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THE ROUNDUP

University of California Cooperative Extension

Livestock, Range, and Natural Resources Newsletter

Kern, Tulare, and Kings Counties

Copper Deficiency, Supplementation, and Toxicity in Ruminants

Copper Deficiency

Copper deficiency in beef cattle is a common disease problem in California. Copper is a trace mineral required by all ruminants that plays an important role in immune system function. In areas where copper deficiency occurs it can cause significant economic losses. An animal that is deficient in copper may show the following symptoms:

1) Diarrhea
2) Illthrift/poor weight gains
3) Weight loss
4) Light hair coat
5) Spontaneous fractures (broken bones)
6) Swollen joints
7) Rear leg weakness or paralysis in calves
8) Infertility
9) Anemia
10) Reduced immune function

Copper deficiency can be a complex topic because the deficiency could be the result of low copper in the diet, a ***primary*** copper deficiency, or it could be the result of interference with copper absorption in the animal, a ***secondary*** copper deficiency. Molybdenum and/or sulfates in the food or water can interfere with copper absorption and cause a secondary deficiency. Some common symptoms are diarrhea, poor weight gain, and a light hair coat. Black haired cattle appear reddish, and brown or red haired cattle appear yellow. In sheep, the wool fibers do not crimp normally and may appear “stringy” or “kinky”. The symptom that costs a producer the most money though, is reduced immune function. A copper deficient animal that has reduced immune function is more likely to get sick, especially when stressed. For example, when an animal is weaned or sent to the feedlot, illness and death loss could be much higher than normal. It should be noted that copper deficiency is not common in sheep and goats as they are more efficient at absorbing copper from their diet than cattle or bison.

Diarrhea and weight loss can be a result of a number of causes and are not specific to copper

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Deworming: Considerations for Fall Treatment

Cattle are susceptible to a number of internal parasites including: Protozoa, Roundworms, Flukes, and Tapeworms. Of these internal parasites combined there are over 70 species listed in Principal Parasites of Domestic Animals in the United States (1978). Some parasites affect the digestive system and "steal" nutrients from the animal, others affect the respiratory tract, some are found in the blood, and some are even found in the connective tissue of an animal. Liver flukes, a particularly challenging parasite to control, damage the liver, make animals more susceptible to the fatal disease known as Redwater, and decrease reproductive performance. The bottom line is, no matter what kind of parasite your livestock may have, internal parasites cost producers money in the form of reduced weight gain and decreased animal health. That's why deworming is an important part of herd health management.

The most ideal time to deworm is right before moving livestock to a new pasture, specifically a pasture they have not grazed in 4 to 12 months. Obviously, this practice may not work for every operation, that's why it is important to understand the reasoning behind this recommendation, so that each operation can create a specialized herd health management plan that fits their needs.

Parasite eggs, shed by livestock, develop into infective larvae during warm, wet weather. Their survival is dependent upon finding a host, but they can survive in the environment for a while, waiting to find a host. Temperature and moisture affect the length of their survival. Cool, dry weather tends to prolong the survival of infective larvae, while warm or hot, wet weather will shorten their survival. If a manager waits long enough to move his cattle, the infective larvae on a rested pasture will have died. If cattle that have been dewormed are moved onto a pasture that has been rested long enough to allow worm larvae to die, the potential for re-exposure and re-infestation are significantly reduced. When it is possible to follow this recommendation, livestock managers can get better "bang for their buck", when they deworm, and allow livestock to remain worm-free for longer, improving their performance and feed efficiency. What this translates into, is the common practice of deworming in the spring and in the fall, just before livestock are moved to "clean" pastures. If livestock are treated for worms and then put back into the same pastures, they are likely to become re-infested quickly.

Each operation must determine the best timing for deworming and the dewormer that works best for them. The ivermectin products (Ivomec ©, Cydectin ©, Dectomax ©, etc.) work well against a broad spectrum of parasites, while other products such as Levamisole ©, Safeguard ©, etc, are more focused on internal parasites. Consult your veterinarian to determine which dewormer is best for your operation.

Earlier in this article I mentioned liver flukes. Liver flukes, as indicated in their name, specifically target the liver of an animal. Livestock ingest an encysted fluke, then the juvenile flukes "burrow" through the stomach lining and into the peritoneal cavity where they migrate to the liver. The flukes

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deficiency. There are two ways to test for copper deficiency through blood samples or through a liver biopsy. Copper is stored in the liver of an animal and is slowly released into the blood stream until copper concentrations in the liver fall too low. This means, that an animal may not be ingesting enough copper, but it may not be obvious in a blood test. As a result, a blood test is not the most reliable method for determining if an animal is receiving enough copper. A liver sample from slaughtered animals or a liver biopsy from live animals (usually 4 – 7 animals is enough), are the best methods for determining copper deficiency.

Copper Supplementation

The minimum recommended dietary amount of copper (dry matter basis) is 4 to 10 ppm (mg/kg) for cattle, 5 ppm for sheep, and 7 ppm for merino sheep. It is important to note that sheep and goats are easily susceptible to copper toxicity and supplementation should be approached carefully, only after consulting with a veterinarian. Usually worming copper deficient sheep or goats solves the copper deficiency in the animals.

Copper can be supplemented through several methods, however, none of the methods are considered "perfect". It is important to consult your veterinarian and discuss which method (s) will work best for your operation.

1) Salt-mineral mixes with copper added
2) Molasses based supplements
3) Injectable copper glycinate
4) Copper oxide boluses

Copper can be added to salt-mineral mixes to aid in supplementing cattle. In copper deficient cattle, these mixes are usually formulated to contain 0.2% to 0.5% copper, with the highest levels reserved for severe deficiencies. These mixes assume daily intakes of about one ounce per head. Salt-mineral mixes are inexpensive, however, they can be labor intensive to keep fresh and in front of the animals. Additionally, the consumption of mineral mixes can be sporadic and/or inadequate. Overconsumption can be expensive and may cause toxicity. Molasses based supplements are formulated similarly and promote better consumption, but are also more expensive.

Injectable copper glycinate has been used successfully for many years to treat and prevent copper deficiency. This product is only available through your veterinarian and requires a prescription. It is no longer manufactured and must be compounded at a compounding pharmacy. The injection is administered subcutaneously and provides adequate copper supplementation for four to six months in most cases. The injection site should be as clean as possible to prevent possible reactions. In some cases, large swellings, granulomas or abscesses have occurred at the injection site. Other potential reactions include a sloughing of the skin at or near the injection site and, occasionally death loss is seen in calves. Reactions can be minimized by using a sterile technique and using the brisket as the injection site. Copper glycinate will settle if it is allowed to sit for any length of time. It should be well mixed before drawing the supplement into a syringe, and only syringes with a low volume capacity (5 – 10 ml) should be used to prevent settling and ensure proper dosing.

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Ask the Advisor

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How do I control…yellow starthistle, mare's tail, fleabane, tobacco weed, and other weeds?

I have received a number of questions and information requests regarding the control of noxious and invasive weeds and I wanted to begin to address them in my "Ask the Advisor" section. It is important to note that, it is not feasible to fully address the control of weeds in one article, there is simply too much information and too many details associated with weed management to provide adequate amounts of information on each of the species listed above in a one or two page article. What I have decided to do instead, is create a new section in my newsletter, devoted to a weed control topic. I will debut this section in the next issue of *The Roundup*, set for Winter 2012/2013.

In this newsletter, I would like to review some of the basics of weed control including types of herbicide, application of herbicides, general plant biology, patch prioritization, and other methods of control. I'm going to start with some general plant biology, but first I want to point out that I am simplifying each topic to maintain brevity; there will be exceptions to some of my statements.

There are three basic types of plants: 1) grasses, 2) forbs, and 3) woody species. Sometimes people look at me funny when I call a plant a forb because it is an unfamiliar term. The best way to define a forb is to define what it is not. A forb is everything that is not a grass or a woody species. Sometimes forbs are also called broadleaves, however, this term can be somewhat misleading as all forbs do not necessarily have large or broad leaves. The grasses category also includes sedges and rushes, which are referred to as grass-like plants. The woody category refers to shrubs and trees. It is important to know the types of plants because herbicides have been developed that can specifically target each of the types of plants.

Giant Reed, *Arundo donax*

Plants have two basic types of life cycles, annual and perennial. An annual plant generally sprouts from seed, sets seed, and dies all within one year. They complete their entire lifecycle in one year. Perennial plants live more than two years and may live as long as a hundred years or more. The category includes long-lived plants like the giant sequoias and bristlecone pines. Perennial plants may set seed each year and they may not. Grasses and forbs can be annual or perennial, but woody species are only perennial.

There are five general methods for weed control: 1) chemical, 2) grazing, 3) mechanical, 4) biological, and 5) fire. Chemical control refers to the use of herbicides. Grazing refers to using grazing ani-

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mals to target a specific species or to achieve a specific goal. Mechanical control involves anything physical including dozers, tractors, and even the hula hoe. Grazing could fall under biological control however, the term is most commonly used to describe any sort of bug, bacteria or fungus that is an enemy of the plant. Finally, with proper timing, fire can have a lasting effect on weed populations.

Fire is a weed management tool that can be difficult to implement due to air quality standards, however, where possible, it can be used to prevent plants from maturing and setting seed. It can also be used to remove above ground biomass and either kill (through heat) or stress a plant and cause it to use energy stored in its roots. If a plant is stressed often enough and severely enough, it will no longer have enough energy in its roots to resprout and it will die. Biological controls are effective in some cases, however, they usually only work to reduce populations, they do not provide complete control in most cases. Also, a permit is needed to release new populations of biological control agents. Mechanical control can be very effective, however, it is not feasible in all situations. For example a hill might have too steep of a slope. Also, in some cases ripping and tilling the soil causes disturbance that may encourage the growth of more weeds, post-treatment. Implementing grazing as a weed management tool is similar to using fire. Timing is critical to prevent plants from setting seed. Grazing can also be effective at removing above-ground biomass and stressing a plant. Grazing is not effective in some cases, when a plant is highly unpalatable or toxic to the animal.

Figure 1: Russian Knapweed, an invasive weed related to Yellow Starthistle.

Herbicides come in two main varieties, pre-emergent and post-emergent. Pre-emergent herbicides prevent a plant from sprouting and post-emergent herbicides kill a plant after it has sprouted. Timing is critical with herbicides and varies based on the herbicide used, however, there are some basic rules to follow. Pre-emergent herbicides should be sprayed before the target plant or plants sprout. Follow label directions closely to achieve the greatest success rate and also for safety purposes. Post-emergent herbicides need to be sprayed when a plant is actively growing and before it has bolted and is starting to set seed. This is when the plants are most susceptible. Again, follow label directions closely to achieve the greatest success rate and also for safety purposes.

Some herbicides have been developed to specifically target grasses, or to specifically target forbs. Some are better for use on trees than others. If you're managing a grass pasture and you want to remove weeds, usually a broadleaf herbicide is the tool of choice. However, if your pasture has clover or filaree in it, the herbicide will kill the clover too.

It is important to take some time to think about your goals before you decide on a course of action. Think about what you want the area to look like. Try to run some worst-case scenarios through your head and have a back-up plan to deal with any potential negative effects. In some cases, one weed is controlled and another, potentially worse weed, invades. This is where some sort of restora-

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tion or seeding can be helpful. As you think about a potential course of action, remember, you can use multiple weed control tools, in fact, using multiple control methods is highly recommended. For example, in the control of a thick patch of starthistle, the plants could be sprayed as an initial control. Then a band of goats could be brought in, late season, to graze on the thistle and reduce the number of seeds set even further. If you have an irrigated pasture and just a few plants of bull thistle, a hoe or a shovel may be the best tool. If there is a severe infestation of thistle, maybe an herbicide should be used and any remaining plants could be removed with a hoe or a shovel.

One part of this planning process is patch prioritization. If you have a patch of weeds next to a road or a stream and a patch of weeds in the middle of a pasture it takes a half a day's ride to get to, which one is more likely to spread and create new patches? Ideally, both patches of weeds could be treated, but if time or resources dictate that you can only treat one, the patch next to the road is more likely to spread and create an even bigger problem.

Once you have a weed under control, maintenance is critical to long-term success. Continue to assess your weed management plan, assess the results of your actions and utilize as many weed control methods as possible to prevent the population from expanding again. Without maintenance, in 3 – 5 years the initial weed problem could return, or it could be worse than before you started. In most situations it is not practical or possible to completely eradicate a weed or other unwanted plant, but with diligence, the population can be successfully controlled at reasonable levels.

How is UC Cooperative Extension different from NRCS?

Recently I attended a Farm Bureau, Young Farmers and Ranchers meeting. I was introducing myself and speaking with folks about UC Cooperative Extension (UCCE), who we are and what we do, and in the process, I was asked to clarify how UCCE is different from NRCS (Natural Resources Conservation Service). This is actually a relatively common question, so I decided it was a perfect topic for my "Ask the Advisor" section.

UCCE is a part of the University of California and is considered the county-based information and outreach arm of the University. We are a resource to producers and a fundamental part of our mission is to support agriculture through research and problem-solving. NRCS is a federal agency administered under the US Department of Agriculture (USDA) and was originally known as the Soil Conservation Service or SCS. NRCS offices are often housed with or near the Farm Service Agency (FSA) because FSA is also administered under the USDA. The NRCS motto is "Helping People Help the Land" and they implement this motto by being available to land owners to answer questions and also through cost-share programs, such as the Environmental Quality Incentives Program (EQIP) and the Wetlands Reserve Program (WRP). Nei-

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ther UCCE nor NRCS are regulatory agencies.

The university extension system has its roots in the Morrill Act, which established a land grant university in each state. The cooperative extension system was officially created across the U.S. with the passing of the Smith-Lever Act in 1914. The purpose of extension as stated in the Act was "to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same". The Act established a cooperative funding mechanism where the salaries of "county agents" would be paid by joint agreement between federal and state governments. All local expenses were to be paid by the county in which the agent worked. In California, the Agents were called "Farm Advisors". As a result of this Act all Cooperative Extension work became an official function of the USDA. What this means, is that, officially, advisors are employed by the University of California, and the University receives federal funds to apply toward our salaries. The county where an advisor is based provides office space, supplies, a vehicle to drive, etc. It should be noted that even though UCCE receives federal funds, we are not federally administered. We are administered through the Division of Agriculture and Natural Resources (ANR). UCCE is affiliated with the three land grant universities in the UC system, UC Berkeley, UC Davis, and UC Riverside. ANR administers local cooperative extension offices, agricultural experiment stations, and veterinary medicine laboratories, for example our local Vet Med Teaching and Research Center in Tulare. Our mission statement says that we are, "dedicated to the creation, development, and application of knowledge in agricultural, natural, and human resources." Advisors are local representatives of UCCE and are charged with extending knowledge and education, research, university and public service and everyday problem solving by answering clientele questions.

An important distinction between NRCS and UCCE is that UCCE does not participate in cost-sharing. We are here to provide information and assistance, and to help solve problems through research. As discussed above, the funds for our salaries come from state and federal sources, however, we receive only a modest sum each year to help support our program development. Advisors must apply for grants or collaborate with grant applicants to receive money for specific projects. In some cases, research or other program related activities may be funded by a large agricultural corporation or through a commodity board or commission. For example, the Table Grape Commission might fund a project that looks at a new control method for glassy-winged sharpshooters. For a research project like this, a special account would be created to manage the funds needed to complete the research. Funds can also be donated through what is known as a "various donors" account, that are for general use, to support the good work that is conducted. Examples of how some of my colleagues have used these funds is for training, to support attendance at a professional society meeting to present research, or to buy supplies or information resources. In these times of shrinking budgets, every source of support, whether in-kind support such as access to ranches for research, county fiscal support, or financial support from the private sector, is greatly appreciated and used as wisely and judiciously as possible.

Deworming, cont...

then bore their way into the liver and make their way to the bile ducts, where they lay eggs. The animal then sheds fluke eggs in their manure. When the eggs hatch they make their way to a secondary host, fresh water snails. They infect the snails, undergo development and eventually emerge from the snail and encyst, or form a resistant coating, on blades of grass, where the cycle begins again, when they are ingested by livestock. Liver flukes are widespread throughout California and research has shown that the damage they cause in the liver is associated with decreased resistance to Redwater (a fatal liver disease) and decreased fertility, in addition to symptoms directly associated with liver damage, such as diarrhea, weight loss, and jaundice.

Treatment of liver flukes is done through the use of flukicides. Currently, there are only two drugs on the market that are effective against liver flukes. Both work best against the adult flukes, but there is some effect on the migrating juvenile flukes. Clorsulon is effective only against liver flukes and is sold alone as Curatrem © or in combination with ivermectin as Ivomec © Plus. Thus, Curatrem © can be used to kill the flukes or Ivomec © Plus can be used to kill the flukes plus internal parasites (worms) and external parasites (sucking lice). Ivomec © Plus contains significantly less clorsulon than Curatrem ©, and therefore is not as effective as the higher dose of clorsulon found in Curatrem ©.

Timing is critical in a strategic fluke control program. Flukicides should be administered as soon as the majority of the invading flukes are sufficiently mature enough to be killed, but before they are mature enough to shed eggs. This usually translates into a fall or late winter/spring treatment, however, the timing of flukicide administration will vary from ranch to ranch because it is highly dependent on the fluke life cycle. Consult your veterinarian to determine which product will work best for your operation and also to determine the most cost-effective timing for administering drugs to kill flukes.

Safety is a concern whenever livestock are being worked and no matter how careful you are with syringes and needles, needle sticks can happen. Because many barnyard bacteria may be on these needles, infections at the site of the injection can occur. These infections may have severe consequences particularly if they occur in the hand. The hand has many complex joints, tendons and ligaments. It also has a relatively limited blood supply, which means slower responses to infection and inflammation. If you accidentally stick yourself with a needle, stop and wash the area thoroughly with soap and clean water. If swelling, redness, or pain develop, be sure to see a physician as soon as possible.

Copper in Ruminants, cont…

The copper oxide bolus is given orally and usually provides supplementation for 6-12 months, depending on the severity of the deficiency. This product works very well, however, it can be difficult to administer as the cattle may cough up the bolus. Also, since the coating of the bolus is water-soluble, it may melt if rained on or if it gets any sufficient amount of water (or saliva) on it. The California Cattleman's Association sells a balling gun that fits the bolus well and seems to increase successful administration. Another tip is to put a little bit of vegetable oil on the bolus to help prevent melting due to water exposure; the oil also facilitates the administration of the bolus by lubricating it and making it easier for the bolus to slide down the throat of the animal.

Copper Toxicity

It is important to remember that while a little bit of copper is good, too much can be extremely toxic. Copper toxicity is usually the result of over-administration, over-feeding, or over-consumption of copper supplements, though it is possible for copper toxicity to result from contaminated feeds. Excess amounts of copper are accumulated in the liver of an animal and, under even small amounts of stress, can be released in large amounts, causing acute copper toxicity. Acute copper toxicity may present as depression and gastro-intestinal distress at first, but most often livestock are simply alive one day and dead or dying the next. Treatment is usually unsuccessful, however, one strategy is to take advantage of the interaction between molybdenum and copper and orally administer sodium molybdate and sodium sulfate. These compounds "tie up" copper in the animal's system and speed its excretion. If you suspect copper toxicity in any of your livestock, be sure to contact your vet to discuss treatment options, proper dosages, and the prevention of further copper toxicity issues.

Special thanks go to Dr. John Maas, Extension Veterinarian with the UC Davis School of Veterinary Medicine for his contributions to the articles on copper and deworming. His willingness to share suggestions, input, and information resources is appreciated.

The price of stamps keeps going up and budgets seem to keep shrinking. If anyone reading this newsletter received a print version, has an email address and would like to receive the newsletter electronically, please email Julie at jafinzel@ucanr.edu. Thanks for your help!

UC CE

In This Issue...

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