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edges, and while a ruffled cutter will work, it won't be as effortless as the really sharp cutter. Effortless is the goal, and sharp tools are what make for a fast and pretty cut. Too much pressure will also create a lot of unnecessary heat and can actually "blue" the tips of the cutter. That kind of heat modifies the steel and it will no longer hold a sharp edge. So don't blue the tips. I also make a practice of modifying the pressure on the pendulum to target individual points. Changes in grip can help do this, but it is a subtle thing that takes practice, practice, practice. I typically find the teeth on the inside to be less sharp than the teeth on the outside so that is what I usually concentrate on.

Heel grinding is a technique used to extend the life of the tools. It refers to grinding the heels or bottoms of the cutters and combs down faster than the tips. You want to save the tips as long as possible, because once the comb is ground out to the point where the lifter no longer remains, you have a dangerous tool on your hands. Instead of the blunt edge of the lifter, the comb will be sharp all the way to the end, and each tooth looks and acts like a needle. It will draw blood with any and every little poke. They sink deep in a hurry and will produce a horrendous cut without much effort. It really hurts to take old tools to the recycling bin because they are so dang expensive, and I just feel better seeing them all lined up in my tool box, but it must be done. They are dangerous and stitches can run up to $100 a piece, so new combs really are cheaper. The cutters don't become dangerous but they get so small that they won't stay sharp and they leave too much fiber behind. Some companies sell cutters that are made with the heel grind profile already established, giving you one less thing to worry about.

When I load tools onto the clipper I want to set my cutter a little bit below the lifter to improve wear life. If the comb is not worn all the way to the lifter you won't have to grind it out so hard. Another thing that saves wear is using more than one cutter to a comb. If you set your first cutter pretty far from the lifter there will still be a sharp surface between the lifter and the wear of the first cutter. The next cutter will be positioned above the first wear mark and closer to the lifters. This can be done by sliding your comb up and down, or the older cutters that are ground down to a smaller size can be used first and then newer cutters that are bigger can be used next. As the season wears on and the weather heats up I usually have to change combs just because they are too hot. Hot combs will burn an animal very quickly.

Changing combs and cutters at the first sign of dullness will also extend the life of your tools. The cutter wears a deep groove in the comb when used too long, and it takes a lot of grinding to take that out. You are money ahead changing tools out and having a quick grind rather than taking a deep wear mark out.

If you are having trouble cutting with freshly sharpened tools, you need to isolate where the trouble is. Try changing the cutter first. Then try that cutter with a new comb. Also take a look at the shear path on the animal. Look for a row of fiber that is longer than the rest, indicating dullness on those particular teeth. Most of my problems are on the right side of the tool, and I find the comb more difficult to sharpen than the cutter. The more teeth on your tool, the more difficult it is to sharpen.

If I know anything else about sharpening I don't remember what it is, but this should be enough information to get you started. The equipment you have may be a little different than what I have written about, but the basics are the same. You need to place your tool on the wheel in the right place and grind until you're sharp. Sounds easy, right? Lots of practice will get you the results that you want. And when in doubt, grind it again! Because if you're not sharp, you're plucking rather than shearing, and lamas hate plucking!

Bone Collectors

by Sue Wilde

The last New Year's Eve I spent with my mother was a memorable one. There was a movie we wanted to see so after supper out we headed to the theatre. The movie we wanted to see was sold out so blindly we bought tickets for Denzel Washington's movie, The Bone Collector (how far wrong can you go with Denzel?) Well, for any of you who have seen "The Bone Collector", you know it was about an ingenious serial killer who had many creative ways of collecting bones.

For the last 20 years I have been a bone collector – llama bones that is! I have collected bones in many creative ways too and in each issue of the LamaLink I try to dispense useful creative ways for others to be "bone collectors" too!

Twenty years ago I saw some ***photos of llamas in a magazine*** that featured a vet from the States who had moved to British Columbia, given up his practice and was raising llamas. The ***magazine article*** hooked me and I began collecting bones. A neighborhood boy who picked up my garbage told me about 2 people on his route that had a few llamas right in my neighborhood! This ***word of mouth*** motivated me to do some ***networking*** and I bought my first llamas!

We eventually had several "collectors" in the area so we started a ***local llama club***. We attended the first ***llama show*** in Canada with a great deal of excitement. We got a ***llama display*** onto the grounds at the Calgary Stampede, the greatest outdoor show on earth, which developed into a very successful show for many years. ***Seminars*** about caring for llamas were sponsored and Legacy Llamas started the Legacy Classic ***Llama Sale.*** We all joined the new Canadian ***Llama Association***, we organized and attended amazing ***national conferences***. I have cherished memories of many ***parades*** with my family and friends and ***school and hospital visits*** where the llamas were treated like celebrities.

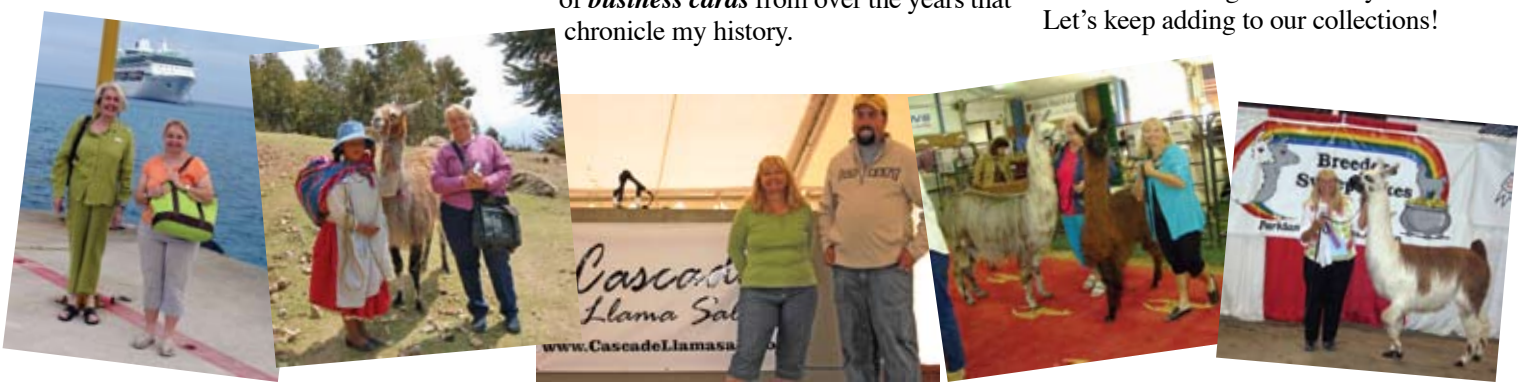
When the world wide web hit, I made a ***website***, Wilde Country Rancho.com, and impressed people who would say, "you have a website!" My picture was in the ***newspaper*** when the llamas participated in the ***annual MS walk*** and the ***farm exhibitions.*** Over the years I have had many ***banners*** for the farm, the first one being a piece of white canvas trimmed in black fun fur with fun fur llamas on it and my farm name printed in pink fabric paint! I have a fun collection of ***business cards*** from over the years that chronicle my history.

I have ***sponsored classes*** at shows ***volunteered*** in many capacities and ***helped other breeders*** whenever I could. I sailed the seas on the ***Lamaribean Cruise*** and ***met so many new wonderful people*** who were devoted to their llamas. I attended an ***international conference and traveled in Bolivia,*** I ***advertised*** in newspapers, catalogs and store windows.

Along the way through all of these aspects of the llama business I have collected a lot of bones and helped others to be ***creative*** collectors, as well, with these time tested ways to market llamas. I am now moving to a smaller farm and have used all of these methods to sell many of my llamas that I have out of ***love and passion*** collected over the last 20 years. I have met many new people and had even more great llama experiences that I will always consider memorable.

Why have I been privileged to have the llamas that give me a wonderful life? Because, I was ***passionate*** about them and ***I got out of my yard*** and into the world, the world of llamas. Ever wonder why you aren't a part of creative bone collecting? Well, you must go out and "just do it"!

By the way, my mother never really got over the shock of the movie, The Bone Collector and the creative bone collection methods and talked about it for months! I will never get over my bone collection either and will be talking about it for years to come. Let's keep adding to our collections!



Copper Nutrition in Camelids Part 2

Robert J. Van Saun, DVM, MS, PhD
Department of Veterinary and Biomedical Sciences
Penn State University

In the previous column the subject of copper (Cu) nutrition was introduced. Biologic roles of Cu in body functions and disease conditions resultant from either Cu deficiency or toxicity were described. Copper was identified as an essential nutrient that has a very narrow range between deficiency and toxicity for llamas and alpacas, similar to sheep. The objective of this column is to complete our understanding of Cu nutrition by defining what is known about its requirement, addressing appropriate supplementation practices, and monitoring of copper status in keeping llamas and alpacas healthy.

Requirements

Defining a "true" requirement, meaning how many milligrams (mg) per day to support a given physiologic state, for a trace mineral is difficult at best. Often a trace mineral requirement is described in terms of dietary concentration, namely parts per million (ppm). Ideally a trace mineral requirement would be defined in terms of how many mg of mineral were needed to support specific physiologic states such as maintenance, pregnancy, lactation, growth, and work/activity. Obviously to determine such needs, specific feeding trials must be completed. The recent National Research Council (NRC) publication for small ruminants has not defined specific mineral requirements for llamas and alpacas, as there are no published studies defining feeding protocols specific to llamas and alpacas (NRC, 2007).

Based on clinical reports of Cu-associated disease conditions, it appears camelids are not significantly different from other species relative to their Cu requirement; other than a concern for sensitivity to Cu toxicity similar to sheep. Assuming no inherent differences among species, mineral requirements for beef cattle, sheep, and goats can be used to generate camelid requirements. The small ruminant NRC recommends mineral requirements defined for sheep as appropriate for llamas and alpacas. Using the requirements from beef cattle, sheep, and goats an averaged requirement of 0.15 mg per kg of body weight was derived (Van Saun, 2006). This would calculate to a daily Cu requirement between 9 and 24 mg/day for llamas or alpacas varying in body weight from 130 to 350 lbs. Assuming a dietary intake of 1.25 to 1.5% of body weight, suggested dietary Cu content should be between 9 and 12 ppm (dry matter basis). This determination is consistent with Cu requirements for other species and accounts for a slightly lower intake capacity, which increases dietary concentration slightly.

Copper Availability and Metabolism

In the more recent NRC publications, mineral requirements have been adjusted for variable availability from dietary ingredients. It has been shown that minerals within forages are not as available for absorption as from mineral sources. Compounds such as oxalates and phytates in forages can bind minerals reducing their availability. Copper availability in fresh pasture is lower than from hay. When the plant is harvested some breakdown of compounds facilitates the release of Cu making it more available. As with many other minerals, there are many documented interactions between minerals that can alter availability. Relative to Cu, high dietary iron (Fe), zinc (Zn), and calcium (Ca) can reduce Cu availability. Iron is high in soil and soil consumed by grazing animals may contribute to the observed lower Cu availability from pasture.

Interactions affecting Cu availability have been well studied as a result of a unique situation in ruminant animals. Bacteria in the fermentation vat (rumen or camelid C-1) can combine dietary molybdenum (Mo) and sulfur (S) to produce compounds termed thiomolybdates. These thiomolybdates chelate or bind Cu in the fermentation vat and prevent Cu from being absorbed in the intestine. Even if absorbed, the chelated Cu is not available for use by tissues. For any ruminant animal, including llamas and alpacas, availability of dietary Cu will be significantly influenced by dietary Mo and S content. In this regard, often the Cu requirement is defined relative to dietary Mo as a Cu-to-Mo ratio. For sheep and camelids that are more sensitive to Cu, a suggested dietary Cu:Mo ratio of 6 to 10:1 is recommended. A Cu:Mo ratio of 16:1 or greater is often associated with Cu toxicity problems (Pugh, 1993).

Table 1. Contribution of individual feed ingredients (hay, pellet, mineral supplement) to total dietary copper (Cu) content. For comparison in the following examples daily Cu requirement for a 300 lb adult llama is 20.41 mg/day. Dietary Cu content can vary from 9 to 12 ppm assuming a total intake of 1.5 and 1.25% of body weight, respectively.

Example 1	Forage	Pellet	Mineral	Total Diet
Intake, lb/day	3.25	0.5	0.015	3.77
Cu, ppm	9.0	26	300	12.4
Cu, mg/day	13.27	5.90	2.04	21.21
Example 2	**Higher pellet Cu content**			
Intake, lb/day	3.25	0.5	0.015	3.77
Cu, ppm	9.0	46	300	15.1
Cu, mg/day	13.27	10.43	2.04	25.74
Example 3	**Lower mineral Cu content**			
Intake, lb/day	3.25	0.5	0.015	3.77
Cu, ppm	9.0	26	30	11.34
Cu, mg/day	13.27	5.90	0.20	19.37
Example 4	**Higher forage Cu content**			
Intake, lb/day	3.25	0.5	0.015	3.77
Cu, ppm	25	26	300	26.23
Cu, mg/day	36.85	5.90	2.04	44.79

Feeding Recommendations

With the requirement numbers presented, one needs to provide sufficient amounts of Cu from the diet without greatly exceeding this requirement and potentially inducing toxicity. The challenge here is remembering dietary Cu is contributed by every ingredient fed to some extent. This is where many people become confused. As previously stated, daily Cu requirement on a dietary concentration basis is between 9 and 12 ppm. However, many feed ingredients can contain much higher Cu content, for example mineral supplements might contain between 30 and 600 ppm Cu. Does this mean these feed ingredients are toxic? Possibly, but only if they were fed as a sole feed source (not practical or realistic) or in combination with other feed ingredients with high Cu content. Each feed ingredient will contribute to the overall total dietary Cu content, but only to the proportion of the total diet the individual feed represents.

In Table 1, a number of examples are provided to demonstrate the concept of ingredient contribution to dietary Cu content. For these examples, three feed ingredients (hay, pellet, and mineral) comprise the total diet. The same amount of hay (3.25 lbs/day), pellet (0.5 lb/day), and mineral supplement (0.015 lb/day or 0.25 oz/day) are provided in each example for simplicity and only Cu content is varied. In these examples it can be seen that hay provides the largest amount of dietary Cu even though it has the lowest Cu content. This is a direct result of hay being the largest proportion of the total diet. Example 1 shows Cu intake (21.2 mg/day) and dietary content (12.4 ppm) are in line with estimated requirements (20.4 mg/day; 12 ppm) for the defined animal (see table legend). In example 2, the pellet Cu content is increased from 26 to 46 ppm, yet dietary Cu intake and content are not greatly increased. Some are concerned about the Cu content of the mineral supplement, yet example 3 shows the mineral Cu reduced from 300 to 30 ppm, but Cu intake is reduced only by 2 mg/day. Of greatest concern is the situation in example 4 where hay Cu content increases from 9 to 25 ppm. In this situation, daily Cu intake and dietary content is greatly increased and, depending upon dietary Mo status, could potentially lead to Cu toxicity problems. Hay Cu content typically is between 4 and 14 ppm, though much higher Cu concentrations are being observed more frequently in many regions of the U.S. High forage Cu content may be the result of inappropriate fertilization practices, especially if poultry or pig manure are used. Dietary Cu is very high in poultry and pig diets, which accounts for the higher manure Cu content. Another concern is the use of copper sulfate footbaths on dairy cattle farms and the spread of this material on croplands. Given these situations, it is important for you to know just how the forages you purchase are raised or you need to test your forages to assess Cu status.

Given these dietary examples, it is imperative that all potential sources of Cu be accounted for in the diet to ensure adequate, but not excessive, Cu is consumed. As previously described, dietary Mo is an important factor to address in assessing dietary Cu status. From these examples both dietary ingredient Cu content and intake amount need to be considered. If testing feed ingredients for Cu content, one should also have Mo and S content determined. In feeding appropriately for Cu, one should first evaluate forage Cu content then match pellet and mineral supplement accordingly. If your pellet product contains more than 50 ppm Cu, then you may wish to use a mineral supplement with low (<100 ppm) Cu. If your hay has a Cu content greater than 15 ppm, then you may need to feed a pellet with lower Cu content and a low Cu mineral. It must be remembered that high dietary Cu intake does not guarantee that a toxicity event will occur. Most reported toxicity cases are associated with dietary Cu content exceeding 25 to 30 ppm and a high (>16:1) Cu to Mo ratio.

Monitoring Cu Status

With concerns for disease related to either Cu deficiency or toxicity, methods to assess Cu status are of interest. Copper can be directly determined in serum, plasma, or liver samples. Serum or plasma Cu concentrations are most easily obtained and determined, though interpretation relative to dietary status is confounded. Only very low (<0.1 μg/ml) or very high (>5 μg/ml) blood Cu concentrations are diagnostic. Values within the normal reference range (0.3 to 0.8 μg/ml) could also be associated with marginally deficient or excessive dietary Cu intake. Liver Cu concentration is considered the best measure of dietary Cu status, but requires an invasive liver biopsy to obtain a sample. If an animal dies from unknown causes, a sample of liver and kidney should be obtained for Cu concentration determination. Liver Cu concentrations below 25 ppm (dry weight basis) or above 500 ppm (dry weight basis) are suggestive of deficiency or toxicity, respectively.

Beyond Cu concentration determinations, Cu status can be assessed by measuring activities of Cu-specific enzymes. Ceruloplasmin activity in blood is a measure of Cu status, but it is influenced by infectious conditions, thus confounding their interpretation. Whole blood super oxide dismutase enzyme activity has also been associated with Cu status, though this enzyme is also influenced by zinc status. Enzyme activities are not very sensitive to

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dietary changes as their activities are highly conserved by the body in the face of deficiency. They also do not reflect toxicity situations. Availability of laboratories capable to measuring these enzymes and having reference values for llamas and alpacas are limited. At this point, serum Cu concentration should be used as a screening tool to assess Cu status. This measure should be evaluated in conjunction with dietary Cu and Mo content.

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NEED Advise?

Dr. Van Saun is answering your lama nutrition questions! Submit your questions to editor@lamalink.com

Cutest Cria!

Spirit – the most high spirited little llama biggest one too (28 pounds at birth)

Bonnie (left) 10 days old & Clyde (right) 3 days old!

Submitted by Katelyn Lines — Age 14