for affected sheep. Treatment is not feasible and often not effective. The sheep will likely die.

The knowledge about this was well established by the time commercial dewormers came on the market. So, who then needs copper sulfate anymore, right? Agricultural officials started warning against copper in sheep feed and they haven't stopped. In my view, it has been taken to an extreme and out of context. Why?

Because the original and correct finding that "copper is potentially toxic to sheep" evolved to "don't add any copper to any feedstuff meant for sheep" to "don't feed copper to sheep." I don't know who came up with the later statement, if it was county agents or if the readers took it that way but not feeding any copper to sheep is *utter nonsense*. Sheep need copper. That is a verifiable fact. They need it for the immune system, for building red blood cells, for the nervous system, for the development of various enzymes, for the embryo and fetal development, for the placenta function... Shall I go on? The issue is not copper. The issue is *too much* copper.

What defines too much copper, though? Turns out, unlike humans, not all sheep are created equal. Some sheep breeds are more sensitive to copper; some are less sensitive to copper. It has by now been well established that meat sheep breeds of British origin like Suffolk sheep or sheep breeds of other countries that were created by using British meat sheep like the Dutch Texel sheep and French Charolais are very sensitive to copper.

Some breeds are less sensitive to copper.

For instance, popular hair breeds like Dorper and Katahdin sheep are less sensitive to copper.

I feed free-choice trace mineral salt (regular feed salt mixed 50/50 with selenium 90 trace mineral salt) to my sheep year-round. They have free access to that mineral mix every day except on rainy days, when I remove the mineral feeder. It has been many years that I have practiced this. It has a copper content of 150ppm. Many years ago, the source for copper in it had been copper oxide, the safe kind of copper source because it is poorly absorbed by the sheep (which makes it safe), but

the company switched to copper sulfate as the copper source. (I want to stress here that I offer my trace mineral salt in a mixture because I have learned that some people understand by free-choice a free-choice "buffet" of individual minerals, which may include pure copper sulfate. That is not what I am referring to or practice and I am definitely not recommending it either.)

For as long as I have purebred White Dorper sheep, I have not encountered a single case of acute or chronic poisoning. I did experience chronic copper poisoning in two separate individual cases perhaps 15 or more years ago. These two individual sheep were 50 percent Texel sheep. (I upgraded my flock of Texel sheep to a flock of White Dorper sheep starting in 2005.) Texel sheep are



*This 50-pound bag of feed-grade copper sulfate cost about \$90 and will last me a lifetime.*

known to be copper sensitive and are one of the more susceptible sheep breeds to copper poisoning.

Also, my sheep are grassfed. A sheep of mine eating about half an ounce of my trace mineral mix per day eats about 2.1 milligrams (mg) of copper a day this way. A sheep fed grain eats about 2.25 mg of copper when it eats just half a pound of soybean meal per day. (I picked soybean meal because the copper contained in it is well absorbed, just like the copper in trace minerals.)

Not feeding grain while a ewe has a daily requirement of 5 to 10 mg of copper per day and having a breed of sheep that is less sensitive to copper than many others leaves me with quite some flexibility when it comes to using copper sulfate as a dewormer. That is essential if you wish to give copper sulfate a try. In other words, if you have Suffolk sheep intended for the show ring, and you feed heavy grain rations, my advice is: don't follow my practice!

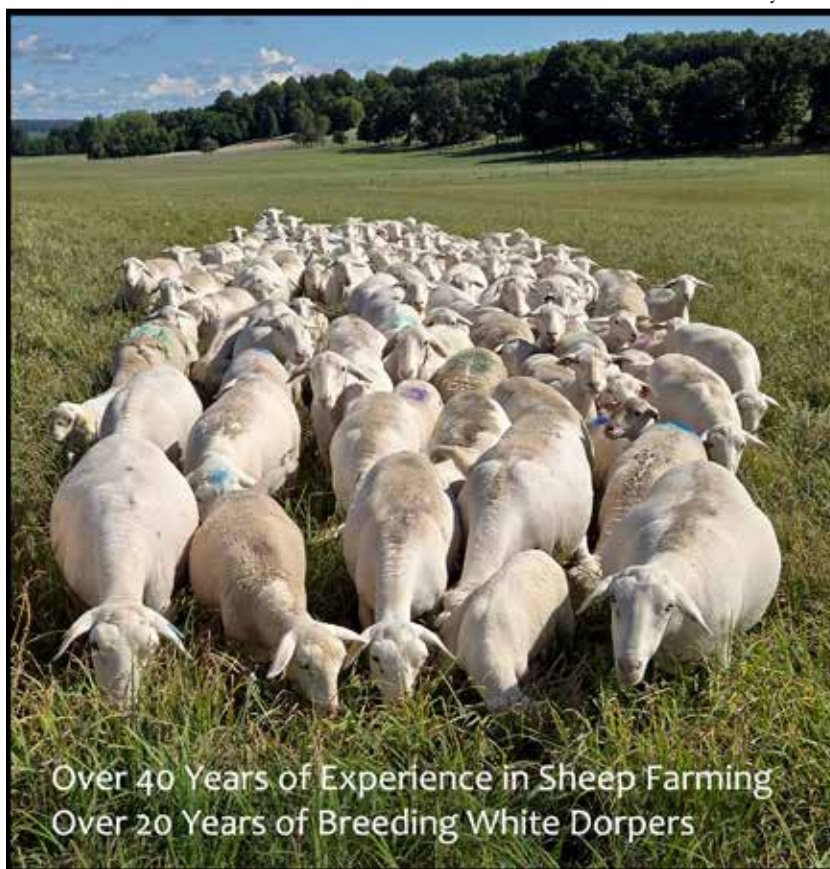
Also, I am using copper boluses intended for goats for my ewe lambs that I retain for breeding purposes for the first summer. It is the first summer of their existence that they are most sensitive to the Barber Pole worm. They will develop more resistance to it over the years. A bolus intended for adult goats contains 3.4 grams of copper, which is just a little over a tenth of an ounce. The copper in this bolus comes in the form

of copper oxide (as opposed to copper sulfate, copper oxide wire particles—COWP—to be precise) and is poorly absorbed by sheep. That means the risk of copper poisoning is low while it has the effect on the Barber Pole worm, especially on its reproduction rate.

Now, after a very lengthy introduction, I come to the actual purpose of my article: A sheep farmer in Alabama, where summers are long, hot, and humid and offer an ideal breeding ground for the Barber Pole worm, mentioned to me that he uses copper sulfate as a dewormer for his Katahdin sheep and provided me with a link to a paper:[https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1135&context=gradschool\\_theses&fbclid=IwAR1p7TBIGT25KnDI2VHQKEWY8MrAH9Cb5yCENu2FY1GC\\_Uz2RoiZr1-yd0](https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1135&context=gradschool_theses&fbclid=IwAR1p7TBIGT25KnDI2VHQKEWY8MrAH9Cb5yCENu2FY1GC_Uz2RoiZr1-yd0)

I will in the following paragraphs describe what I learned from this paper. I need to credit the author of this publication since it is their intellectual property. The recommended citation for it is Simpson, Melinda Mallory, "USE OF COPPER SULFATE TO CONTROL *HAEMONCHUS CONTORTUS* INFESTATION IN HAMPSHIRE EWES" (2011). University of Kentucky Master's Theses.

It is written in very academic terms, using fancy words like "cutability," "hypobiosis," and "desiccation," all of which and many more I had to look up in a dictionary. Yet, it gave me hands-on guidance as to how,



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in what dose, to use copper sulfate as a dewormer, and addressed how effective it was and how likely (or unlikely) it is to be toxic. The sheep used for this field trial were Hampshire sheep, a breed known to be sensitive to copper, more sensitive than my White Dorper sheep.

I used copper sulfate twice last year to deworm the ram lambs, which are in a separate pasture than the breeding ewes and are not as often rotated as the main flock. That increases the likelihood of a Barber Pole worm infestation by quite a margin. I also used it on individual younger ewes on one occasion.

So, where did I get my copper sulfate and how did I make the dewormer? I bought finely ground feed-grade copper sulfate in a fifty-pound bag for \$90 at a local farm store. On pages 41 and 42 in the paper it says: “The 1% CuSO<sub>4</sub> (copper sulfate) solution was prepared by dissolving 28.4 g of CuSO<sub>4</sub> in 2,850 ml of water in a plastic container. Each ewe received 100 ml of the 1% solution.” (28.4 g is about one ounce of copper sulfate and 2,850 ml is about 96 ounces of water.) I found the amount of liquid very high and impractical. 100 milliliters are about 3.4 ounces. That’s a lot when deworming. I changed the formula using far less water but containing approximately the same amount of copper. I prepared a 5% CuSO<sub>4</sub> solution:

I used 60 grams/2.12 ounces of copper sulfate and mixed it with 1,140 ml/38.55 ounces of water. That amount treats 57 ewes. Then I gave only 20 ml per ewe, which is five times less the amount of liquid than in the original one percent solution. 20 ml (or cc, which is the same) compared to 100 ml is a more practical amount when drenching. When I treated my ram lambs that were affected by the Barber Pole worm, I used the same amount. I did not adjust the amount according to weight.

If the measurements sound too complicated to you, let me assure you that a *close* approximate is good enough because in the end it doesn’t matter if the ewe receives a *tiny* amount more or less of the 1 gram of copper sulfate when treated. Just be sure that you emphasize the word *tiny* when you consider an approximate.

When I prepared the “potion,” I used my wife’s measuring cup for baking and cooking. It measures

liquids simultaneously in ounces and milliliters. I also used her kitchen scale, which allows you to weigh in grams as well as in ounces. I avoided any potential resistance I might face using these items by mixing the brew while she was away at work.

How did it all work out? The copper sulfate was extremely effective. Within days the red color in the eyelids of the treated ram lambs as well as the young ewes I selectively treated returned. All animals without exception no longer showed any signs of a Barber Pole infestation. No animal showed any sign of acute copper poisoning. Of course, for me to make this

article more comprehensive I had to wait three to six months to see if there were any cases of chronic copper poisoning. I didn’t encounter any either. (Theoretically speaking, chronic copper poisoning may still be a possibility for up to 12 months after treatment but is far less likely than within the three to six months window.) If you are feeding a trace mineral salt that contains molybdenum, you are aiding a faster excretion of excess copper and more importantly, it prevents copper accumulation in the liver in the first place. Its effectiveness is greatly enhanced if it can bind with sulfur, forming thiomolybdates, which in turn bind copper.



*To administer the dewormer I used an old drench gun and rinsed it thoroughly after use since copper sulfate is corrosive to metal.*

Among the nematodes affecting sheep, copper sulfate works well against the Barber Pole worm. Many nematodes that reside further down the intestinal tract, often associated with diarrhea, cannot be effectively controlled with copper sulfate because copper concentrations in the intestines cannot be raised to lethal levels without causing toxicity in sheep. Copper is effective against Barber Pole worms because they reside in the abomasum, where higher local copper concentrations persist after treatment.

Lastly, allow me to express a word of caution. In no way do I want my article to be understood as a recommendation to use copper sulfate instead of chemical dewormers. Instead, I want it to be viewed as a suggestion to entertain copper sulfate as an occasional alternative to prolong the effectiveness of currently used dewormers or to combat an acute infestation. The breed

of sheep you are raising, the feeding regimen (grass-fed versus grain-fed), and possibly copper levels of the soil and in your forage need to be taken into consideration. A thoughtful approach is warranted because copper poisoning in sheep is a real thing. All other management tools to mitigate the dangers of the Barber Pole worm still apply, such as rotational grazing, leaving a residual of about four inches, and selecting for worm resistance by culling more susceptible animals. Copper sulfate as a dewormer should not be viewed as a sole substitute for all of it. It is simply one more tool in my toolbox.

On a personal note, I have been enjoying writing this article. It has been written piece by piece since last summer. My “incipient” retirement (as my friend Steve called it, making me look up what “incipient” means) makes it possible that I can dive deep into one subject or another. I now have the time to do it. I learned a lot of new words, too...but forgot most of them already. 🐑

*Ulf owns and operates White Clover Sheep Farm and breeds and raises grass-fed White Dorper sheep without any grain feeding and offers breeding stock suitable for grazing. He is a native of Germany and has lived in the U.S. since 1995. He farms in the Finger Lakes area in upstate New York. His website address is [www.whitecloversheepfarm.com](http://www.whitecloversheepfarm.com). He can be reached by e-mail at [ulf@whitecloversheepfarm.com](mailto:ulf@whitecloversheepfarm.com) or by phone during “calling hour” indicated on the answering machine at 585-554-3313.*

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