Winter 2019 – Volume 31, Issue 1

# Hoof Print

The Small Ruminant Magazine

DAIRY & MEAT GOAT
ONLINE
CERTIFICATION
COURSES

THE TWO FACES OF
COPPER
NUTRITION
IN SHEEP & GOATS

NEWS TO EWES
LAMBS GALORE

Kentucky Small Ruminant Grazing Conference
Feb. 23, 2019 - Morehead State University

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***Hoof*Print**: *The Small Ruminant Magazine* is a periodical to promote better animal health, husbandry, and knowledge among sheep and goat producers. ***Hoof*Print** is the joint effort of members of the sheep and goat industries and serves as a united voice for all small ruminant producers.

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**Winter 2019 – Volume 31, Issue 1**

*Hoof* **Print**
The Small Ruminant Magazine

## In this Issue



## Special Features





## Association News & More



Tennessee Sheep Producers Association

Kentucky SHEEP & WOOL PRODUCERS ASSOCIATION

KENTUCKY GOAT PRODUCERS ASSOCIATION

# 2018 CONFERENCE WRAP-UP

**2018 MEMBERSHIPS:** KGPA grew in memberships again in 2018 to over **150** members. These members are from all over the state and encompass fiber, meat and dairy operations. During the 2018 KY Annual Producer Conference, KGPA elected their board members for 2019-2021. See the list of new Board Members below.

## 2019 KGPA Board of Directors

**2 Year Appointment:**
Donna Puckett

**3 Year Appointment:**
Dee Daniels
Christina Morris
Chris Stewart

**Active Directors:**
Shawn Harper
Beth Johnson
Denise Martin
Emily Robinson
Kay DeMoss
Karen Cooper

## 2019 President!

You will be excited to know that the 2019 KGPA President is **Dr. Beth Johnson!** Dr. Beth Johnson is a Staff Veterinarian in the Kentucky Department of Agriculture and has 40 years of experience raising and treating small ruminants. Her family farms in Parksville, KY where she raises Gelbvieh cattle and Boer goats. Be sure to congratulate her on this achievement!

You can read bios of the new board of directors at
https://www.kysheepandgoat.org/kgpa-annual-meeting

KENTUCKY GOAT PRODUCERS ASSOCIATION

## JOIN or RENEW TODAY!

**KGPA Membership Application**

**Your $30 membership provides:**

- 4 issues of the *Hoof*Print Magazine plus the newly designed 2019 Sheep and Goat Management Calendar
- A unified voice for the goat industry on the state and national level
- Representation on important committees such as the Check-Off and the Animal Care Standards boards
- Support of various educational and youth activities
- Youth Membership forms can be found at kysheepandgoat.org/KGPA.html
- **And much, much more!**

**Visit www.kysheepandgoat.org to join today!**

Name: _____

Address: _____City: _____State: _____Zip:_____

Phone: _____E-Mail: _____

Please enclose a check for $30 made out to KGPA and mail to:

Kentucky Sheep and Goat Development Office
P.O. Box 4709, Frankfort, KY 40604-4709.

# CALENDAR OF EVENTS

## JANUARY

**8th** **Marion County Sheep and Goat Meeting,** Marion Co. Ext. Office 7pm
**10th** **Jessamine County Goat and Sheep Association,** Agriculture Learning Center; 7pm
**10th** **United Producers Graded Sale**
**14th** **Bluegrass-Richmond Graded Sale**
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**23rd** **Kentucky Small Ruminant Grazing Conference,** Morehead State University Morehead, KY https://2019smallruminant.eventbrite.com
**26th** **Paris Stockyards Graded Sale**
**28th** **United Producers Graded Sale**

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**12th** **Marion County Sheep and Goat Meeting** Marion Co. Ext. Office 7pm
**14th** **Jessamine County Goat and Sheep Association,** Agriculture Learning Center; 7pm
**14th** **United Producers Graded Sale**
**16th** **Springfield Graded Sale**
**19th** **West KY Graded Sale**
**19th** **South Central Goat and Sheep Producers Meeting,** Barren Co. Ext Office, 6:30pm (CT)
**21st** **KSU Third Thursday Goat Field Day,** KSU Research Farm
**26th** **Paris Stockyards Graded Sale**
**28th** **United Producers Graded Sale**

## APRIL

**1st** **Jessamine County Goat and Sheep Association,** Agriculture Learning Center; 7pm
**16th** **South Central Goat and Sheep Producers Meeting,** Barren Co. Ext Office, 6:30pm (CT)

## *Letter from the President*

### *KGPA NOTE'S FROM THE KIDDING BARN*

By the time you are reading this the holiday season has come and gone, and we welcome a New Year, 2019!! I hope that everyone had a peace filled holiday with their family and friends. We start the New Year with hopes that the kidding season goes well with only a few manageable problems. As we all know, every day is a learning day in the world of Goat Production.

In November, many goat producers, Dairy and Meat, enjoyed exhibiting their animals at the North American International Livestock Exposition in Louisville, KY. The Dairy Goat show, sanctioned by the American Dairy Goat Association, was one of the largest in several years with over 600 Dairy Goats from all over the United States exhibiting. Our own Tess Caudill was the Dairy Goat Show superintendent. There was also a large Wether, Wether Dam, and Registered Boer Goat Show, ABGA sanctioned, held with Ray Graves tackling the job of superintendent for these shows. Both Tess and Ray did an excellent job as superintendents of their respective shows. These shows are a beautiful example of the diversity of goats and if you have never attended one of the shows, you don't know what you are missing. In 2019, put this on your bucket list to attend and talk with the many producers for new ideas.

While you are making some New Year's resolutions be sure to add goat production education as one of your resolutions. Try joining a local small ruminant club near you and learn through interaction with the different producers. You will be surprised that most producers have the same problems you do, but just need to tweak their management to be more successful, and you never know what ideas you have that may help a new producer. It's called mentoring. Also on February 23, 2019, there will be a Small Ruminant Grazing Conference held at the Derrickson Agricultural Complex in Morehead. To register for the conference go to https://2019smallruminant.eventbrite.coms, and click on the Small Ruminant Grazing Conference link.

Here's to a successful year to each and every one of you!

Dr. Beth, KGPA President

## KGPA and KSWPA NEED YOUR HELP!

With the increasing population of goats and sheep in our state, there are lots of people who could benefit from your knowledge. Having a mentor could be the difference between a new producer thriving or diving! Consider becoming a mentor so that you can make a difference in someone's life. Together we can continue to strengthen and grow our industries.

**kysheepandgoat.org/become-a-mentor**

# Seasons Greetings from Tennessee!

Here's hoping you had a wonderful Thanksgiving along with a beautiful day as we were provided here in Middle Tennessee. As temperatures soared into the mid 60's, it was a great occasion to visit with family and express gratefulness for all blessings in our lives. I certainly hope you were able to experience the fantastic day as well.

As this issue goes to press, my family will soon be moving to a new farm and more territory. Coyotes have been spotted there over a few years along with many deer and turkey. We moved the bred ewes there earlier in summer along with the guardian dogs. Although we've not had any issues at our previous farm, we purchased a couple of part Anatolian, part Akbash litter mates three years ago. Our ewes quickly taught those pups which way was up and the boys, Larry and Moe, became part of the flock. I've placed a lot of trust and faith in these guys to take care of things and will certainly rely heavily on them at our new farm. They've appeared at the gate wounded a few times and not sure if it's from each other or a coyote encounter, but so far, the ewes are just fine.

Our board opted to change the date of our Tennessee Sheep Producers Association annual meeting to April 2019 and we're working on details at this time. We're leaning towards an East Tennessee gathering as we haven't been there in quite some time. Keep an eye out on our website for updates to be coming soon. Of course, our Shearing School is always a hit and will be held April 26-27th so be sure to save the date. By the way, even if you have hair sheep, this is a great opportunity to expand your knowledge and skill set.

If there is anything we can do for you, just let me know.

**Merry Christmas & Happy New Year!**

Debbie Joines,
TSPA President

**JOIN ONLINE TODAY!**

## TSPA Membership Application

**Annual Dues: Adult: $30.00 Junior $10.00**

Name: _____

Address: _____ City: _____ State: ___ Zip: _____

Phone: _____ E-Mail: _____

Breed(s) of Sheep: _____

Please enclose a check for amount made out to TSPA and mail to:
Tennessee Sheep Producer's Association • 4233 Poplar Hill Road, Watertown, TN 37184

If you are interested in a committee please select below:

_____ Wool _____ Youth
_____ Jr. Expo _____ Sale
_____ Production Education
_____ Membership/Revenue
_____ Publicity
_____ Annual Meeting

**Pay dues and join online at www.tennesseesheep.org**

# 2019 Annual Shearing School

## April 26 – 27, 2019

taught by Doug Rathke

## Middle TN State University

For More Info Contact: Warren Gill 615-478-3828 / Warren.Gill@mtsu.edu or
Mark Powell 615-519-7796 / shepherdboy1@yahoo.com

### 2018 TSPA Board of Directors

**President/ ASI Rep.**
*Deborah Joines,* Mt. Juliet, TN
**djoines@utk.edu**

**Vice President**
*Robert Walker,* Alpine, TN
robert.walker@westforkfarms.com

**Secretary/ Treasurer**
*Mark R. Powell,* Watertown, TN
shepherdboy1@yahoo.com

### 2018 TSPA Board Members

- Steve Alsup, *Lascassas, TN* – palsup@dtccom.net
- Dwight Loveday, *Louisville, TN* – hloveday@tennessee.edu
- Reyes Rich, *Moss, TN* – ginnyridge@gmail.com
- Brandon Tavalin, *College Grove, TN* – tavalintails@gmail.com
- Mark Shedden, *Knoxville, TN* – rmnps@bellsouth.net
- Kevin Durett,*Cottontown, TN* – kevin.durrett@ymail.com
- Thomas Greenlee, *Rutledge, TN* – jgreenl4@utk.edu

# 2018 CONFERENCE WRAP-UP

- KSWPA membership continues to grow. In 2018, we were able to serve **157 producers** in fiber and meat operations.
- During the 2018 Annual Conference, KSWPA elected the 2019 KSWPA Board Officers and Directors. **Elected Officers for 2019 are:**

1. **President – Bill Decker**
2. **Vice President – Madeline Rosenberg**
3. **Secretary – Jim Mansfield**
4. **Treasurer –Dorthy Vale**

## *Congratulations!*

- New persons elected to the Board of Directors were Sue Churchill, Eileen O'Donohue and Richard Popham. ***Welcome aboard!*** To read more about our new board of directors, visit https://www.kysheepandgoat.org/kswpa-annual-meeting.

- KSWPA also worked hard in 2018 to help producers learn more about changes in the Scrapie Program, provide mentorship to new producers and create a marketing opportunity for wool.

1. **Wool Outreach** ($1312)- Funds were put towards expenses related to the 2018 Wool Pool
2. **Scrapie** ($1000)- Funds were used to educate producers on the changes made to the Scrapie Tag program
3. **Mentoring** ($1000)- funds were used to recruit mentors, connect mentors to mentees, and recruit participants to SRPS

You can see summary reports of each of these programs at https://www.kysheepandgoat.org/kswpa-annual-meeting

## 2018 - 2019 KSWPA Board of Directors

**President**
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**bdecker@cisco.com**

**Past President**
*Scott VanSickle,* Auburn, KY
scottvansickle@wheattech.com

**Vice President**
*Madeline Rosenburg,* Bagdad, KY
Madeline.ballyhoofarm@gmail.com

**Secretary**
*Jim Mansfield,* Salvisa, KY
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**Treasurer**
*Dorothy Vale,* Nicholasville, KY
valerdv@aol.com

**ASI Representative**
*Madeline Rosenburg,* Bagdad, KY
Madeline.ballyhoofarm@gmail.com

## 2018-2019 KSWPA Board Members

- Warren Adcock *Campbellsburg, Ky*
  Wadcock6307@hotmail.com
- Frank Berry, *Lexington, KY*
  frankrberry@gmail.com
- Sue Churchill *Versailles, KY*
  thistlesend@gmail.com
- Eileen O'Donohue *Willisburg, KY*
  eod1954@yahoo.com
- Richard Popham *Brandenburg, KY*
  rapopham@gmail.com

## JOIN or RENEW TODAY!
**Visit www.kysheepandgoat.org**

**KSWPA Membership Benefits**

- Quarterly issues of HoofPrint Magazine plus the newly designed 2019 Sheep and Goat Management Calendar
- A unified voice for the sheep industry and representation on important state and national committees
- Assistance with new marketing opportunities such as The Kentucky Sheep and Fiber Festival and HoofTrader.com
- Receive a membership to the American Sheep Industry, our national lobbying, marketing and promotional support system.
- Support of various educational and youth activities

**Name:** _____ **Phone:** _____ **E-Mail:** _____

**Address:** _____ **City :** _____ **State:** _____ **Zip:** _____

**Please enclose a check for $30.00 made out to KSWPA and mail to:**
**Kentucky Sheep and Goat Development Office**
**P.O. Box 4709, Frankfort, KY 40604-4709.**

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**16th** **South Central Goat and Sheep Producers Meeting,** Barren Co. Ext Office, 6:30pm (CT)

## Greetings Sheep Producers,

It seemed that we went from summer to winter and skipped fall all together, but every year is different therefore, we just have to adapt. Our ability to adapt is our key to survival and success in the sheep industry.

On November 7, I attended the Kentucky Farm Bureau 2019 Legislative Session Preview for Kentucky Agriculture. The purpose of the meeting is to allow commodity groups the opportunity to hear of upcoming legislation pertinent to Kentucky agriculture, and for government representatives to hear concerns from commodity groups that may need to be addressed in the next session. For the larger commodity groups like soybeans, corn, milk, and beef, the news was not good. Pressure of stagnant markets, low yields and lack of a Farm Bill are making all Kentucky agriculture areas very nervous.

Farm incomes are expected to hit their lowest point since 2006. Borrowing costs are rising as a deepening slump in the ag economy enters its fifth year. The general sentiment from the Kentucky Farm Bureau conference was that things are pretty rough in the farm economy and the question is when it might make a turn for the better. Right now, there is not a light at the end of the tunnel.

The sheep business may not be the best right now, but compared to the dairy, tobacco and soybean farmers, we are doing ok if we are doing things the best we can. Unlike most dairy farmers and big grain farmers, most of us who raise small ruminants have city jobs to subsidize our sheep operations. Our sheep farming in many cases is our second or third job, and we need to make sure we are doing things the very best we can, both for the sake of our animals and, secondly, to make sure we are making good use of our time and financial resources. Feeding properly, managing parasites, and maintaining health are the most important factors in making our operations efficient and profitable. We need to take advantage of small ruminant classes in our area and online- attend the Ewe Profit Schools at the University of Kentucky, our annual producer conference, and other events sponsored by the Kentucky Sheep and Wool Producers Association. We need to network with each other to learn better shepherding techniques and find out ways to sell our animals and meat for the very best price possible.

Our KSGDO Annual Producers Conference held on October 27 at the Kentucky State University Research Farm in Frankfort, Kentucky was wonderful- one of the best conferences I have attended. I learned a lot of good marketing and parasite control ideas from Dr. Reid Redden our keynote speaker. Dr. Redden had hands on practical (affordable) suggestions on how to deal with the barber pole worm, our "arch enemy", in the sheep industry. If you didn't make it to the conference this year, go to our KSGDO website to get the highlights of the conference. We look forward to seeing you next fall at the 2019 conference!

As president of Kentucky Sheep and Wool Producers Association, I hope 2019 will be a prosperous year for you, your family, and our association. Join me in seeking new ways to increase the consumption and popularity of lamb in Kentuckians diets and to grow the membership of the KSWPA.

Best Wishes,
Bill Decker, President
Kentucky Sheep and Wool Producers Association

# The Two Faces of Copper Nutrition in Sheep & Goats

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

In most small ruminant circles, the mention of "copper" brings shivers of dread, but for different reasons with sheep and goat owners. Copper (Cu) is an essential micromineral required by all small ruminant species to maintain normal body functions when provided in appropriate amounts. However, Cu nutrition is a double-edged sword being associated with both deficiency and toxicity disease concerns with much variation among the small ruminant species. Although all microminerals are of importance, Cu is receiving more attention as a result of the potential toxicity concerns with sheep, llamas, and alpacas and for deficiency issues in goats. There is evidence of increasing Cu content in forages and feeding with other copper-containing supplements (pellets and mineral) may predispose animals to a greater risk for toxicity problems. However, the specter of animal health concerns related to Cu deficiency, even in sheep, is becoming more apparent. The objective of this article is to provide an overview of Cu nutrition by describing biologic functions and associated deficiency and toxicity disease conditions in sheep and goats.

## *Copper's Biological Roles*

All trace minerals, including Cu, perform their biologic role as a component of a protein enzyme (i.e., metalloenzyme) in catalyzing a specific reaction. The measured activities of these mineral-specific enzymes are used to define a deficiency situation. Essentiality of Cu in animals was not discovered until 1928, though it had been discovered in animal and plant tissues much earlier. Copper performs many essential roles in the body as a component of Cu-containing enzymes that include ceruloplasmin, tyrosinase, lysl oxidase, cytochrome C oxidase, and superoxide dismutase (Table 1). Through the action of these metalloenzymes, Cu has been associated with iron regulation and red blood cell function, cellular respiration, bone and connective tissue formation, hair pigmentation, nerve tissue and cardiac development, and immune function.

Ceruloplasmin is a blood protein with multiple functions and contains seven copper atoms, thus accounting for a majority of copper in blood. Ceruloplasmin converts stored ferrous iron (+2) into the ferric (+3) state to be incorporated into hemoglobin or myoglobin for oxygen transport. Ceruloplasmin is a liver generated acute phase protein with an important role in the non-specific immune response and its blood concentration will be elevated in response to an infectious agent. Functional activity of most cell types responsible for the various immune system responses are influenced by Cu through superoxide dismutase activity.

Of interest to fiber producing small ruminants, Cu plays an important role in fleece coloration and quality. Tyrosinase is the enzyme responsible for the formation of melanin, a pigment responsible for hair and skin coloration. Hair or fleece would appear lighter in color or "bleached out" without the presence of melanin. Cross linkages of disulfide groups within the keratin structure of hair provide the physical properties of fleece and are dependent upon Cu. Wool from sheep with copper deficiency are described as having "steely wool" where the crimp has been lost and the fiber is straight.

Normal development of bone and connective tissue is dependent upon the copper-dependent enzyme lysl oxidase. This enzyme is responsible for modifying specific amino acids within the collagen protein structure that facilitates cross linkages between collagen fibers within connective tissue. These cross linkages impart properties of rigidity or elasticity to the collagen structure. Rigid connective tissue provides the scaffolding for mineralization in the development of bone. Elastic properties of collagen are seen in the large blood vessels such as the aorta, which must withstand wide fluctuations in pressure in circulating blood.

The cell's ability to generate energy through the transfer of electrons to the final receptor oxygen to form water is one of the functions of cytochrome C oxidase. Integrity of the nervous system is dependent upon the specialized phospholipid coating (myelin) around nerve fibers facilitating transmission of nerve signals. Myelin formation in the brain and spinal cord is related to cytochrome C oxidase activity. Besides the structural effects on nervous tissue, Cu is linked to nervous and cardiac tissue communications through its effect on production of neurotransmitters and heart muscle fiber (myofibril) development. Both cytochrome C oxidase and dopamine-β-monooxygenase are responsible for these biologic functions of Cu.

## *Copper Deficiency Diseases*

With the number of biological functions attributed to Cu, a spectrum of disease entities has been associated with a deficient nutrient status (Table 1). A common Cu deficiency disease occurring in a wide range of animals is anemia. Anemia can be characterized by the size and pigment (hemoglobin) content of red blood cells. In older ruminants, Cu deficiency can induce a macrocytic, hypochromic anemia due to low ceruloplasmin activity, whereas in lambs

**Table 1. Selected examples of biologic functions of copper as part of metalloenzymes and associated disease conditions.**

| Cu Metalloenzyme | Function | Biologic Actions | Disease Condition |
|---|---|---|---|
| Ceruloplasmin | Activation of $Fe^{2+}$ to $Fe^{3+}$ | Allows stored iron to be incorporated into hemoglobin in red blood cells. Acute phase protein that helps kill invading bacteria | Anemia, poor immune response |
| Cytochrome C oxidase | Terminal electron transfer – respiratory chain | Allows for electron transport in metabolism, Production of myelin sheath of nerves | Swayback in young animals, Enzootic ataxia |
| Dopamine-b-monoxygenase | Catecholamine metabolism | Production of metabolic regulators, heart function | Unknown association maybe abnormal heart development |
| Lysyl oxidase | Desmosine cross-linkages in connective tissue | Proper formation of structural components of bone, elastin, cartilage | Bone deformities similar to rickets in young growing animals; Rupture of large blood vessels |
| Peptidylglycine-a-monooxygenase | Elaboration of numerous biogenic molecules (e.g. gastrin) | Production of many different regulatory molecules impacting digestion, metabolism, reproduction | Unknown linkage to specific disease, but may be related to poor growth, reproduction |
| Cu-Zn Superoxide dismutase | Dismutation of $0_2^-$ to $H_20_2$ | Antioxidant to protect against various oxidizing agents from metabolism or environment | May be associated with stillbirths or weak neonates, poor immune response |
| Tyrosinase | Conversion of tyrosine to melanin | Produces melanin pigment for skin and hair or wool | Decolorization of wool, hair, dark colors become "reddish" or lightened |

the anemia is characterized as microcytic and hypochromic. Similar Cu-responsive anemia can be seen in goats.

Copper deficiency has been associated with neurologic degeneration in sheep and goats as a result of abnormal myelin formation with resulting disease signs of progressive muscular weakness of the legs and ataxia. Young lambs affected due to the pregnant animal being fed a low Cu diet is described as "swayback" whereas when older animals present with this disease process it is termed "enzootic ataxia".

Achromotrichia (loss of fleece pigmentation) and fleece structural changes is seen in sheep and other species with Cu deficiency. Bone development abnormalities (similar to rickets), blood vessel ruptures, and heart degeneration are other recognized Cu deficiency diseases, but these are not seen in all species. Copper deficient diseases will vary among animal species.

More recently sheep flocks, goat herds and beef cattle herds have been recognized with animal losses, poor reproductive performance and high losses of newborns with the only definitive finding of low Cu status. I have documented low liver Cu in aborted fetuses where no other potential cause could be found. In another study, stillborn calves have lower trace mineral status compared to healthy calves. One of our primary findings in sheep flocks experiencing low Cu is high stillbirth and death loss of newborn lambs. More research is underway to further characterize what is happening and why in these flocks.

The disease conditions discussed thus far are classified as clinical disease syndromes. Clinical disease is characterized as the "classical" disease processes associated with a specific nutrient and often described in various nutrition textbooks. In contrast to clinical disease is a less specific disease process termed subclinical disease. Subclinical disease is described as non-specific consequences of a nutrient being marginally deficient or toxic. Subclinical Cu deficiency is associated with impaired immune response and greater susceptibility to disease, reduced reproductive fertility, and poor growth or lactation. Clinical disease is more readily identified but is not near as prevalent as subclinical disease. With difficulties in assessing Cu status using blood concentrations, subclinical disease becomes a difficult process to diagnose.

## *Toxicity Disease*

In contrast to Cu deficiency, more emphasis is on the implications of excess Cu from the diet. Copper toxicity is the result of the highly reactive nature of the Cu ion when not protectively bound in tissues or blood. Copper like most minerals is a strong oxidizing agent that can damage cellular membranes and proteins. The liver is the body's primary trace mineral storage organ and contains special protein molecules capable of binding minerals and keeping them isolated from doing any damage to the surrounding tissues. Stored Cu is inefficiently excreted through bile produced in the liver and transported to the intestinal tract to be lost in fecal matter. The ability to excrete Cu is species dependent and accounts for the observed differences in sensitivity to Cu toxicity. Once the liver has become saturated with stored Cu, excess will spill out into the liver and blood reeking oxidative havoc. The challenge is being able to recognize disease risk early and initiate appropriate dietary changes as there is no treatment once the disease process has initiated.

In most situations Cu toxicity is a progressive disease process (e.g., weeks to months) where excess dietary Cu accumulates in the liver until the liver Cu storage proteins become saturated. Acute Cu toxicity (e.g., hours to days) can occur if the animal consumes excess highly soluble Cu sources such as copper sulfate. Sheep are well known to be extremely sensitive to excess dietary Cu (>10 mg/kg); however, llamas and alpacas do not seem to be as keenly sensitive but are prone

*Copper continues on pg. 12*

to toxicity whereas goats seem more tolerant. However, goats can become Cu intoxicated just as well if they receive excess Cu in their diet or through copper wire boluses in treating parasites.

Clinical Cu toxicity in sheep is characterized by red blood cell breakdown (i.e., hemolysis) due to oxidative damage from the Cu ion released into the bloodstream. With hemolysis there is leakage of free hemoglobin into the blood (hemoglobinemia) and urine (hemoglobinuria). Hemoglobin in urine will damage the kidneys. The hemolytic crisis stage of the disease is nearly always fatal. The disease process is different in goats, llamas and alpacas as the "hemolytic crisis" has not been reported or seen in field cases. The common theme in goat Cu toxicity cases is the documentation of severe and widespread degenerative changes (necrosis) in the liver. Liver necrosis may or may not be associated with elevated blood enzyme activities assessing liver function. Affected goats will have highly elevated blood (>200 µg/dL) and liver (>600 µg/g dry weight) Cu concentrations as well as elevated kidney (>10 µg/g dry weight) Cu concentrations.

Typically blood and kidney Cu concentrations are not highly elevated until the final initiation of the disease process; therefore, they may not be useful in diagnosing potential risk. Additionally, kidney Cu concentrations are only determined in animals that have died. The difficulty in dealing with this disease is that animals may only show minimal signs of poor doing prior to the final demise. Stress factors or previous liver disease may precipitate the disease. Key to understanding and preventing Cu toxicosis is nutritional management practices.

### *Copper 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 was 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, 2007) publication for small ruminants has defined specific mineral requirements for sheep based on factorial models and for goats based on dietary concentration as there was insufficient data to generate predictive models. For sheep the suggested total dietary Cu concentration ranged from 5-8 mg/kg, while for goats the recommendation was 15-20 mg/kg. This would translate into a daily absolute Cu requirement between 5 and 22 mg/day for sheep depending upon body weight and physiologic state. On the other hand, the daily absolute Cu requirement for goats across body weights and physiologic states ranged from 12 to 50 mg/day. Clearly, supplements or mineral products cannot be formulated to meet the Cu requirements of both species appropriately. Unfortunately, Cu feeding is not this simple and is influenced by many dietary factors.

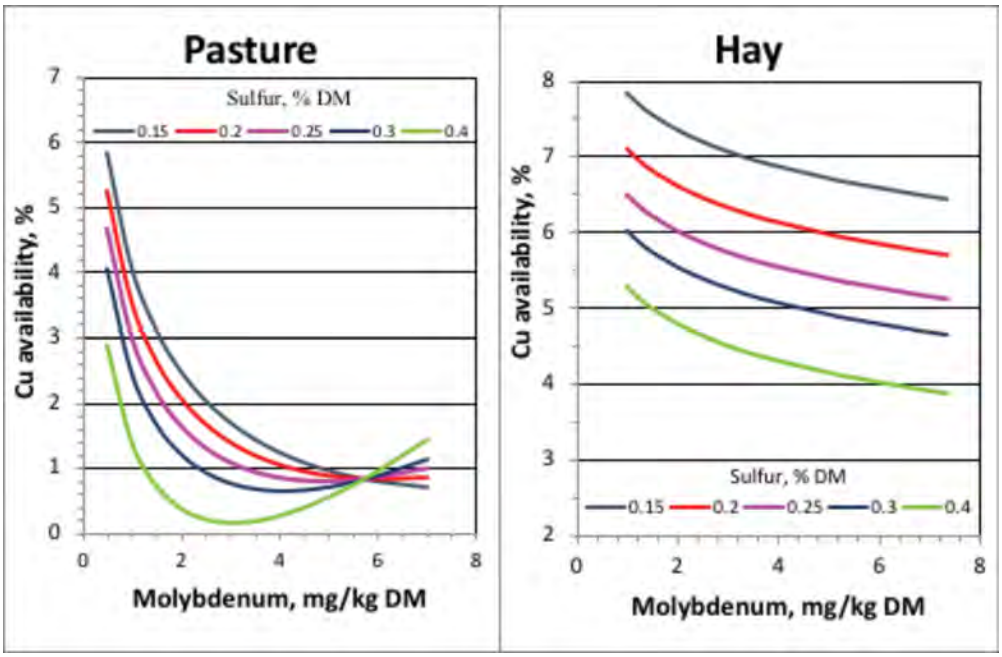
### *Copper Availability and Metabolism*

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 (Figure 1). 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 thiomolybdate compounds. These thiomolybdates chelate or bind Cu in the fermentation vat and prevent Cu from being absorbed in the intestine (Figure 1). Even if absorbed, the chelated Cu is not available for use by tissues. For any ruminant animal, including sheep and goats, 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 8:1 is recommended whereas a range of 6 to 10:1 is suggested for goats and cattle. A Cu:Mo ratio of 16:1 or greater is often associated with Cu toxicity problems, especially if total Cu is well above requirements. A dietary Cu:Mo ratio less than 4:1 is associated with deficiency of Cu.

**Figure 1. Relationships between dietary molybdenum (Mo) and sulfur (S) concentrations on copper (Cu) availability. Graphs are based on predictive models from Suttle, 2010. Green shaded areas represent the assumed range of Cu availability in NRC mode**




## *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 with the daily Cu requirement on a dietary concentration basis ranging from 5 to 20 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 2, several examples are provided to demonstrate the concept of ingredient contribution to dietary Cu content. For these examples, three feed ingredients (hay, grain, and mineral) comprise the total diet. The same amount of hay (6.0 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 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 (18.8 mg/day) and dietary content (7.3 ppm) are in line with estimated requirements (10.4 mg/day; 5-9 ppm) for the maintenance ewe (see table legend). In example 2, the grain Cu content is increased from 10 to 46 ppm and a more typical forage Cu of 9 ppm are used. Dietary Cu intake and content are increased to a level that might be of concern. Example 3 shows the impact of higher Mo in the forage and generates a diet that potentially could lead to Cu deficiency. Of greatest concern is the situation in example 4 where hay Cu content increases from 9 to 18 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 grain and mineral supplement accordingly. If your grain product contains more than 30 ppm Cu, then you may wish to use a mineral supplement with low (<60 ppm) Cu. If your hay has a Cu content greater than 15 ppm, then you may need to feed a grain 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. The role of Mo is becoming more of an issue and needs to be addressed and measured in all feed ingredients to properly assess dietary Cu status relative to risk for deficiency or toxicity.

## *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

*Copper continues on pg. 14*

**Table 2. Contribution of individual feed ingredients (hay, grain supplement, mineral salt) to total dietary copper (Cu) content. For comparison in the following examples daily Cu requirement for a 175 lb adult sheep at maintenance is between 7 and 10 mg/day. Dietary Cu content can vary from 5 to 9 ppm assuming a total intake of 2.2 and 2.0% of body weight, respectively.**

| Example 1 | Forage | Grain | Mineral | Total Diet |
|---|---|---|---|---|
| Intake, lb/day | 6 | 0.5 | 0.015 | 6.52 |
| Cu, ppm | 7.0 | 10 | 30 | 7.3 |
| Cu, mg/day | 16.6 | 1.9 | 0.19 | 18.8 |
| Mo, ppm | 1.0 | 0.5 | 2.0 | 0.96 |
| Cu:Mo ratio | 7:1 | 20:1 | 15:1 | 7.6:1 |
| | | | | |
| **Example 2** | **Higher pellet Cu content** | | | |
| Intake, lb/day | 6 | 0.5 | 0.015 | 6.52 |
| Cu, ppm | 9.0 | 46 | 30 | 12.31 |
| Cu, mg/day | 21.1 | 8.9 | 0.19 | 31.7 |
| Mo, ppm | 1.0 | 0.5 | 2.0 | 0.96 |
| Cu:Mo ratio | 9:1 | 92:1 | 15:1 | 12.8:1 |
| | | | | |
| **Example 3** | **High Forage Mo content** | | | |
| Intake, lb/day | 6 | 0.5 | 0.015 | 6.52 |
| Cu, ppm | 9.0 | 10 | 30 | 9.1 |
| Cu, mg/day | 21.1 | 1.9 | 0.19 | 23.5 |
| Mo, ppm | 3.5 | 0.5 | 2.0 | 3.23 |
| Cu:Mo ratio | 2.6:1 | 20:1 | 15:1 | 2.8:1 |
| | | | | |
| **Example 4** | **Higher forage Cu content** | | | |
| Intake, lb/day | 6 | 0.5 | 0.015 | 6.52 |
| Cu, ppm | 18 | 10 | 30 | 17.33 |
| Cu, mg/day | 36.85 | 1.9 | 0.19 | 44.6 |
| Mo, ppm | 2.0 | 0.5 | 2.0 | 1.87 |
| Cu:Mo ratio | 9:1 | 20:1 | 15:1 | 9.3:1 |

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 a 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. Kidney Cu concentrations below 10 mg/kg (dry weight basis) are considered normal. Elevated kidney Cu is highly supportive of Cu toxicity and is the preferred sample for analysis.

## *Summary*

Copper is an essential micromineral for all small ruminant species, though differences in the species Cu requirement results in differential risks for deficiency or toxicity disease. Sheep and camelids are more prone to copper accumulation from an over supplemented diet thus predisposing them to greater risk for toxicity problems. Goats have a much higher tolerance for Cu and have higher requirements compared to other small ruminants and are more prone to present with deficiency disease. A common problem in the feed industry is the lack of recognition for the difference in copper requirement between sheep and goats with many products labeled for their use being formulated for low Cu content relative to sheep requirements. Proper Cu dietary supplementation requires that all feed ingredients be analyzed not only for their Cu content, but the content of important interfering substances to Cu availability such as iron, molybdenum, and sulfur. Ongoing monitoring of animal Cu status is a necessary component of a small ruminant health program.

**Suggested Resources:**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National Research Council: *Nutrient Requirements of Small Ruminants, Sheep, Goats, Cervids, and New World Camelids*. Washington, D.C., National Academy Press, 2007.

Suttle NF: *The Mineral Nutrition of Livestock, ed 4.* Cambridge, MA, CAB International, 2010, pp 255-305.


***The objective of this article is to address pertinent aspects of copper metabolism, nutrition, and disease concerns relative to small ruminant feeding programs. Clinical manifestations of copper deficiency are associated with a critical decline in activity of a specific copper-dependent metalloenzyme. Though any disease process may occur in all small ruminant species, there seems to be some species differences in presentation of copper diseases. Goats tend to have greater problems with copper deficiency due to their higher requirements compared to other small ruminants. Copper toxicosis results from the accumulation of copper from the diet culminating in uncontrolled copper ion release from storage and subsequent oxidative damage. Toxicosis is of concern for sheep, llamas, and alpacas and less so for goats, though clinical presentation is not equivalent across the species. All dietary ingredients need to be accounted for in addressing sheep and goat dietary copper management to prevent copper-related disease risks.***

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**Dr. Van Saun** *is a professor and extension veterinarian with Pennsylvania State University. He has a clinical practice background and completed graduate work in ruminant nutrition at Cornell University. He lectures nationally and internationally on nutrition and health topics for cattle and small ruminant animals.*

tales from
# The Kentucky Fiber Trail
Winter 2019


## Kentucky Fiber Trail Market Day

*by Sarabeth Parido*

The Kentucky Fiber Trail is where we weave art and agriculture and we have been taking our trail on the road! In November, we held our first ever Market Day at the Kentucky Artisan Center at Berea. We introduced over 200 people throughout our 4 hour event to the Fiber Trail. We stayed busy the entire time, with our foot traffic starting a half hour early! Many of our members took Holiday orders at the event and promoted their Small Business Saturday offerings.

Our website and social media have seen over 200% increase in traffic since our event. We have caught the attention of several potential new members and have received wonderful feedback from our trail travelers. We have now made our interactive online map printable for those who want to take it as they go. In the next year, we are seeking new funding opportunities to keep the Kentucky Fiber Trail growing. We are reaching out to more retail locations for membership and looking forward to new events, such as regional pop-up markets, a progressive trail traveling day to several locations, and a Market Evening in conjunction with The Kentucky Sheep and Fiber Festival in May.

The Market Day really ended our year on a high note. We received a wonderful reception and garnered a lot of interest in our local fiber industry. We are delighted to look back and see how far we've come in this first full year of growth and anticipate more wonderful events for the Kentucky Fiber Trail in the future!

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**Sarabeth Parido,** *is the Director of the Kentucky Sheep and Fiber Festival. She raises her own small flock of sheep in Clark County, Kentucky along with her husband and four sons. She spins and dyes her fiber into yarn and has taught knitting classes for 14 years. Sarabeth is passionate about Kentucky fiber and wants to see great things happen for Kentucky wool producers.*

# Consider Your Wool Pool in 2019

*by Julie Stepanek Shiflett, PhD*

Preparing your wool for the 2019 season starts today. Ensure that your wool is kept clean and contamination is minimal, and take time this winter to understand your local wool pool. The primary marketing challenge in Kentucky and its surrounding neighbors is the relatively small volume of wool produced by each grower. Wool pools are one solution. Through collective marketing--pooling smaller clips into a larger volume—farmers can enhance returns.

## Wool Pools Critical to Marketing

Wool pools serve a critical role in marketing U.S. wool. Many states across the country organize wool pools serving local wool growers. The Kentucky Sheep and Wool Producers and the Tennessee Sheep Producers Associations collaborate each year to conduct a wool pool.

The wool pool provides an essential value-added service. It will gather members' wool, grade it, pack it into bales, organize a bidding process for buyers, and then sell the wool. Wool pools are only as successful as the strength of their collective support by farmers. In general, the larger the volume of wool the pool can secure, the higher the price.

The key to attracting competitive bids is to expand volume. The cost of shipping wool from the wool pool to the buyer's operation is inversely proportional to the volume purchased. If a buyer's truck is packed half-full then the freight rate is double that if the truck was fully loaded. One option for any wool pool selling below this threshold is to combine efforts with wool pools in neighboring states. The more wool that a pool can offer, the more buyer interest it will receive.

Regardless of volume, there are still important steps that the pool can take to maximize farmer returns. The pool can increase competition for its wool by inviting many buyers to offer bids. It can also sort wool efficiently, so there are no surprises when the buyer processes his or her wool. If black hairs or kemp—hair sheep fibers—are found in a bale that is labeled white faced wool, the buyer may not return. Last, the pool can offer attractive packaging by baling wool in large, standard commercial bales.

## Wool Pool Pricing

The wool pool contacts the wool buyers and collect bids for the pool in mid-April of each year. The highest bidder is immediately notified of their winning bid. The buyer is awarded all of the wool pool's volume. The pool then conducts the pool two months later in mid-June. Therefore, the wool is sold before it is collected. The farmers know what price they will receive on their wool before they drop it off at the pool.

The wool pool offers prices based upon wool bids by buyers and wool grades received from growers. There are five grades of wool, with prices set according to wool grade. Last year, buyer and farmer prices at the wool pool were as follows: $0.48 per lb. white face, $0.48 per lb. black face, $0.38 per lb. short (e.g., lamb wool), $0.41 per lb. for burry wool (full of cockleburs), and $0.08 per lb. for black wool. Black wool is any wool that is not pure white or has any black fibers in it. The pool charges growers a $0.04 per lb. marketing fee to cover processing costs, wool packs, and any repairs or maintenance on the balers. Additionally, a membership fee is required.

## Wool Value in Marketing

Sheep producers spend a lot of time caring for their flock through the year; thus, equal consideration of how to market wool can yield additional rewards for a year's worth of effort.

The price received for the pool's wool is directly linked to its reputation. If a buyer finds contaminated wool in a bale, the pool's reputation can be severely damaged. Mark

Powell, secretary/treasurer Tennessee Sheep Producers Association, attributes good prices to the role of the pool: "This effort includes careful grading, eliminating hair or kemp from the wool, avoiding mixing dark wool fibers in the white wool, and marketing clean wool," (11/14/18).

An efficient marketing system will reward higher quality wools to promote desirable industry traits, such as clean white wool. As desired, the amount of inferior wool with black fibers was relatively low at the Tennessee/Kentucky wool pool. Last year, 13 percent was wool with black fibers, 13 percent was short (lambs' wool), 30 percent was white faced wools, and another 43 percent was black faced wool. A negligible amount was burry wool.

Overall, farmers are commended for keeping wool sheep and hair sheep separate, but there is still some room for improvement in management practices by keeping black fibers out of white wool. The white faced and black faced wools received 48 cents per lb. each, but the wool with black fibers received 83 percent less, 8 cents per lb. Producers can greatly increase returns by keeping white and black faced sheep separate, and black fibers out of white faced wools.

One potential downside to wool pools is that there are only a few broad graded categories. Within one grade, white faced wool, for example, there may be different microns of wool that are not recognized. In the U.S. and internationally, micron (fiber width) is the most important factor determining price. For example, the Dorset breed can produce wool ranging from 27 to 33 micron. A core test can reveal the exact micron. The difference of six micron can yield a price difference of 20-80 cents per lb. greasy in the United States.

## 2019 Wool Price Forecasts

This spring, the U.S. wool market will again look toward Australia to set prices. Towards the end of 2018, the Australian wool market was facing severe headwinds. Prices saw a downward slump during the fall, yet prices were still high historically. China is the largest raw wool imported worldwide. Yet, the Chinese economy was facing an economic slowdown in late 2018 which was exacerbated by the U.S.-China trade war. Raw wool purchases by China were historically driven by income growth of higher income countries such as the U.S., Europe, and Japan, but in recent years, Chinese demand--particularly by its rising middle class--has played a more significant role in defining China's raw wool demand.

While international raw wool demand has softened, tighter supplies internationally and a possible lower U.S. sheep inventory this January could lend support to U.S. wool prices in 2019. In Australia, the world's largest raw wool exporter, a severe drought will likely catch up with its wool production in 2019. The Australian Wool Production Forecasting Committee forecasted that 2018/19 wool production could be down 6 percent year-on-year to 322 million kgs (9/3/18). It explained that continuing dry conditions across most of the country resulted in high sheep and lamb sales -- up about 10 percent year-on-year.

A more immediate concern for U.S. wool growers is the potential rise in retaliatory tariffs by China—the U.S.'s largest wool buyer--on U.S. wool. As of this writing, the retaliatory tariff had jumped from 1 percent on U.S. wool before the trade war to 10 percent in the fall, with the threat of a rise to 25 percent this January.

It is anticipated that Chinese buyers—and others-- will ask for a price discount equal to the tariff this season, or, even worse, will not buy U.S. wool at all. If domestic wool buyers are buying western wools at a lower price level this spring, this might, in fact, also depress wool pool price offers.

Diversification of U.S. raw wool export markets will be essential to managing the tariff war, and a key determinate of U.S. wool prices this spring. While roughly 60 percent of U.S. raw wool is currently exported to China, other export markets are available, although the volume demanded is lower. The U.S. could expand raw wool exports to India, Eastern Europe, and to a lesser extent, Western Europe.

## Demand Prospects for Coarser Wools

Enhanced demand for coarser wools has the potential to propel the value of coarse wool higher. While the wool pool mostly handles relatively coarser 30-31 micron wools, most wools processed in the U.S. or shipped overseas are finer than 30 micron. There is not a lot of demand for coarser wools compared to the more fashionable finer wools. That said, all wools have value. Coarser wool is utilized by mixing it in with 27-28 micron wools, a little at a time. Domestic wool blankets made for the U.S. military is a good example.

About three-quarters of New Zealand wool is coarse, and demand is struggling. This market faces a shrinking demand for wool carpets that is rapidly transforming toward synthetic substitutes. The Wool Research Organization of New Zealand and the New Zealand Ministry for Business, Innovation and Employment are researching the creation of new markets for coarse wools by breaking down the fiber into smaller parts with very fine wool-fiber width (micron). "Successfully deconstructing coarse wool to create new materials is a major breakthrough that has the potential to add huge value to the wool industry," (Voxy.co.nz, 10/29/18).

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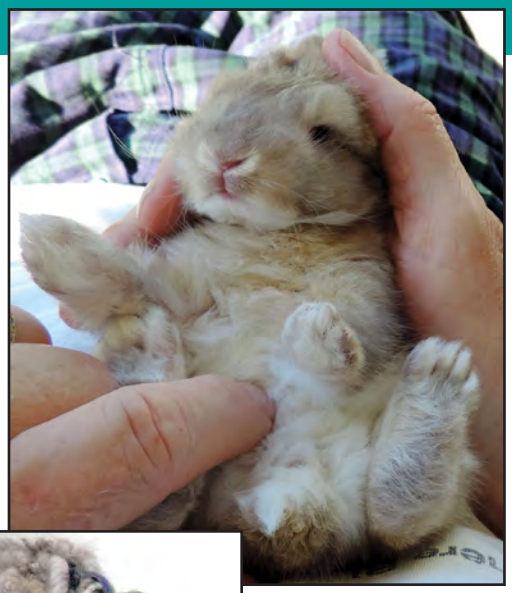

# Paula Greene, The Fiber Queen

*by Sarabeth Parido*

Another stop on our Tales from the Trail tour, we are visiting with The Fiber Queen herself, Paula Greene Bowron. Located in the city of Lexington, Kentucky, Paula proves that you don't have to live on a farm to raise fiber! Paula is an established French and English Angora rabbit breeder and processes the fiber from her animals in her own home studio.

### Are you originally from Kentucky?

I am originally from KY, and have lived here all of my life except for about 4 years.

### What do you as a producer do with your fiber?

I process all of my Angora fiber in my home studio. After collecting the fiber, it is combed or carded, sometimes blended with other fibers such as silk, Alpaca, and sheep wool, and then made into batts for spinning into yarn, felting and for use in other fiber art applications. Sometimes, I dye the fiber before or after spinning into yarn. I sell my fiber in my Etsy store - 'The Fiber Queen', on Facebook, and at various fiber festivals, and I crochet and knit scarves, ear warmers, mitts, and make other items as well.

### How much work goes into your farm and fiber production?

Between taking care of my 20+ Angora rabbits and processing all of the fiber myself, it is a full time job. Angora rabbits require quite a bit of care because of their long fur. The fiber processing, though, takes about 90% of my time.

### How much fiber knowledge did you have before starting to raise your own fiber animals?

I had virtually no experience with raising Angora rabbits before I purchased my first trio. I had raised other types of rabbits over the years, but I had never seen an Angora rabbit in real life. It has been a joy to love and care for these beautiful animals.

### What was the most valuable resource for you as you were getting started?

My most valuable resource as I was getting started was the wealth of information about Angora rabbits that was available on the internet.

### If someone came to you and asked you for your best piece of advice about getting started in fiber farming, what would that be?

My best advice would be to research Angora rabbits thoroughly before purchasing your rabbits and equipment. Learn all you can about their care, nutrition needs, grooming and the tools you will need, and what type and size of cages they require. Also, try to find someone who has experience in raising Angora rabbits to help you along the way.

Paula is the real Fiber Queen. Her rabbits are one of the star attractions of the Kentucky Sheep and Fiber Festival each year in May. Please visit her website **www.thefiberqueen.com** for more information, her shop and a list of upcoming events.

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**Sarabeth Parido,** *is the Director of the Kentucky Sheep and Fiber Festival. She raises her own small flock of sheep in Clark County, Kentucky along with her husband and four sons. She spins and dyes her fiber into yarn and has taught knitting classes for 14 years. Sarabeth is passionate about Kentucky fiber and wants to see great things happen for Kentucky wool producers.*

# NEWS TO EWES

# Lambs Galore

*by Donald G. Ely, University of Kentucky*

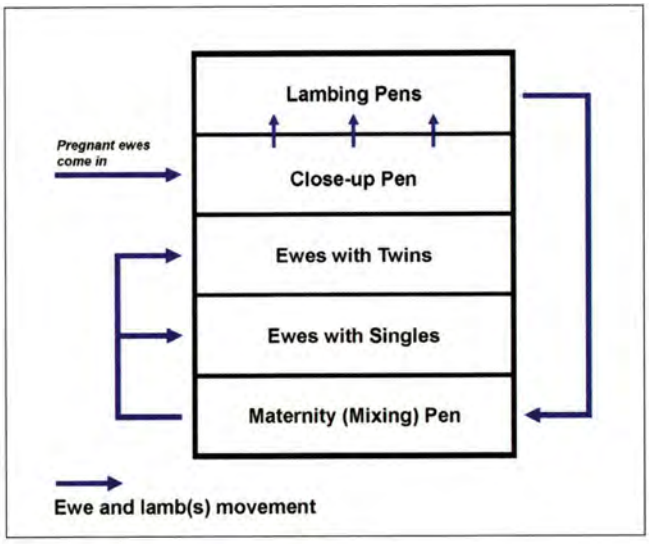
## Introduction

The Traditional Lambing Season in Kentucky is January/February, the coldest months of the year. Shepherds subject themselves to these two stresses because tradition has shown the number of lambs born per ewe is high, labor is readily available, barn(s) are available for lambing, spring grass can be used by both ewes and lambs, lambs can be marketed before encountering internal parasite problems, and prices for milk-fed slaughter lambs (100 to 120 lb) are usually high in May/June. Although management expertise is required for any lambing season to be successful, the level of expertise is probably more critical during the Traditional Lambing Season because of the cold temperatures and Lambs Galore. Furthermore, the belief that **more shepherding skills are required in the first 2 to 5 days after lambs are born than are required before and/or during the actual lambing process** becomes fact in the Traditional Lambing Season.

## Lambing in the Barn

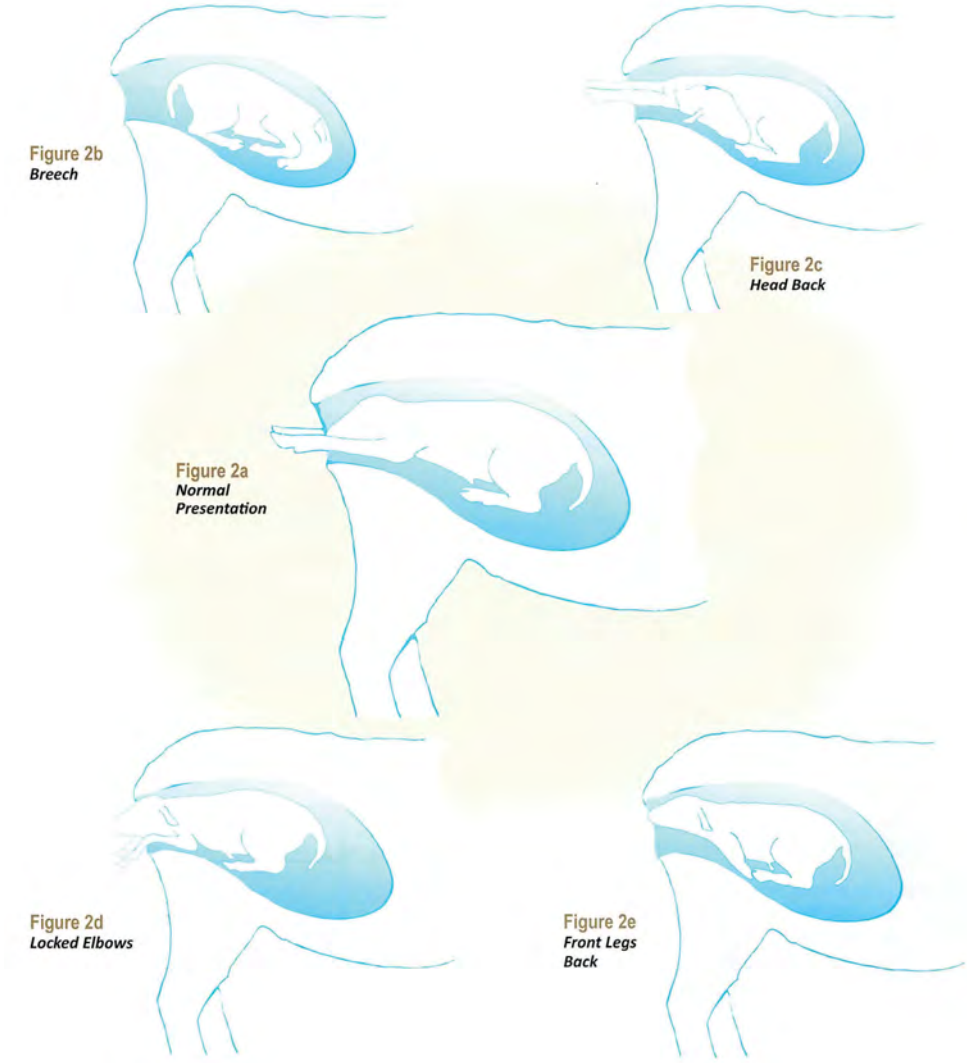
Ewes that lamb in January/February in Kentucky require shelter. This may be in a tobacco barn, hoop structure, open-sided barn, or other facility where ewes can get inside (out of the weather) to lamb. Figure 1 is an example setup for a lambing facility. Lambing Pens (Jugs) are for ewes and their new lambs born in the Close-Up Pen. This pen is fluid in regard to numbers---as ewes and lambs are moved to the Lambing Pens, they are replaced with other ewes that are becoming close to lambing. After ewes and lamb(s) bond in the Lambing Pens, they move to the Maternity (or Mixing) Pen. This pen contains ewes with singles and twins that are all about the same age. As this pen fills, ewes with twins and singles are segregated into separate pens so ewes can be fed differently for maximum milk production. Additional pens for ewes with twins versus those with singles can be made, depending on the flock and barn sizes. Ewes and their lambs can even be moved to barns completely separate from the Lambing Facility when the lambs are a week or two old.

**Figure 1. Example Lambing Facility Outline**




The lambing process is a complex one in which hormonal and nervous reflexes are delicately coordinated to achieve a desire end. Although pregnancy may last from 140 days in Finns to 151 days in Southdowns, the average length across all breed is 147 days. Pregnancy length can also be affected by litter size (single vs. twins vs. triplets), sex of lamb, and age of ewe. During the early stages of lambing, the visible signs may be a sunken appearance on each side of the ewe's rump, a pink colored enlarged vulva with vaginal discharge, and an appearance that the fetus has "dropped." The ewe may paw at bedding, lie down, get up, and turn her head towards her rear and bleat. In the final stages, she will usually lie on her side and raise her head skyward as each involuntary contraction exerts pressure to expel the lamb. Hopefully, each fetus will be positioned in the birth canal as shown in Figure 2. Unfortunately, however, some abnormal presentations may

**Figure 2. Fetal Position in Birth Canal**




occur (Figure 2b, c, d, e, etc.). Every lambing situation is different, so each shepherd has to respond to each abnormal presentation to make sure as many lambs as possible are alive when they are expelled from the ewe.

## Ewe/Lamb Management First 24 Hrs

Once the newborn takes its first breath of cold, fresh air in the Close-Up Pen, the ewe should be "all over it" to dry it, get it to its feet, and direct it to the teat. Bonding time between ewes and lambs in this pen can vary from a few minutes to 4 to 6 hours depending on ease of lambing (normal vs. abnormal presentations), ewe age, mothering instinct, size of lamb, number of lambs born per ewe, lamb vigor, and environmental temperature. The shepherd has to make the call as to the length of this bonding period. After the initial bonding, move ewe and lamb(s) to a Lambing Pen. Check each lamb's eyes and mouth for any abnormality and dip the navel in a 7% iodine (tincture of iodine) solution. Some shepherds may weigh each lamb. Even if a weight is not taken, give the lamb a number and record the ewe's number, lamb sex, date of birth, and any problems encountered with the ewe and/or lamb(s) during the entire lambing process. Check the ewe's udder for colostrum (milk) flow and make sure every lamb has nursed. It is so, so critical for the lamb to consume colostrum as soon as possible after birth, especially in cold weather. For example, the newborn lamb may leave an environment in the uterus of the ewe that was 103 degrees Fahrenheit and enter an open-air environment that is zero degrees Fahrenheit. This lamb is wet, has little ability to control its body temperature, has limited nutrient stores, and, therefore, has an immediate need for nutrition (colostrum). The colostrum is its only immediate source of nutrients. Colostrum also provides antibodies to the lamb for disease prevention and, simultaneously, it serves as a laxative to start functioning of the digestive tract. The timing of colostrum consumption is critical. The newborn lamb should receive a supply by 30 minutes to an hour after birth. It must continue to consume colostrum for 18 to 24 hours. So, if the lamb has not nursed by the time it enters the Lambing Pen, the shepherd must help it nurse. If it is weak, if the weather is extremely cold, if the ewe doesn't want to claim the lamb, or if other problems are encountered, milk some colostrum from the ewe into a 60-cc syringe connected to a stomach tube. Administer the colostrum directly into the digestive tract of the lamb via the stomach tube (Figure 3). This procedure may have to be repeated any number of times during the first 24 hours after the lamb is born (2 ounces every 2 to 4 hours). **The stomach tube may be the most important piece of equipment in the shepherd's inventory!**

Once the ewe and lamb(s) are settled into the Lambing Pen that is bedded with fresh, clean straw, provide a small bucket of 50-degree Fahrenheit water to the ewe. She will be more thirsty than hungry. Tie the bucket 18 to 24 inches off the ground so baby lambs can't fall into it any time during the 2 to 5 days they will be confined to this 4 feet x 5 feet Lambing Pen. Usually the ewe will not require any feed for the first 18 to 24 hours after lambing. Thereafter, provide 1 to 2 lb of grass or alfalfa hay 2x per day for the rest of her stay in the Lambing Pen. Check on the ewe and her lamb(s) every 2 hours during the day, after supper, and again before going to bed every day while in the Lambing Pen.

## Trouble Shooting the Ewe and Her Lamb(s)

When checking the "normality" of newborn lambs, it is a good idea to know how normal, healthy ones act. Normal lambs vocalize very little. They nurse, sleep a lot, and may even play a little in the Lambing Pen. They sleep in a curled position and may have to be gotten up when making the rounds at 2-hour intervals during the day, after supper, and before bed time. The normal lamb will stretch when it gets up, will go the ewe to nurse, will have a warm mouth, and will have a full belly. When standing, its back will be level (Figure 4). It will have a rectal temperature between 102 and 103 degrees Fahrenheit. Shepherds should be alert to any variations from these "normal" activities, especially hypothermia.

## Hypothermia (Chilling)/ Hypoglycemia (Low Blood Sugar)

Rectal temperature is the primary guide to identification and treatment of hypothermia in newborn lambs. Lambs with mild hypothermia have a temperature between 98 and 102 degrees Fahrenheit whereas those with severe hypothermia may be less than 98 degrees. Hypothermia is caused

**Figure 3. Administering colostrum via a stomach tube**

**Figure 4. Normal, healthy lambs**

by excessive body heat loss coupled with reduced heat production. Newborn lambs are unable to regulate their body temperature for the first 36 hours after birth, so environment (cold weather) and management greatly affect how much body heat may be lost. In contrast, to generate body heat, the lamb may use any of the fat it may have in its body at birth. But, the best source of energy is ewe colostrum for the first 24 hours, then plenty of milk. If these sources are not available, lambs will suffer from hypothermia, starvation, and finally death.

Shepherding practices intended for preventing losses from hypothermia include: (1) providing shelter for ewes and newborns; (2) shearing or crutching wool producing ewes before lambing; (3) confine ewes and newborns in lambing pens for 2 to 5 days after lambing; (4) help lambs nurse during the first 24 hours after birth; (5) graft extra lambs to ewes that can raise an extra one; (6) cull ewes with poor milk production records before the breeding season; (7) make sure you have plenty of lambing pens (a common ration is 1 pen to 10 ewes); and (8) provide adequate nutrition in late gestation and early lactation so ewes will give plenty of colostrum and milk.

Hypothermic lambs do not get better on their own. Assuming lambs born in the Traditional Lambing Season are in a shelter, the following steps are recommended for treatment.

1. PRIOR TO LAMBING, lambs more than 5 hours old with severe hypothermia should be given an intraperitoneal injection of warm (20 to 25%) dextrose (glucose) solution at a rate of 5 cc per pound of body weight.
2. Towel-dry wet lambs and supplement with heat or warm in a box using dry heat from a hand-held hair dryer or heat lamp. Temperature in the box should not exceed 103 degrees Fahrenheit. Warm lambs to a rectal temperature of 99 degrees Fahrenheit.
3. Tube feed colostrum as described above.
4. Return lambs to the ewe when rectal temperature becomes normal (usually after 1 to 3 hours) and they can stand and nurse on their own. If they are still weak after treatment, but strong enough to be with their mother, continue to feed by stomach tube until they are able to nurse on their own.
5. If only one of a set of twin lambs is suffering from hypothermia, remove both lambs from the ewe when warming is taking place. Return both lambs at the same time so the ewe will claim both.

The procedures outlined are useful for lambs showing hypothermia symptoms regardless of the production system. However, these procedures are labor intensive and are most easily justified in a Traditional Lambing Season when there are Lambs Galore.

## Out of the Lambing Pen

Healthy lambs and their mothers leave the Lambing Pens after the 2-to 5-day stay to enter the Maternity (Mixing) Pen. This is the perfect time to ear tag, dock and castrate lambs. If ewes were vaccinated for sore mouth as lambs, their lambs should be vaccinated at this time. If none of the sheep have been vaccinated for sore mouth, do not vaccinate the lambs. Lambs born to ewes that were vaccinated for over enterotoxemia and tetanus before lambing will be safe until 5 weeks old. If the ewes were not previously vaccinated, this is a good time to give the lambs their first dose of CD/T vaccine.

Each ewe's udder should be checked for "normality." Their feet can also be trimmed and they can be de-wormed. Although the FAMACHA system may have been used throughout the year to determine which ewes get de-wormed, all ewes in the Traditional Lambing Season will be carrying some stomach worms lying dormant as they enter the Close-up Pen. All ewes should be de-wormed as they leave the Lambing Pen because these parasites will come out of dormancy within a few days after ewes lambing (periparturient rise) and can decrease ewe productivity throughout lactation.

## Summary

The Traditional Lambing Season in Kentucky offers significant management challenges for shepherds. Most certainly, dealing with cold weather and Lambs Galore requires a Lambing Facility that allows efficient flow of pregnant ewes, lambing ewes, and ewes and newborn lambs through it. Although getting as many live lambs on the ground as possible is always an objective, more shepherding skills are required during the first 2 to 5 days after the lamb is born than was required to make sure it was born alive. These skills include management of ewes and lambs during the first 24 hours after birth and knowing how normal lambs look and act versus those that may be suffering from hypothermia. Recognize the stomach may be the most important piece of equipment in the shepherd's inventory because of the colostrum that it can administer to hypothermia. Intensive labor expended in the Traditional Lambing Season can be paid for when Lambs Galore weigh 100 to 120 pounds and command high market prices spring.

**Dr. Donald G. Ely**, *Professor in the Department of Animal and Food Sciences at the University of Kentucky*

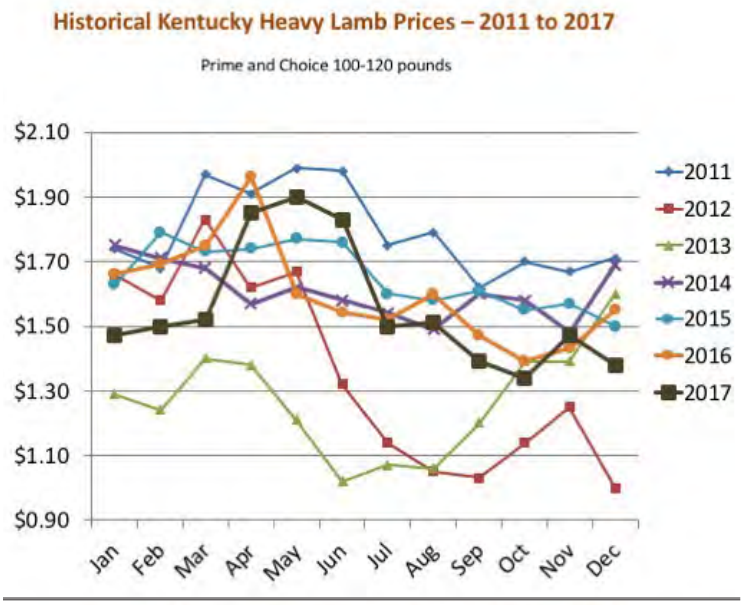
# Seasonality Issues of Kentucky's Lamb and Goat Industry

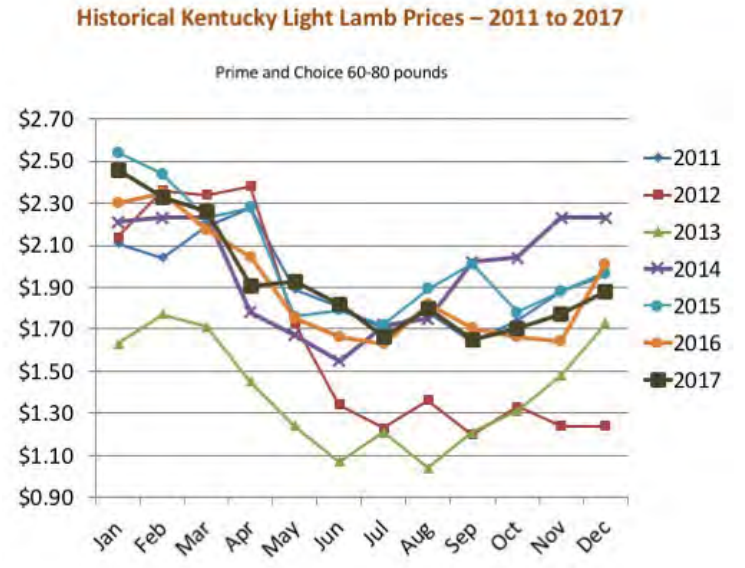
*by Tess Caudill*

I recently read an article from the United States Lamb Resource Center titled, "Seasonality of the US Lamb Industry". It is always interesting to me to hear the seasonality of our industry explained, as I see the tremendous volatility of our markets working on the "front lines" of Kentucky's sheep and goat industry. Finding ourselves in the winter months, there seems to be a sense of excitement at each and every sale as supply lessens, buyer demand peaks, and prices climb higher and higher each week. Even after many years grading and reporting markets, high prices for the producers still makes me as happy as a kid in a candy store. Unfortunately, what goes up must come down. I dread the late spring and summer markets where all I hear from buyers is how full they are and how they really don't need any lambs. Then, I sadly report lower prices week after week. I hate to see the faces of producers that have brought in high quality animals that maybe would have been worth several cents more per pound just a few weeks or even days ago. But this seasonal price cycle is reality in our industry. Learning about it and making farm management decisions based on it is key to the success of any sheep or goat enterprise. Here are some highlights from the article "Seasonality of the US Lamb Industry"and how, in my opinion, they relate to Kentucky's industry.

**Seasonality of Production:** Production seasonality is the biggest contributor to market seasonality. According to this article, 80% of the US lamb crop is born in the first 5 months of the year. While the article did not discuss goat production, I would venture to say this number is very similar for goats. Sheep and goats are seasonal breeders. Yes there are breeds and individuals that will breed out of season, but the reality is that sheep and goats will most readily breed in the fall, as the days are getting shorter which translates to them lambing in the first 5 months of the year. In addition to the natural tendencies of the sheep or goats, some producers choose to lamb in the spring to avoid lambing or kidding in bad weather, or to avoid feeding lambs and kids through the winter. The Lamb Resource Center article discussed in depth the market incentives for altering production systems and different ways to alter production in lambs. While there are no doubt price advantages for having lambs and kids ready for market in the winter and early spring, I still think it is up to each farm manager to make this decision for his or her farm. Yes, those high prices we see in the winter and early spring are wonderful, but here in Kentucky we primarily rely on stored feeds in the winter, thus each farm manager must weigh the added costs of feed and hay versus the added returns. Furthermore, the extra time and energy of feeding stored feeds to both mature females and lambs or kids in the winter months must be considered. Add to that extra barn space needed, extra bedding, and occasional frozen water, I would say most producers could talk themselves right out of feeding through the winter! All this being said, there are advantages (both personal and industry wide) and disadvantages to out of season kidding and lambing. Each producer should put pencil to paper, weigh the other factors mentioned above as well as other personal factors, and make the best management decision they can for their operation.

**Traditional Markets:** Traditional markets mainly describe wool sheep that are marketed heavier and fatter at 120 to 160 pounds, or anything over 100 pounds for the eastern states. According to this article, it usually takes 8 to 14 months to produce lambs for the traditional market. Therefore most lambs born in the first 5 month of the year don't hit the market until winter, spring and early summer of the following year (November to June). Most of these lambs are produced out west and often end up in feedlots. In the winter and spring when lambs are plentiful, sometimes they stay in the feedlots too long and we end up with larger than desired carcass sizes. According to this article, it is when the feedlots run out of lambs in the summer and early fall (July to October), that we see stronger traditional lamb prices. However, this is not the pattern we typically see in Kentucky. Our traditional lamb prices are fairly consistent for most of the year with the exception of a peak in April and May when prices may jump as much as $0.30- $0.40 cents per pound. In my opinion, this late spring peak is because the buyers are simply tired of the overweight, overaged lambs coming out of the western feedlots and are willing to pay a premium for our young (primarily winter born), more




moderate sized lambs. Any Kentucky traditional lamb producers that are winter lambing should consider the advantages to pushing lambs to try to get them to market during this price peak.

**Non-Traditional Markets:** Non-Traditional markets describe goats and lambs that are marketed at lighter weights (40 to 90 pounds) and typically end up in ethnic market channels. According to the Lamb Resource Center article, the supply of most winter and spring born lambs in the non-traditional market occurs from April through October which accurately describes the situation we see in Kentucky with our seasonal summer slump in prices. Because lambs and kids are marketed at a lighter weight, it is harder to spread out the supply throughout the year without lambing/kidding out of season. One interesting tidbit from the article is that in the past 10 years, approximately half of the sheep producers in Texas have shifted to raising hair sheep breeds for the non-traditional market. This has no doubt contributed to some of the oversupply issues we see with lambs during the late spring and summer months.

Non-Traditional markets are where the majority of kids and lambs produced in Kentucky, as well as other southern and eastern states, end up. As hair sheep breeds become more and more popular, I think this oversupply issue from April through October is likely to get worse and we may see summer prices drop even lower than we have the past several years. Fortunately, many hair sheep breeds seem willing to breed out of season. This gives producers more options if they want to try to hit the market during the winter or early spring. However, as mentioned above, there are many factors that need to be considered when making this management decision.

In summary, the seasonality of sheep and goat production and the resulting seasonality in prices is not an issue that is likely to be resolved any time soon. As producers, we must educate ourselves about these issues and make our best management decisions. I encourage producers that want to explore alternatives to winter and spring kidding/lambing to do lots of research to determine if it is a good fit for their operations. The market could sure use these out of season kids and lambs if you determine this production system is right for you.

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**Tess Caudill,** *is the marketing specialist for the for the Kentucky Department of Agriculture and has been instrumental in developing a graded marketing program for goats and sheep. She has a B.S. degree from the University of Kentucky in Animal Sciences and currently raises goats, sheep and cattle in Harrodsburg, KY.*

# PREVENTION AND TREATMENT OF NEONATAL DISEASES IN KIDS/LAMBS

by Beth Johnson, DVM

You planned your breeding just perfect, and now the time has come to reap your rewards at kidding or lambing. There are several steps that should be taken to insure that these young offspring get off to the best start possible. Management efforts made towards adequate housing and monitoring after birth can increase the survivability of offspring.

## ADEQUATE HOUSING

Prior to the start of kidding/lambing, a clean, dry, draft free area should be designed for the newborns. Newborn lambs/kids can become hypothermic very quickly and die when housed in a wet cold area. During the cold winter months, it is usually recommended to place the dam and her offspring in a pen to allow them to bond and provide warmth and nutrition as soon after birth as possible. These pens, sometimes referred to as "jugs", are 5'-7' square to provide enough space for the ewe or doe to lay down comfortably with her newborns, but not too much that allows her to avoid them.

## FAILURE OF PASSIVE TRANSFER

Always be sure that the ewe or doe has an adequate quality and quantity of colostrum. If newborn ruminants do not receive adequate amounts of good quality colostrum in the first 12 hours after birth, they do not receive adequate amounts of life saving immunoglobulins resulting in failure of passive transfer. While drying the lamb/kid off and dipping the umbilical cord with chlorhexidine/7% tincture of iodine, reach under the ewe or doe and squeeze a little bit of colostrum out of each teat. This not only allows you to feel her udder but also allows you to evaluate the consistency of the colostrum. Some of the causes of agalactia (no milk) are: Caprine Arthritis Encephalitis/Ovine Progressive Pneumonia, scar tissue from previous mastitis, premature delivery, fatty tissue in the udder from obesity in the dam, or genetics. If you discover that the ewe/doe has very thick, small amount or no colostrum be sure to offer stored colostrum (frozen) or a colostrum replacer product. Be sure it is a colostrum replacer and not a supplement. It is recommended that newborn lambs or kids receive 2-3oz/lb of weight of colostrum at birth over the first 24 hours, i.e. a 10 lb newborn should receive 20-30 ounces of colostrum within a 24 hour period.

## WHITE MUSCLE DISEASE/SELENIUM DEFICIENCY

One of the largest causes of death in newborns in the first 24 hours is hypoglycemia caused from not receiving an adequate quantity of colostrum. Just because you see a kid/lamb nursing doesn't necessarily mean that it is receiving the essential colostrum. White muscle disease, i.e. selenium deficiency, causes weakness in the muscles of newborn lambs/kids. These newborns with selenium deficiency are unable to control their tongue muscles. If you look closely, they appear to be nursing but the tongue is sticking out of the side of their mouth. Many of these lambs/kids experience difficulty in standing as well. Simply treat each lamb/kid with 0.5cc Bo-Se® subcutaneous injection at birth to help their muscles (both tongue and leg) perform properly.

## HYPOTHERMIA/HYPOGLYCEMIA

If environmental conditions warrant, provide warmth to the newborn. If you decide to utilize heat lamps and/or heated huts, **Figure 1**, for the lambs/kids be sure that the lamps are secured so the electrical cords cannot be chewed on and that they will not fall down causing a fire hazard. Also, be sure there are enough huts available so that the lambs/kids don't pile up inside and suffocate the smaller, weaker ones. I utilize baby kid coats pictured in **Figure 2** that are easily made or purchased to place on the newborns to provide warmth for the first several days. Coats can also add an added advantage when trying to foster a kid onto a doe that has lost her offspring. Remove the coat from the dead kid and place it on the foster kid so she smells her kid's scent on the coat.

Now that you are past the first 12 hours after delivery, you are feeling fairly safe that everything is going to go smoothly. BUT, if you go to the barn and find a newborn unresponsive, then gather it up and place it somewhere warm. First thing you should do is take a rectal temperature. Almost always, its body temperature is low and it is suffering from hypothermia/hypoglycemia. Place it in a warming box- use a cardboard box with a heating pad placed under a couple of towels to prevent thermal burns and a warm towel to place on top of the lamb/kid. Milk colostrum/milk out of the dam and tube feed 60cc. In **Figure 3** you can see the tools necessary for tube feeding lambs/kids. Be sure the colostrum/milk is warm but not hot. Before too long the newborn will start coming around and you can take them back down to their dam after their

**Figure 1. A securely fastened large plastic drum with heat lamp securely fastened is ideal but be sure there aren't too many newborns in the pen.**

**Figure 2. Picture demonstrating a very simplistic kid warming box with a heating pad under two towels. The kid is wearing a kid coat that was placed on it at birth. Notice the kid is not completely cleaned. We try to maintain as much natural odor as possible on the kid to make it easier for doe to claim the newborn when it is placed back with her.**

**Figure 3. A 60cc Cather tip Syringe and Lamb/kid Feeding Tube is all that is necessary to tube feed a weak newborn.**

body temperature is normal (100-102°). Always try to diagnose the reason why it became hypothermic, i.e. lack of nutrition, diarrhea, pneumonia, sepsis, or meconial impaction. If the environmental temperature is extremely cold, you may not want to leave the newborn in the barn for an extended period until it appears that it can control its internal temperature.

## MECONIAL IMPACTION

The first bowel movements of young lambs/kids, called meconium, are extremely thick, tarry and black. The colostrum they consume along with the dam's maternal instinct and nurturing will aid in evacuation of the meconium. For several reasons, delayed nursing, not enough colostrum, abandonment, or hypothermia, can cause impaction of the meconium in the intestinal tract. Most newborns with this condition appear full but fail to nurse and succumb to sepsis, hypoglycemia, and death within 72 hours after birth. If you notice a newborn that is weak or doesn't want to nurse, take its rectal temperature. If the stool on the thermometer appears dark and sticky instead of yellow, then they probably have meconial impaction. I utilize small animal or infant enemas applied once or twice rectally as an aid to evacuate the large colon.

***Now that we have discussed ways to get the lamb/kid off to a good start, I will discuss some of the bacterial, viral and protozoal diseases and their symptoms.***

### Septicemia

When a lamb/kid develops septicemia, it has disease-producing organisms or their toxins in its blood. It is usually the result of a bacterial infection which can occur while the lamb/kid is in the uterus or during, at, or immediately after birth. The route of infection can be the blood of a sick dam, an infected placenta, the lamb or kid's umbilical stump, mouth, nose (inhalation), or wound. An early sign of septicemia is usually depression. Most young lambs/kids will rise when you come up to them and stretch. If they remain laying down and/or stand in a hunched position, appear weak, and reluctant to nurse then, they may be developing septicemia. Advanced signs of this are swollen joints, diarrhea, pneumonia, meningitis, cloudy eyes, and/or a large, tender umbilicus. When their rectal temperature is taken, they may or may not have an elevated temperature and in advanced stages, many have subnormal temperature. Most septicemic lambs/kids have a history of inadequate colostrum intake or failure of passive transfer. Unfortunately, most cases of septicemia are very difficult to successfully treat. Injectable antibiotics must be used and supportive care provided.

### Diarrhea

Diarrhea is one of the leading causes of death in young kids/lambs from birth to one month of age. Contrary to older sheep/goats, diarrhea is not caused by intestinal parasitism until they are at least 6 weeks of age except with coccidiosis in severely mismanaged herds. Most of the causes of diarrhea in newborns is caused by bacteria, viruses, and/or protozoal organisms. The clinical signs develop as follows[1]:

Production of thin and watery feces
↓
Signs of dehydration appear (sunken eyes, dry mucus membranes, rough hair)
↓
Extremities become cold to the touch
↓
Loss of appetite
↓
Difficulty getting up
↓
Unable to rise
↓
Loss of consciousness

If it appears to be a herd/flock outbreak in newborns, it is essential to diagnose the cause of the diarrhea and develop a treatment plan. A fecal culture/exam may diagnose the cause but a thorough necropsy may also be necessary to determine the causative organism. Some of the causes of diarrhea include: *E. coli, Salmonella spp., Clostridium sp., Campylobacter, Rotavirus, Coronavirus, Cryptosporidium parvum, Eimeria spp.* (coccidiosis), *Giardia* sp.

Once a diagnosis has been made, consult with your veterinarian to develop the appropriate strategy for treatment which will involve antibiotics, electrolytes and probiotics. In the face of an outbreak, it is essential to thoroughly clean and disinfect the lambing/kidding area between animals.

### Pneumonia

Many factors lead into pneumonia caused by viral and bacterial organisms. As with diarrhea, pneumonia in lambs/kids less than one month of age is usually attributable to lack of adequate colostrum intake or failure of passive transfer. Environmental conditions, i.e. bad ventilation, high ammonia levels, mold, fungus, and significant fluctuations in environmental temperature, may also compromise the respiratory tracts defense mechanisms allowing the bacterial organisms to develop pneumonia. Some of the more common bacterial organisms are Pasteurella multocida, Mannheimia haemolytica, Mycoplasma ovipneumonia, with *Trueperella pyogenes*, *Bibersteinia* trehalosi. Clinical signs include coughing, nasal discharge, depression, roughened hair coat, respiratory distress (usually rapid labored breathing), elevated rectal temperature or sudden death. Most of the effective antibiotics require extralabel use which requires a valid veterinary:client:patient relationship; therefore, consult with your veterinarian for the appropriate antibiotic treatment. Non-steroidal anti-inflammatories (i.e. Flunixin meglumine) should also be used but with caution to prevent gastric ulceration.

### Starvation

Now that we have discussed most of the causes for neonatal diseases in kids/lambs lets be sure that we do not overlook the obvious: **Starvation**. I have seen many kids/lambs that never reach their full potential due to lack of nutrition from their dam. As stated earlier, be sure to check the dam's udder and milk production as soon after birth as possible. If you notice that the newborn kid/lamb is constantly nursing their dam, there is a good possibility that the ewe or doe is not producing enough milk or may have developed a case of mastitis. If you notice this, try offering a bottle of milk as a supplement and provide a creep area with a highly palatable ration. Then go to your record keeping system and mark the dam as a cull. Milk production is heritable and there is no sense in keeping an animal that cannot raise her offspring,

Soremouth in young kids/lambs may also cause starvation. If the lesions on the mouth are so severe, nursing may be too painful. Another concern is when the ewe or doe develops ulcerated lesions on their teat or udder from a nursing newborn with soremouth. If severe enough, the dam may not let her offspring nurse. It is easy to diagnose but these lesions take a while to heal. Apply an emollient antibacterial cream, i.e. chlorhexidine ointment, to the lesions to help decrease soreness and enhance healing. Supplement the newborn if necessary. **REMEMBER:** soremouth is zoonotic so wear gloves while treating or handling animals with soremouth.

To sum up the contents of this article, the **Five C's** provide an effective formula for managing and preventing diseases in any newborn:[1]

- Colostrum
- Cleanliness
- Comfort
- Calories
- Consistency

Footnote:

https://articles.extension.org/pages/15695/calf-diseases-and-prevention, Sheila M. McGuirk, DVM, PhD, and Pamela Ruegg, DVM, MPVM University of Wisconsin-Madison Extension Dairy Publication, January 14, 2011

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**Dr. Beth Johnson,** *is a Staff Veterinarian in the Kentucky Department of Agriculture and has 40 years of experience raising and treating small ruminants. Her family farms in Parksville, KY where she raises Gelbvieh cattle and Boer goats.*

# BREEDERS PAGE

# MARKETPLACE

**American Institute for Goat Research**
http://goats.langston.edu
**Bluegrass Livestock Marketing Group**
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**HoofTrader**
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# Dairy & Meat Goat Online Certification Courses

*by Dr. Terry Gipson, Ph.D., Langston University*

*& Dr. Roger Merkel, Ph.D., Langston University*

## Introduction

The time between fall breeding and spring kidding is often a slight down time for many goat producers. This is often a good time for producers to invest in self-improvement via continuing education. Many producers obtain information from the World Wide Web. While proper, science-based information does exist on the internet, producers with little to no livestock experience have no background to discern "good" versus "bad" information. In some cases, information posted could be harmful to animals and to the economic viability of goat enterprises. Langston University has recently launched an online certification program for dairy goat producers and updated and relaunched its popular online certification program for meat goat producers.

As the goat industry grows and evolves, a quality assurance program, that is compatible with HACCP-like programs, is essential. Such a program ensures the production of a safe, healthy product that satisfies consumers and increases profit for the production industry. The objectives of this certification website are:

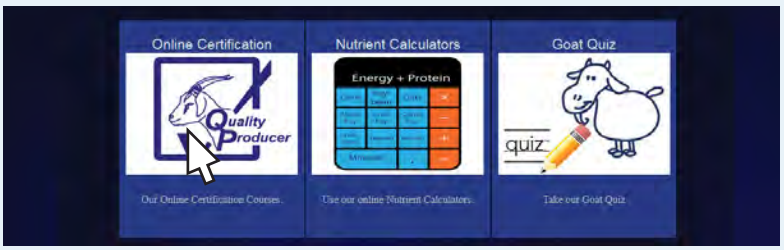
1. to provide reliable educational information incorporating a Quality Assurance Program that is suitable for dairy and meat goat producers, county agents and other agriculture professionals and

2. to provide testing methodologies allowing for certification of dairy and meat goat production for those producers desiring certification.

## How to Enroll in the Online Certifications

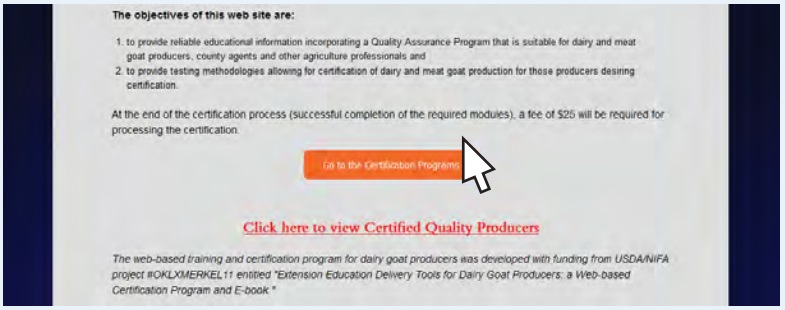
1. Go to http://goat.langston.edu or http://goats.langston.edu (new server for Langston University Agriculture Research and Cooperative Extension).
2. Scroll down the home page and you will find three tiles labeled ACTIVITIES (RESEARCH), LIBRARY, and TRAINING.


3. Click on the TRAINING tile. Alternatively, you can click on the TRAINING menu item at the top of the home page. In addition to being the gateway to the online certification courses, this page serves as the gateway to our Nutrient Requirement Calculators page, where you will find links to the Technical Version Calculator and the Producer Version Calculator. The Training page also give access to the Goat Quiz, where you can test your knowledge on goat facts.
4. Click on the Online Certifications tile. You will arrive at the online certification page.



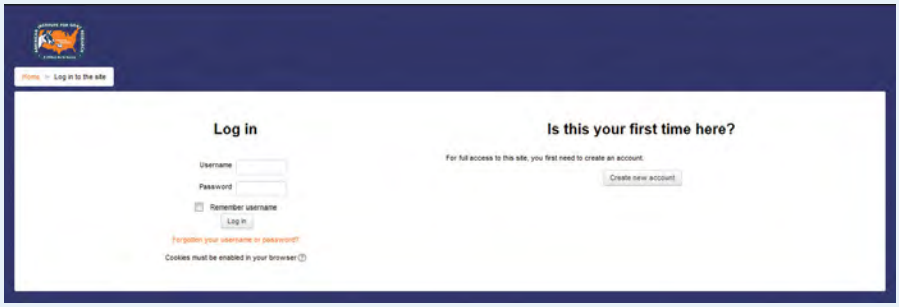

The certification home page showcases the various dairy and meat goat Quality Producer icons that will be awarded to participants who successfully complete the certification process and pays the $25 fee for a completion certificate. In addition, links listing the modules of the Dairy and Meat Goat Producer Certification Courses are provided. To qualify as a Quality Dairy Producer or Quality Meat Producer, you must successfully complete all of the 18 core modules and 7 of the 10 elective modules of the dairy goat certification, and/or all of the 21 core modules and 9 of the 12 elective modules of the meat goat certification, respectively.


5. Click on the orange button that is approximately ¾ of the way down the page and you will be taken to the courses home page. Further down the page, you will find a link to see enrollees who have received certification. On that page, certified producers are organized alphabetically by name. Tables detailing geographical association or certification program affiliation can be found.





6. Alternatively, you can type ***http://certification.goats.langston.edu*** into the address bar at the top of your browser and you will be taken there directly. Bookmark the courses page so that you can easily return to it. The certification courses have been constructed in Moodle, which is a Learning Management System (LMS). Moodle is a free Open Source LMS designed to help educators create effective online courses. If you have had no experience with an LMS or specifically Moodle, the learning curve is easy and the interface is intuitive.
7. Create an account. If this is your first time to visit the courses page, you will be asked to create an account and subsequently to verify your email account. The email verification is to confirm your identity and to receive enrollment information and course updates. If you are a returning user, you will simply log in with the credentials that you used to establish your account. You only have to register once to have access to both the dairy and meat goat certification courses.

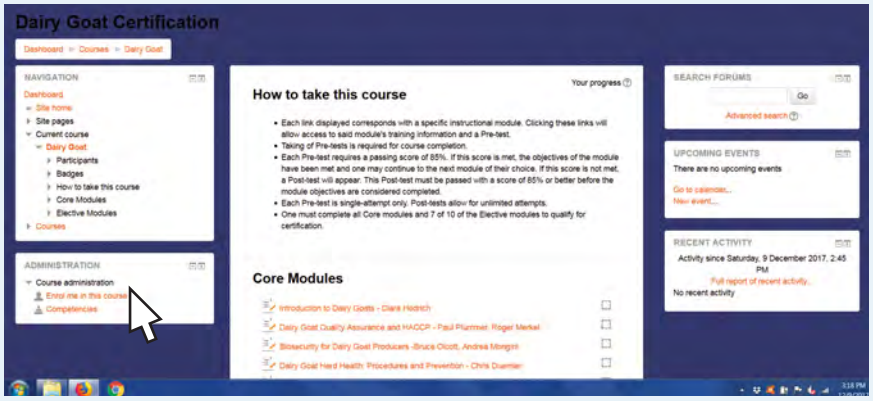



8. Once you have logged in, you can click "Site home" on the Navigation panel to see your available courses, which looks similar to a previous screen except now you are logged into the site.
9. Choose your course and enroll. When you click on either the Dairy Goat Certification or the Meat Goat Certification link, you will be taken to the individual course content page, which will display the course modules. However, you are not yet enrolled and will not have access to the modules.


*Online Certifications continues on pg. 30*

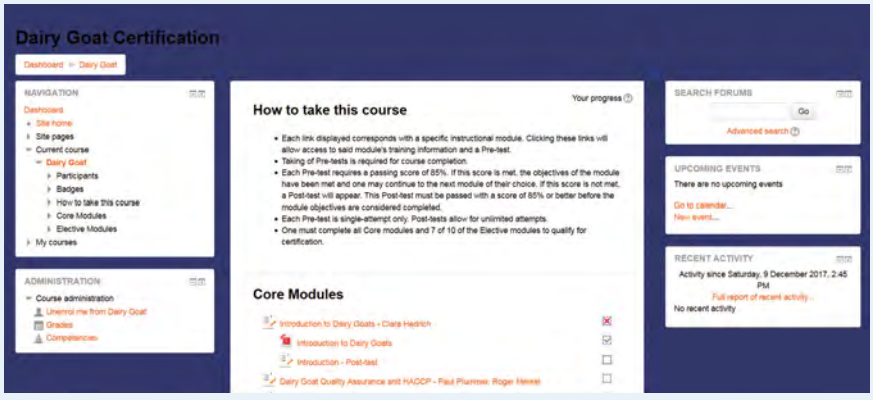
*Online Certifications continued from pg. 21*

10. Click on the "Enrol me in this course" link in the Administration panel. Enrollment is a **free** and simple self-enrollment process and you should receive an email confirming enrollment.




11. On the course content page, each link corresponds to a specific instructional module, either core and elective. Core modules are required for certification. There are 18 core modules for the dairy goat certification and 21 core modules for the meat goat certification. Not all elective modules are required for certification; however, 7 of the 10 elective modules for dairy goat certification, and 9 of the 12 elective modules for meat goat certification are required in order to receive Quality Dairy Producer or Quality Meat Producer certifications. The combination of elective modules is your choice. Valuable information is in each and every elective module. When you click on a module link, you will be taken to the pre-test for that module. This pre-test measures your knowledge of the module instructional content before you have access to the module content. In other words, the pre-test measures your current state of knowledge. That particular module pre-test is only offered once during the certification process. Once you have taken the pre-test, you will be allowed access to the instructional module content, which is in pdf format and can be downloaded. If you score 85% or greater on the pre-test, you have sufficient grasp of the subject matter for that module, the instructional objectives of that module have been met, and you will not be required to take a post-test. Regardless of the pre-test score, a post-test score of 85% or greater will be required to meet the instructional objectives of that module. The post-test may be taken as many times as needed to achieve a score of 85% or greater.

12. You can see the red × to the right of the Introduction to Dairy Goats - Clara Hedrick module (Clara Hedrick is the author of that module). The red × means that the participant did not score an 85% or greater on the pre-test; therefore, taking of the post-test is required to fulfill the instructional objectives of that module. The blue check mark to the right of the module title means that the participant has accessed the module content. You can track your progress by clicking on "Grades" in the Administration panel. Upon successful completion of the core and elective modules, you will receive an email detailing the final steps in the certification process, which will include the option to purchase a paper certificate.




# IMPORTANT REMINDER

For both online courses, the process is:

1) take the pre-test,

2) access the module,

3) take the post-test, if required.

You cannot access the module content before taking the pre-test. The objective of the pre-test is to measure your knowledge **before** reading module content. The objective of the post-test is to measure your knowledge **after** reading module content.

You have one attempt at the pre-test and then later an unlimited number of attempts to take the post-test, if required.

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# Genetically Speaking...

# Acronyms Galore: What do they all mean?

*by Debra K. Aaron, University of Kentucky*

Genetic improvement in your flock depends on your ability to select breeding sheep that are genetically superior for traits of economic importance. Unfortunately, visual appraisal alone may not identify those sheep that have the greatest potential as parents. That is why records are a necessary part of your breeding program. In this *Genetically Speaking*, we take selection and genetic improvement a step further and answer some questions about heritability, estimation of genetic merit, and genetic evaluation programs. In the process, we will define some of the acronyms you will encounter as you use those genetic evaluation programs for flock improvement.

### Is What You See Always What You Get?

An animal's performance (**Phenotype**, **P**) for a trait is the result of its genes (**Genotype**, **G**) and the effect of the **Environment** (**E**) in which it is raised (i.e., nutrition, health program, housing, temperature, humidity, parasite exposure, etc.). Thus, the phenotype of an animal is often expressed as:

$$P = G + E$$

An animal's genotype is the set of genes that affects a particular trait. Those genes that act independently, or additively, make up the animal's **Breeding Value** (**BV**). This is the portion of the animal's phenotype that can be passed on to its offspring. As a result, we express the phenotype as:

$$P = BV + E$$

This is a slight oversimplification, but it will work for our discussion here.

In real life, we observe an animal's phenotype, but we want to know its breeding value (e.g., its genetic merit as a future parent). Unfortunately, it is not possible to know the ***true*** genetic merit of an animal for a particular trait. Therefore, in order to make selection decisions, we must ***estimate*** its breeding value. The animal's own performance is one indicator of its breeding value. The usefulness of this individual information depends on the proportion of the differences in performance between animals that is due to differences in breeding values. This is called the **heritability** (represented by the symbol, $h^2$) of the trait.

$$h^2 = \frac{\text{BV Variation}}{\text{Phenotypic Variation}}$$

**Heritability measures the relative importance of genetics and environment in developing an animal's phenotype, for a trait.**

Traits are not equally heritable; that is, traits are not equally affected by an animal's genetics. Theoretically, heritability can range from 0 to 100%. A heritability of zero indicates that all of the phenotypic differences between animals are due to environmental effects. A heritability of 100% indicates that all phenotypic differences between animals are due to differences in breeding values. Heritabilities for most economically important traits in sheep range from 5 to 55% (Table 1). This tells us that most of the phenotypic differences we observe between sheep are due to non-genetic, or environmental,effects. This is the reason ***what you see is not always what you get.*** For highly heritable traits (35% or higher), the animal's own performance is a good indicator of its breeding value. For lowly heritable traits (below 15%), the animal's phenotype is much less useful. In these cases, having performance information on the animal's relatives (progeny, pedigree) will be important in estimating its breeding value.

**Table 1. Heritabilities for Different Types of Traits in Sheep.**

| Type of Trait | Level of Heritability |
|---|---|
| Reproductive | Low (5 to 15%) |
| Growth | Moderate (20 to 25%) |
| Carcass | High (30 to 45%) |
| Fleece | High (35 to 55%) |
| Dairy | High (30 to 40%) |

## What are EBVs?

An animal receives one-half of its genetic make-up from each parent so we expect the breeding value of an individual to be equal to the average of the breeding values of its parents:

**Expected BV = ½ (Sire's BV) + ½ (Dam's BV)**

This is only an expectation. An animal's ***true*** breeding value for a trait is never known. We must estimate it using the animal's own performance and/or performance of its relatives. This is called the **Estimated Breeding Value** (**EBV**); it is the ***predicted*** value of an animal as a parent compared with other potential parents. Because selection is about picking the parents of the next generation, this measurement is important to a breeding program.

The simplest form of EBV is based on an animal's own performance:

**EBV = $h^2$ x Selection Differential**

**where Selection Differential is the difference between the individual's performance and the average performance of its contemporaries.**

For example, suppose a ram has a weaning weight of 40 kg (or 88 lb) and his contemporary group (other rams of the same breed and approximate age raised under the same conditions) has an average weaning weight of 28 kg (or 62 lb). His selection differential for weaning weight is 40 - 28 = 12 kg. Assuming a heritability of 10%, his EBV is 0.10 x 12 kg = +1.2 kg (or +2.6 lb).

## What are EPDs?

A sire (or dam) passes on a random half of his (or her) independent gene effects to his (or her) offspring. Because the breeding value is the sum of the independent effects of all of an individual's genes affecting a trait, a parent transmits, *on the average*, half its breeding value to its offspring. Half of the parent's breeding value for a trait is our expectation of what is inherited from the parent and is called the **Progeny Difference** (**PD**).

**PD = ½ BV**

Recall, the previous equation:

**Expected BV = ½ (Sire's BV) + ½ (Dam's BV).**

We can rewrite this as equation as:

**Expected BV = Sire's PD + Dam's PD.**

In other words, the expected merit of progeny from a particular mating is equal to the average of the parents' breeding values *or* the sum of their progeny differences.

Progeny difference is a very practical concept. Think of it as the expected difference between the average performance of an individual's progeny and the average performance of all progeny (assuming randomly chosen mates). For example, if a particular ram has a PD = +0.5 kg for weaning weight, and we mate him to an average set of ewes (their average PD = 0), we can expect the weaning weights of his lambs to average 0.5 kg heavier than average lambs.

Like breeding values, progeny differences are not directly measurable, but can be predicted from performance data. Such predictions are called **Expected Progeny Differences** (**EPDs**) and are commonly used to make genetic comparisons among animals. Just as the predicted difference is equal to half the breeding value, an EPD = ½ EBV.

## What is the NSIP?

Purebred producers can have EBVs calculated on their sheep by enrolling their flocks in the **National Sheep Improvement Program** (**NSIP**, www.NSIP.org). Producers submit on-farm performance data and NSIP returns genetic evaluations. Currently, genetic

evaluations are limited to purebred sheep. However, commercial producers can use EBVs to improve traits in their flocks by selecting purebred rams with strong EBVs for the traits that are economically important to them.

NSIP was established in 1986. Initially, it was limited to within-flock evaluations. As the program grew and more flocks with linkages (common genetics) joined, across flock (within pure breed) evaluations were generated and NSIP became a breed-centered program.

Predictions of genetic merit were originally reported as EPDs. Through 2009, yearly genetic evaluations were conducted by Virginia Tech under the direction of Dr. Dave Notter. In 2010, NSIP finalized a partnership with Meat and Livestock Australia that transferred data processing from Virginia Tech to LambPlan, the national sheep performance program of Australia. This partnership allows the U.S. sheep industry to generate genetic evaluations, now reported as EBVs, every two weeks.

Currently, NSIP provides genetic evaluations for 20 breeds:

| | |
|---|---|
| **Black Welsh Mountain** | **Meat Merino** |
| **Border Leicester** | **Oxford** |
| **Columbia** | **Polypay** |
| **Dorper/White Dorper** | **Rambouillet** |
| **Dorset** | **Royal White** |
| **Finnsheep** | **Shropshire** |
| **Hampshire** | **Suffolk** |
| **Katahdin** | **Targhee** |
| **Icelandic** | **Texel** |
| **Lincoln** | **White Suffolk** |

## What Traits Have EBVs?

Specific traits for which EBVs are calculated vary among breeds. EBVs for some of the more economically important traits are described below (Dr. Dave Notter, NSIP EBV Notebook, September 1, 2011): Please refer to the blue tables shown here to the right.

## How are EBVs reported?

An EBV is reported, in the normal units of a trait (kg for weight traits), as a deviation (+ or -) from the average population value, which is considered to be zero. Therefore, EBVs always have a positive (+) or negative (-) sign in front of them. The positive and negative symbols don't always mean better or worse; it depends on the trait. For example a WWT EBV of +0.5 kg is good (i.e., heavier lambs at weaning) but a FD EBV of -0.3 microns is also good (i.e., smaller diameter fiber).

| EBVs for Weight Traits<br>Reported for all breeds, expressed in kg; 1 kg = 2.2 lb. | |
|---|---|
| **Birth Weight (BWT)** | The BWT EBV estimates direct genetic effects on weight at birth. Positive selection on BWT EBV is expected to increase birth weight; negative selection is expected to decrease birth weights. |
| **Weaning Weight (WWT)** | The WWT EBV provides an estimate of preweaning growth potential. Selection for high WW EBV is expected to increase weaning weights. |
| **Maternal Weaning Weight (MWWT)** | The MWWT EBV estimates genetic merit for mothering ability. It reflects genetic differences in ewe milk production as realized her lambs. It is derived by evaluating whether individual ewes produce lambs that are heavier or lighter than expected based on EBVs of the parents. Ewes whose lambs grow faster than expected are assumed to be better milk producers. Ewes whose lambs grow slower than expected are assumed to produce less milk. Selection for high MWWT EBVs is expected to improve milk production. |
| **Total Maternal Weaning Weight** | The Total Maternal Weaning Weight EBV combines information on weaning weight and maternal milk. Previously, this was provided by NSIP as the **Milk plus Growth EBV**. Total Maternal Weaning Weight EBVs are not directly provided by LambPlan, but can be calculated from maternal weaning weight and weaning weight EBVs as:<br>**MWWT EBV + ½ WWT EBV**<br>The Maternal Weaning Weight EBV recognizes the genetic contribution of a ewe to the weaning weight of her lambs is the combined effect of her milk production (measured by the MWWT EBV) and a random one-half of her genes for preweaning growth potential (measured by the WWT EBV). |

| EBVs for Wool Traits<br>Reported for Western Range Breeds and Maternal Wool Breeds. | |
|---|---|
| **Fleece Weight (GFW)** | The GFW EBV is expressed as a percentage (%). It is based on grease fleece weight and estimates the animal's genetic potential for wool production. |
| **Fiber Diameter (FD)** | The FD EBV is expressed in microns. It estimates genetic merit for fleece quality. Animals with finer, more desirable fleeces have negative FD EBV, so negative EBVs are favored for this trait. |
| **Staple Length (SL)** | The SL EBV is expressed in millimeters. It estimates genetic potential for length of the wool fiber. |

| EBVs for Reproductive Traits<br>Reported for all breeds. | |
|---|---|
| **Number of Lambs Born (NLB)** | The NLB EBV (%) evaluates genetic potential for prolificacy. For example, ewes with NLB EBVs of +10.0 are expected to have an average of 0.10 more lambs at each lambing than average ewes, and their daughters are expected to have an average of 0.05 more lambs at each lambing compared to daughters of average ewes. Selection on NLB EBV is expected to increase prolificacy in the flock. |
| **Number of Lambs Weaned (NLW)** | The NLW EBV (%) evaluates combined ewe effects on prolificacy and lamb survival to weaning. For example, ewes with NLW EBVs of +10.0 are expected to wean an average of 0.10 more lambs at each lambing than average ewes. Their daughters are expected to wean an average of 0.05 more lambs at each lambing compared to daughters of average ewes. Selection on NLW EBV is expected to increase weaning rates in the flock. |

| EBVs for Parasite Resistance<br>Reported for all breeds. | |
|---|---|
| **Worm Egg Count (WEC)** | The WEC EBV (%) evaluates genetic merit for parasite resistance based on worm egg counts recorded at weaning or at early or late postweaning ages. Animals with low WEC EBVs are expected to have greater parasite resistance |

## How Can Sheep Producers Use EBVs?

Consider the NSIP genetic evaluation for a sample set of five rams presented in Table 2. We can use these data to rank rams based on their expected contribution as sires and to choose sires for different flock situations.

**Table 2. Sample EBVs for Growth, Maternal and Reproductive Traits.**

| | | | EBV | | | |
|---|---|---|---|---|---|---|
| ID | Sex | Birth Year | Weaning Weight (WWT, kg) | Maternal Weaning Weight (MWWT, kg) | Total Maternal Weaning Weight (kg) | Number of Lambs Born (NLB, %) |
| 1 | Ram | 2015 | -1.2 | +0.1 | -0.5 | +10.1 |
| 2 | Ram | 2015 | +0.3 | -0.6 | -0.5 | +2.8 |
| 3 | Ram | 2006 | +2.2 | +0.7 | +3.3 | -4.4 |
| 4 | Ram | 2017 | +0.4 | +0.2 | +0.4 | +17.2 |
| 5 | Ram | 2017 | +2.4 | +1.0 | +2.2 | +0.8 |

**Ranking Rams.** Consider weaning weight. Ram #5 ranks highest for this trait. He has a WWT EBV of +2.4 kg. This means that Ram #5 is estimated to have genes that result in lambs that are 2.4 kg heavier at weaning than a ram of average genetic value from the same population (i.e., a ram with a WWT EBV of 0.0). Ram #5's WWT EPD is 1.2 kg (EPD = ½ EBV). This means that if Ram #5 is mated to a group of ewes of average genetic merit (WWT EBV = WWT EPD = 0.0), his progeny are expected to weigh 1.2 kg more at weaning than lambs sired by a ram of average value (WWT EBV = WWT EPD = 0.0).

Ram #1 is on the other end of the rankings for weaning weight. He ranks last with a WWT EBV of -1.2 kg and, therefore, a WWT EPD of -0.6. If Ram #5 and Ram #1 are both mated to a group of ewes of average genetic merit, Ram #5's progeny are expected to weigh 1.8 kg more at weaning than Ram #1's progeny.

**Expected Difference in Performance of Progeny of Ram #5 and Ram #1** = **Ram #5's WWT EPD - Ram #1's WWT EPD** = **1.2 - (0.6)** = **1.8 kg**

## Selecting Sires for Specific Flocks

Consider the flock situations presented below. Given the breeding objectives of the respective producers, which of the five rams (**Table 2**) would be the best choice?

**Situation 1:** ***Producer is satisfied with lambing percentage (already 220%) but wants to improve milk production and growth rate.***

Choose Ram #5 for high EBV for weaning weight, maternal weaning and total maternal weaning weight. We would expect Ram #5 to sire fast-gaining lambs that grow well to weaning, relative to the breed average, and to sire daughters that will produce above average weaning weights for their lambs.

**Situation 2:** ***Producer is satisfied with lamb weaning weight and growth rate but wants to improve lambing percentage.***

Ram #4 is the choice for this flock because he ranks highest for number of lambs born. His EBV for weaning weight, maternal weaning weight and total maternal weaning weight are all positive, so no progress should be lost for those traits. We would expect Ram #4 to sire daughters to have an average of 0.086 [(½)(0.172)] more lambs at each lambing compared to daughters of average rams.

**Situation 3:** ***Producer knows the flock has serious production problems and needs a general improvement in total productivity.***

This situation is different from the other two. The producer is not satisfied with overall production in the flock and wants to improve production in both growth and maternal traits. The goal here is to select a ram with high EBVs for all traits. Most of the time, rams will not be rank high in *all* traits, so trade-offs are often required. In this example, it is a hard decision. Ram #5 is positive for all traits, but ranks next to last for number of lambs born. Ram #4 ranks highest for number of lambs born, but ranks in the middle for the other traits. Ram #3 ranks higher for weaning traits but has a negative EBV for number of lambs born. Neither Ram #1 nor Ram #2 are considered because of their overall rankings for the traits shown. Thus, it boils down to either Ram #4 or Ram #5. Either way, the producer has to make a trade-off. Because the primary determinant of profit in a flock is number of lambs sold, we may choose to give up a little with regard to weaning performance in order to make a big improvement in number of lambs born. In that case, Ram #4 is our choice.

*Remember, EBVs (and EPDs) do not predict absolute performance. EBVs (and EPDs) are used for ranking and for ranking.*

## Finally, What Does It All Mean?

Estimated breeding values are the best available estimates of genetic merit. They allow animals to be compared fairly and directly with other animals from the same breed. They do not necessarily reflect the animal's observed performance (phenotype), which is a combination of both genetic and environmental influences. Rather, they are an estimate of the genetic component of that performance. Estimated breeding values are tools to create and manage genetic change. The optimal use of estimated breeding values requires a clearly stated breeding objective. The breeding objective is a statement of the genetic characteristics that need to be changed in your flock, that need to be maintained at the current level or that can be ignored. Ultimately, your breeding objective depends on your role in the sheep industry.

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