Using Copper Oxide Wire Particles to Help Control Barber Pole Worms on Northeast Sheep & Goat Farms - *Dr. tatiana Stanton, Cornell Sheep and Goat Program*

Barber pole worm (*Haemonchus contortus*) is the most serious parasite problem on pasture-based Northeast goat and sheep farms. Copper oxide wire particles (COWP) have effectively reduced infection of barber pole worm in studies in the Southeast US, but it is not clear how safe and effective they are in the Northeast. Therefore, Cornell University has embarked on a 3 year study to look at methods for incorporating COWP into Northeast parasite control programs.

Copper oxide wire particles were developed to treat copper deficiencies in livestock in regions where copper is not readily available in soil and forages. Because of this important role, they are already approved for organic farming and may prove to be a new parasite tool for both organic and conventional farms. They are administered to livestock in the form of gel capsules with a dosing syringe (Figure 1).

The exact mechanism for how they adversely affect barber pole worms is not clearly understood but is at least two fold. When an animal is dosed with COWP, the wire particles pass through the rumen and hopefully lodge in the abomasum (true stomach). There, the gastric juices produced by the gastric glands dissolve the wires, releasing the copper. The barber pole worms are directly damaged by the copper. In addition the copper is absorbed by the sheep or goat helping to boost their immune system's response to parasite infection. However, it is important to understand that COWP is not effective against all worms. It is primarily antagonistic to barber pole worm. In fact, if the animal has a large infestation of brown stomach worm (*Ostertagia circumcincta*), the copper will not be released and will have no beneficial effect. This is because brown stomach worms attack the gastric glands of the stomach, reducing production of gastric juices, and making the pH of the stomach too high to dissolve the copper in the particles. Therefore it is important to know what types of worms are parasitizing your animals. Barber pole worms, unlike brown stomach worms, typically cause anemia. Another thing to keep in mind is that sheep are easily poisoned by too much copper. Commercially available COWP boluses of 12.5 to 25 grams contain too much copper and should be split into far smaller portions for use in sheep and goats (Figure 1).

During the summer of 2013, Cornell researchers kept track of how barber pole worm populations changed after administering COWP at four pasture-based NY goat and sheep farms. The first on-farm study was with lactating does at a commercial goat dairy. There were 15 does per treatment. Treatments consisted of 1) HIGH (1 gram of COWP per 22 lb live weight), 2) MED (2 grams/head,) and 3) LOW (1 gram/head). Two treatments (HIGH and MED) decreased barber pole worm loads about 50% two weeks after administering them (Table 1). These treatments were not significantly different from each other. In contrast, giving 1 gram of COWP per adult dairy doe did not decrease fecal egg counts on that farm. There was a significant increase in copper content of milk on the HIGH treatment as compared to the MED treatment although the copper levels in the milk were still

within levels naturally found in milk and considered very acceptable. There were no adverse effects on curd formation for the 4 types of cheeses made the week following COWP dosing. Although 1 gram of COWP per 22 pounds live weight is recommended on many popular online blogs, it is a higher rate than recommended by Southeast researchers. Our preliminary studies indicate that at least on this farm, it had no beneficial effect over the 2 grams per head treatment for adult dairy goats. We had no control group so do not know if fecal egg counts would have increased on control animals receiving no COWP.

We also did on-farm studies with COWP boluses on weaning age lambs on three NY farms in Franklin, St. Lawrence, and Westchester counties. There were 3 treatments: CONTROL (no deworming and no COWP), LOW (0.5 g COWP/head) and MED (1 gram COWP/head). There was no significant difference in effect between the LOW and MED treatment on each farm. Both COWP treatments substantially reduced barber pole worm loads for the entire 42 days of the study in the flock where the treatments were given 2 weeks prior to weaning. The lambs on all three treatments were always pastured together. It was given two weeks after weaning or 5 weeks after weaning at the other two farms and did not have a long lasting effect. At one farm fecal egg counts for barber pole worm were significantly reduced 2 weeks after giving COWP for lambs getting COWP compared to CONTROL lambs while at the other farm, barber pole worm counts were so low that no difference was observed between any of the treatments. We are not sure if the increased success at the farm that gave the COWP 2 weeks prior to weaning was because 1) more COWP may lodge in the true stomach on nursing lambs versus weaned lambs (less forage mass in the digestive track) or 2) the true stomach may be more acidic in nursing lambs compared to weaned lambs causing more copper to be made available, or 3) the worm challenge on this farm was more severe making it easier to observe differences in fecal egg counts.

In summary, our preliminary studies indicate that COWP boluses have potential in barber pole worm control programs in Northeast goat and sheep farms but do not need to be given at the higher dosages some farms use. Dosages of 0.5 gram/head were as effective as 1 gram dosages in lambs and 2 gram/head dosages were as effective as 1 gram/22 lb live weight dosages in adult lactating does. Some studies in the Southeast have indicated that barber pole worms could become resistant to COWP. Therefore in agreement with Southeast researchers, we envision farmers using COWP as part of a FAMACHA program. For example, conventional farms might give COWP to lambs and kids scoring “3” while more anemic animals scoring “4” or “5” would be dewormed with an effective dewormer. Studies for 2014 include comparing the effect of COWP on lambs within the same farm that get COWP 2 weeks prior and 2 weeks post weaning, and testing COWP on meat and dairy goat kids.

These studies were undertaken by the Cornell Sheep & Goat Program (Drs. Michael L. Thonney and tatiana Stanton) ,the Cornell School of Medicine Department of Microbiology & Immunology (Dr. Dwight Bowman and Janice Liotta) and Cornell Coop. Ext. of St. Lawrence County (Betsy Hodge), and partially funded by Federal Formula Funds and the Northern NY Agricultural Development Program.

(Figures and tables are on next page)

Figure 1. Copper Oxide Wire Particles can be put in a small sized #00 (0.95 ml) gel capsule to give with a cat pill gun or put in a larger sized #13 (3.2 ml) gel capsule for use with a traditional livestock drenching gun. (Photos by Adriana Stimola, Stone Barns Center for Food & Agriculture)

Table 1. Effect of copper oxide wire particles (COWP) on the change in fecal egg counts after 14 days in lactating does.

COWP Treatment	Egg count/gram for all Strongyle worms	Egg count/gram for Barber Pole Worm Only
HIGH (1 g/22 lb BW)	-1185	-1153
MED (2 g/doe)	-1191	-1226
LOW (1 g/doe)	75	107
SE	477.9	484.6
P-value for 1 g/head vs average of 1 g/22 lb and 2 g/head	0.036	0.034
P-value for 1 g/22 lb vs 2 g/head	0.993	0.914

Table 2. Effect of copper oxide wire particles (COWP) and days on fecal egg counts for Sheep Farm #3 where COWP was administered 2 weeks prior to weaning.

		Strongyles		Haemonchus	
COWP Treatment, g	Days after treatment	Log_e	Antilog, eggs/g feces	Log_e	Antilog, eggs/g feces
CONTROL (no COWP)	0	5.22	185	5.14	171
	14	7.39	1620	7.37	1588
	28	7.56	1920	7.38	1604
LOW (0.5 g COWP/head)	0	4.20	67	4.13	62
	14	2.66	14	2.02	8
	28	6.12	455	5.93	376
MED (1 g COWP/head)	0	5.46	235	5.29	198
	14	3.07	22	2.63	14
	28	6.19	488	5.68	293
SE		0.728		0.736	
P-value		0.026		0.010	