Volume 27 Spring 2017

Hoof Print

The Small Ruminant Magazine

NEWS TO EWES

A HAY FOR EVERY SEASON

A LIVESTOCK GUARDIAN DOG

DAIRY GOAT NUTRITION:

FEEDING FOR TWO - PART 2

BREEDERS PAGE

Hoof **Print** Magazine
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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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Volume 27 Spring 2017
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In This Issue

Special Features

In Every Issue

President's Letter

Dear KSWPA Members,

My name is Bill Decker, and it is my honor and privilege to serve as the President of the Kentucky Sheep and Wool Producers Association (KSWPA) for 2017. I hail from a family that was steeped in the grain and livestock business in Ohio. From 1868 until 1978, my family operated Val Decker Piquality Meats, a meat packing business started by my great grandfather, a German immigrant to America.

Since 1978 when I moved to the Bluegrass for college, I have proudly called Kentucky my home. In 2002, I purchased land in Eastern Shelby County, and since that time I have owned and operated Decker Quality Stock Farm in Waddy. My wife, Jennifer, and I have lived on our farm since 2011. While we focused on breeding cattle for 9 years, in 2011 we began gradually to shift our focus from cattle to sheep.

When we bought our first 33 Katahdins in 2011, our purpose was simply to provide a safe means of maintaining the grass on the beautiful, but dangerous-to-mow, sloping hills surrounding our farm ponds. From the beginning of our experiences with sheep, we have been thrilled with the beauty of those gentle creatures, the alacrity at which they manicure the land without harming it, the speed in which they reproduce, and the amount of the proceeds we receive when we sell ewes and lambs. Each year we have been in the sheep business, we have increased our Katahdin flock, until, at one point we owned more than 300 sheep. Earlier this year, after reviewing all the positive aspects of our sheep, we decided to sell our cattle herd and to continue increasing our sheep flock.

Just as my interest in the sheep industry has grown exponentially since 2011, my desire to serve the Kentucky Sheep and Wool Producers Association has increased. I first learned of KSWPA's important work while attending two excellent class series offered by the University of Kentucky and the Agriculture Extension Service. During those series, I learned quite a bit about both the business of breeding sheep and the impact KSWPA has on the sheep industry.

Three years ago, I became a member of the KSWPA board, where I learned that the Association's mission is to promote the consumption of lamb and lamb products, and to sponsor educational programs like the two series I had attended. In addition, I learned that the Association's ultimate goal is to be the voice of the Kentucky Sheep Producers. The KSWPA designs programs and activities to improve both our members' production and their marketing skills. We desire to help producers learn to be market makers versus market takers.

In order for us to achieve this goal, we ask that you participate in regional training opportunities, attend our annual lamb cook off, come to the KY Sheep and Fiber Festival, join us at our annual conference, and, most importantly, provide us with feedback on how we can better serve you. In addition, we ask you to encourage your friends and family who are involved in the sheep industry to join the Kentucky Sheep and Wool Producers Association, so we can multiply our membership, increase the services we provide, and increase the number and variety of the programs we sponsor.

Over the past two years, I have assisted a number of friends who entered the sheep business. Also, by recounting my positive experiences with sheep, I have recruited other sheep farmers to join the KSWPA. I am excited about the future of the sheep industry in Kentucky, and I look forward to working with you. Let's all become evangelists for the sheep industry! With good management and enhanced marketing efforts, we can all make more money in this business we love.

Please stay informed and become active by visiting our website (https://www.kysheepandgoat.org) and by following us on Facebook (https://www.facebook.com/KySheepAndGoatOffice/) . Help us help you!

Sincerely,
Bill Decker
President of the KY Sheep and Wool Producers

KSWPA - UPCOMING EVENTS

APRIL

4th	**EweProfit School III, Oran C. Little Research Farm**
6th	**Jessamine County Goat and Sheep Association;** Jessamine County Fairgrounds; 7:00pm
10th	**graded sale Richmond**
13th	**graded salw Bowling Green**
15th	**KY Proud Elite Breeder Sale,** Franklin Co. Fairgrounds
15th	**graded sale Springfield**
18th	**graded sale in West Kentucky Auction Barn**
18th	**South Central Goat & Sheep Producers Assoc.,** Barren County Extension 6:30pm (CT)
22-23	**2016 TN Shearing School Middle TN State University-** TN Livestock Center, Murfeesboro,TN
25th	**graded sale Paris**
27th	**graded sale Bowling Green**

MAY

4th	**Jessamine County Goat and Sheep Association;** Jessamine County Extension Office; 7:00pm
8th	**graded sale Richmond**
9th	**Central KY Goat and Sheep Association;** Marion County Extension Office; 7:00pm
11th	**graded sale Bowling Green**
16th	**graded sale West Kentucky Auction Barn**
16th	**South Central Goat and Sheep Producers Association,** Barren County Extension 6:30pm (CT)
18th	**Fort Harrod Goat and Sheep Association Meeting;** Mercer Co. Extension Office 6:30pm potluck and 7pm meeting
19th	**UK SheepProfit Day,** Oran C. Little Research Farm, Midway, KY
20th	**graded sale Springfield**
20-21	**KY Sheep and Fiber Festival**
23rd	**graded sale Paris**
25th	**graded sale Bowling Green**

JUNE

1st	**Jessamine County Goat and Sheep Association;** Jessamine County Extension Office; 7:00pm
8th	**graded sale Bowling Green**
12th	**graded sale Richmond**
13th	**EweProfit School I,** Oran C. Little Research Farm, Midway, KY
18th	**graded sale Springfield**
20th	**graded sale West Kentucky Auction Barn**
20th	**South Central Goat and Sheep Producers Association,** Barren County Extension Office 6:30pm (CT)
22nd	**graded sale Bowling Green**
27th	**graded sale Paris**

2017 National Make It With Wool

Congratulations to Tiana Lenos the Junior winner that represented Kentucky at the National Make It With Wool Competition in Denver. She placed fourth out of twenty five junior contestants who represented their state. All contestants that entered Make It With Wool used 1641 yards of wool fabric and 229 skeins of wool yarn! Tiana received a Singer Felting Machine, Wool Roving, Wool Fabric, Coat & Clark thread, felting and sewing books plus other sewing notions. All contestants at national had a workshop on drop spindle where they all received the drop spindle and wool roving.

Tiana Lenos, KY Junior Representative to the National MIWW competition in Denver, CO

Thanks to Kristy Sturgill of Kristy Kreations for sending a beautiful felted picture for the American Sheep Women auction, which helps fund the National Make It With Wool competition. The winner of the felted picture said she always looks for Kristy's work at the auction.

Felted picture created by Kristy Sturgill of Kristy Kreations

It is time to think about sewing to enter the 2017 competition which will be in Bowling Green on October 7, 2017. The categories are Preteens (12 and under) and they can enter one piece such as a skirt, pants, jumper or a dress. Juniors (13 to 16), Seniors (17 to 24), Adults (25 and older) can enter a dress, jumper, and outerwear lined coat or jacket, two piece outfit or an ensemble. The Made for Others (any age) can be any wool garment and will be modeled by the person for whom the garment was made. The garment is to be made from 100% wool or wool blend (minimum 60% wool or specialty wool fiber including mohair, cashmere, alpaca, camel, Ilama and vicuna) for each fashion fabric or yarn uses. **Please send a 5x5 piece of wool along with five dollars to be tested before construction. Each year I have test results that are not 60% wool.** The top 4-H wool garment at the 2017 Kentucky State Fair will receive 2 ½ yards of Pendleton Wool. Remember the winner of the Junior and Senior will represent Kentucky in the National Competition held in San Antonio, Texas, February 1-3, 2018, and the Adult garment will go on to be judged in the National Adult Competition. Entry forms will be available by contacting Dorothy Vale, KY State Director; 142 Carolyn Lane, Nicholasville, KY 40356, cell 859-420-3217, e-mail kymiww@aol.com. Entry forms will also be on kysheepandgoat.org web site in the spring.

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- Madeline Rosenburg, *Bagdad, KY*
  Madeline.ballyhoofarm@gmail.com

Kentucky SHEEP & WOOL PRODUCERS ASSOCIATION

President's Letter

Dear KY Goat Producers,

Spring is upon us and I know our fellow producers are hard at work in the barn! Seems we are busy all year but spring brings many exciting activities to our wonderful KGPA members and fellow goat producers.

The Kentucky Proud Elite Breeders Sale is right around the corner, April 15, 2017 and will be held again at the Franklin County Fairgrounds. A very thoughtful thank you goes to Tess Caudill , Ethan Berry and Evan Davis, KDA, for all the work that goes into this sale. The Kentucky Proud Elite Sale is the start of youth activities and the Kentucky Goat Producers is always proud to support our Kentucky youth. For more information on Kentucky youth shows and activities please visit the KDA Show and Fair pages at tohttp://www.kyagr.com/marketing/show-and-fair.html. I ask our fellow producers to go out and support our Kentucky youth as they participate in County and KDA sponsored events.

The KGPA is venturing on a new project in 2017 and we are proud to take this event to our KGPA current and future members. The Kentucky Goat Producers Field Day will be held on July 15, 2017 at the Hart County Fairgrounds. There will be many hands on workshops and question/answer sessions with some of the most knowledgeable professionals in the Kentucky goat industry. The field day will focus on the improvement of breeding, health, marketing and productivity of goats. KGPA members and goat producers from Kentucky, Tennessee and the surrounding area are encouraged to attend. Please keep a watchful eye on KGPA website for additional information https://www.kysheepandgoat.org/kgpa.html

As a Kentucky Goat Producer member please know that your association is here to support you. Please feel free to contact any of your board members when you have questions or would like for us to come and visit with your group. Membership and involvement make us strong and will unify the producer as an industry. Please visit the KGPA website for additional programs that support our producers.

Happy goating,

Donna Puckett, KGPA President

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  4lcloverb@gmail.com
- *Vicki Watson* Auburn, KY
  dvwatson@logantele.com

KENTUCKY GOAT PRODUCERS ASSOCIATION

Your $30 membership provides:

- 4 issues of the *Hoof***Print** Magazine plus the newly designed 2017 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!**

JOIN or RENEW TODAY!

KGPA Membership Application

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.

THE KENTUCKY GOAT PRODUCER YOUTH PROGRAM

The Kentucky Goat Producer Youth Program was established to primarily promote education and awareness of the Market/Commercial doe/ Dairy Goat youth projects within Kentucky. By joining as a youth member of KGPA, you are provided the opportunity to compete in the KGPA Youth program. The program gives awards based on points earned for community service, showing, hosting educational exhibits and purchasing Kentucky Proud animals. If interested in this program, visit our website, https://www.kysheepandgoat.org/kgpa.html and download the necessary forms. New for this year, is a 5-minute video (instead of the essay) which describes your project and some of the activities you have done during the year to further your understanding and inform those around you of your project.

Committee members;
Beth Johnson, Angie French,
Kay DeMoss, Anita Vaske

MARK YOUR CALENDARS!

Kentucky Goat Producers Field Day
July 15, 2017
Hart County Fairgrounds

A focus on health, marketing, breeding improvement, & productivty of goats

Hands-on Workshops &
Q & A Sessions with KY Goat Industry Professionals

Who wants a KGPA T-shirt?

For details contact
Donna Puckett
donnagpuckett@gmail.com

www.kysheepandgoat.org/kgpa

KGPA - UPCOMING EVENTS

Calendar of event items can be sent to kyates@kysheepandgoat.org with date, location and time.

APRIL	
4th	**Norther KY Goat Producers Assoc. Meeting;** Kenton Co. Extension Office 6:00 p.m.
6th	**Jessamine Co. Sheep and Goat Meeting;** Jessamine Co. Extension Office 7:00 p.m.
15th	**Kentucky Proud Elite Breeders Sale**
18th	**South Central Goat and Sheep Producers Assoc.,** Barren Co. Extension 6:30pm (CT)
20th	**KSU Third Thursday Goat Field Day**
MAY	
2nd	**Norther KY Goat Producers Assoc. Meeting;** Kenton Co. Extension Office 6:00 p.m.
7th	**Jessamine County Goat and Sheep Meeting;** Jessamine Co. Extension Office; 7:00pm
16th	**South Central Goat & Sheep Producers Assoc.;** Barren Co. Extension, 6:30pm (CT)
18th	**KSU Third Thursday Goat Field Day**
18th	**Fort Harrod Goat and Sheep Association Meeting;** Mercer Co. Ext. Office; 6:30 pm potluck, 7p.m. meeting
JUNE	
1st	**Jessamine County Goat and Sheep Meeting;** Jessamine Co. Extension Office; 7:00 pm
6th	**Norther KY Goat Producers Assoc. Meeting;** Kenton Co. Extension Office 6:00 p.m.
10th	**Kentucky Junior Breeding/Market Goat Show**
20th	**South Central Goat & Sheep Producers Assoc.;** Barren Co. Extension, 6:30pm (CT)
JULY	
15th	**The Kentucky Goat Producers Association Field Day**

PRESIDENT'S LETTER

Hello TN Sheep Producers,

Another year has sped by and 2017 is upon us. I am excited about this new year and look forward to the challenges ahead. For those of you finished lambing, I hope all went well. Good luck to those of you with flocks lambing in March or April.

I am the new President of the Tennessee Sheep Producers Association, having been elected during the TSPA Annual Meeting held in Murfreesboro mid-January. As your president, I'm looking forward to meeting you and hearing what you need from us as your Association. I plan to be present at most of the sheep related events across the state, so please come by and visit. We've included upcoming events so plan to attend those that may interest you. Success of the sheep industry depends on your participation and us working and learning from each other.

Most importantly, I would like to take a moment to recognize and thank Mr. Alan Bruhin, our past TSPA president for his service and leadership in 2016. Alan served us well, and I'm sure to lean on him for guidance and advice in the next year. Congratulations to new board members Robert Walker of Alpine, Brandon Tavalin of College Grove and Dwight Loveday of Louisville (returning for another term). Robert was also elected to serve as Vice President. It's a great group of experience and knowledgeable sheep producers and I'm excited for the opportunity to work with them.

2016 award winners were also announced:

Joe Hall of Clinton, *Ben Powell Shepard's Award* for a member showing outstanding service to TSPA and the sheep industry. Mr. Hall has been a member of TSPA for many years and produces club lambs for TN youth.

Lacy Upchurch, past TN Farm Bureau President, *TSPA Service Award.* This award is granted to an individual or organization for promotion or service to our sheep industry.

The Tennessee Sheep Producers Conference was held in conjunction with the Tennessee Cattlemen and Tennessee Dairy Producers Associations at the Murfreesboro Embassy Suites Hotel January 13-14, 2017. The first day was spent on marketing while concerns shifted on day two regarding management decisions related to the current drought. A youth program and silent auction was held in conjunction with the program. 2018 dates and location have not yet been decided however we'll let you know when confirmed. We have various breeds of sheep produced in Tennessee which makes our association so diverse however we are also alike in many ways. If you have any ideas or suggestions regarding topics of concern, we would love to hear from you.

I encourage you to visit the TSPA website, tennesseesheep.org, when you get a chance. There is great content on sheep management and presentations you might find helpful. If you haven't renewed your membership or haven't joined yet, this can be easily done there too. We also have a presence on Facebook so be sure to go by and "Like" us to stay current. Of course, please feel free to contact me or any of our board members if we can help you.

Be well,
Debbie Joines, TSPA President

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- Brandon Tavalin, *College Grove, TN* – tavalintails@gmail.com
- Mark Shedden, *Knoxville, TN* – rmnps@bellsouth.net
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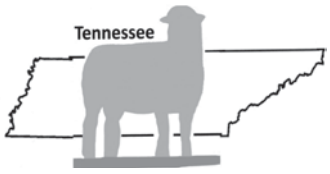

JOIN ONLINE TODAY!

If you are interested in a committee please select below:

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

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

Pay dues and join online at www.tennesseesheep.org

TSPA - UPCOMING EVENTS

Date • Details • Location • Website

April 21-22
TSPA Shearing School,
MTSU Livestock Center FMI: Mark Powell
sheperdboy1@yahoo.com
Apply for the shearing school online at
www.tennesseesheep.org

April 21-23
Smokey Mountain Fiber Festival
GSM Heritage Center, Townsend
www. townsendartisanguild.net/fiber-arts.html

May 20
TN Katahdin Sheep Assoc. Field Day,
Mohawk, TN.
www. tennesseekatahdinassociation.com

May 18-20
Small Ruminant Conference-
Brehem Animal Science Bldg,
UT Ag Campus
https://extension.tennessee.edu/rhea/Pages/2014-Small-Ruminant-Conference.aspx

May 26-27
10th Annual Middle TN Fiber Festival,
Dickson County Fairgrounds
www.tnfiberfestival.com

May 26-27
State 4-H Sheep Conference,
Hyder-Burks Pavilion, Cookeville
https://4h.tennessee.edu/news/Pages/Tennessee-4-H-Sheep-Conference.aspx

June TBA
Wool Pool
www.tennesseesheep.org

July 6-8
TN Junior Livestock Expo,
Hyder-Burks Pavilion, Cookeville

July 21-22
National Dorper Show and Sale.
Hyder-Burks Pavilion, Cookeville
dorpers@ymail.com. *Entries close June 1.*

October 21
Fiber in the 'Boro.
Lane Ag Park, 315 John Rice Blvd,
Murfreesboro
http://www.fiberintheboro.com

University of Tennessee to Host Small Ruminant Conference




The University of Tennessee will host its third Small Ruminant Conference on May 18-20, 2017 at the Brehm Animal Science Building on the University of Tennessee campus in Knoxville. This conference has been attended by more than 500 producers from seven states. The three-day event will include topics on dairy goats, meat goats and sheep production. Topics include: Starting a Commercial Dairy, Animal Disposal and Composting, Predator Trapping and Predation and much more.

Program highlights include a parasite lab at the UT College of Veterinary Medicine, FAMACHA training, and trade show. Door prizes totaling over $1,000 will be given during the event including equipment provided by Sydell and feed from Tennessee Farmer's Cooperative.

The cost is $100.00 per individual or $160.00 per couple and will include lunch each day, refreshments and materials. All participants are eligible for Tennessee Small Ruminant Certification. For more information visit https://rhea.tennessee.edu or call the Rhea County Extension office at 423-775-7807. The program is partially funded by Southern Extension Risk Management Education.

What Is Good Hay?

(updated article originally printed in *HoofPrint Fall 2012*)

Dr. Gary Bates, Director- UT Beef & Forage Center

Debbie Joines, former Manager- Soil, Plant & Pest Center

Hay is one of the necessary evils of livestock production. Even with the best forage programs, there will be certain times when some hay needs to be fed. If you are going to have to feed it, it is important to know the characteristics of good hay. Regardless of the forage species, good hay has certain things in common. It is a matter of knowing what to look for.

It is important to keep in mind that hay is a package to provide protein and energy in an animal's diet. These are the two nutrients needed in the greatest amounts. The best way to determine the nutrient content is to have a sample of the hay analyzed by a forage testing laboratory. This will let you know if the protein and energy content (expressed as TDN-Total Digestible Nutrients) is high enough to meet animal needs, or if some type of grain needs to be fed. But there are also certain physical characteristics that can be used as clues to hay quality.

1. Is the hay stemmy or leafy? As the proportion of leaves increase, the quality of hay increases. Leaves have the most protein and energy of any part of the plant. More leaves means more protein. Stems make the hay coarse, and not as palatable. Cut hay early to get as much leaf and as few stems as possible. On first cuttings of tall fescue and orchardgrass, cut the grass at the late boot stage, which means just as the seedheads are beginning to appear.

2. What color is the hay? Color can give a good indication of the conditions when the hay was produced. Hay cut early and cured fast will have the same green color as the growing plant. The more yellow or brown a hay is, the more mature the plant was when cut, and the longer it took to dry for baling. The longer hay is exposed to the weather before baling, even if it doesn't get rained on, the lower the quality will be. The weather conditions are out of our control, but try to be ready to cut when the weather permits, and don't waste that first day of good weather.

3. How does the hay smell? The goal is to have a clean odor in the hay. Hay that is put up wet will have a dusty or moldy odor. This makes hay less appealing. Also, if you have moldy hay, the quality is reduced because mold is using the protein and energy instead of the animals. Hay that is put up wet can also heat up to the point that it looks dark brown and is burnt. The quality of this hay is probably so poor that it takes more energy to digest the hay than the animals can get from it.

4. Are there a lot of weeds in the hay? Weeds in a bale tell us two things. First, the quality of the hay is low. Weeds like buttercup, horsenettle, thistle, broomsedge etc., are low quality, so large amounts of them will reduce the quality and palatability of hay. Also, a weed is growing where a grass or clover plant should be. More weeds mean less yield from the pasture. It may be time to think about fertilizing and doing something to improve the stand of grass or renovate with clovers.

5. What should I pay for this hay? If all the above qualities are good, nutritional attributes will vary seasonally and year to year. In the end, we want a hay with adequate energy and protein at the best price. Most producers purchase hay based on price per bale without much consideration given to actual weight of the product. According to Dr. Andrew Griffith, Assistant Professor with UT Extension Agriculture and Resource Economics, round bales of the same dimensions (height and width) can vary widely which can greatly affect value. In fact, university studies have shown most growers over estimate actual bale weight. Furthermore, absence of a forage analysis creates a major guessing game which can be costly for gestating ewes. Dr. Griffith provides examples comparing protein percentages on an 800 pound bale of hay costing $35.00 (See Figure 1). By evaluating unit cost of a pound of protein (and/or energy/TDN), the producer can get a much clearer idea of what the hay is actually worth (See Forage Test Results). Looking at the 800 pound bale, unit cost per pound of protein would be $0.31 if hay tested 14% however cost increases to $0.44 if test was 10% protein. Quite simply, you're getting fewer pounds of protein per bale

Figure 1:	**Hay price ($/800 pound bale)**			
	$20	$25	$30	$35
8% Protein	0.31	0.39	0.47	0.55
10% Protein	0.25	0.31	0.38	0.44
12% Protein	0.21	0.26	0.31	0.36
14% Protein	0.18	0.22	0.27	0.31

as weight decreases. The forage results provided are adequate in protein so let's look at TDN unit cost. The example shows TDN values quite different at 55% and 49% thus unit cost of TDN will be greater on the lower TDN at $0.09 with the higher TDN cheaper at $0.08.

Would it be cheaper to supplement lower quality hay with corn or buy the higher quality hay? Most hays in the Southeast are sufficient in protein for gestating ewes, however may lack adequate energy (TDN). Corn is an excellent energy source often used to supplement rations. At a $4.50 bushel price, corn will have a TDN unit cost of $0.09, which is comparable to TDN cost of the lower quality hay, which is sample 2 in the example. In this case, it would be more cost effective to purchase the Bermudagrass hay as it requires less supplementation. A higher quality hay will have a lower cost per unit price (and require less supplementation) than a lower quality hay. To become better producers, we must strive to weigh purchased hay (preferable buy at ton price) and furthermore, request a forage analysis to determine nutritional quality. Your county extension agent is always there to assist you.

These are questions that you have probably thought of before. But reconsider them with respect to how they impact the value of hay to the animal. Since they are the ones that have to eat it, evaluate the hay from their point of view.

Visual evaluation of hay is good, however a lab forage evaluation with a recommendation for additional supplementation can help the producer save money by giving the flock exactly what they need and not under or over feeding nutrients. The following is an example of a forage test on two different types of hay. Each has a different nutrient profile. At the end of the analysis is a recommendation for additional supplementation depending on the ewe's stage of production.

Dr. Bates, *received his Ph.D from the University of Georgia and his M.S. and Bachelor's of Science from Louisiana State University. He joined the faculty of The University of Tennessee in 1993 as an Extension Forage Specialist. Dr. Bates's educational program emphasizes the practices needed for profitable forage production. Forage species selection, establishment, fertilization, harvest and storage are the major areas of his program.*

Debbie Joines, *has a small flock of registered and commercial Katahdins in Middle Tennessee and is recently retired from UT Extension after 25 years with the Soil, Plant and Pest Center. She is president of TN Sheep Producers Association.*

UT Extension

Ewe Acres

The University of Tennessee
Soil, Plant and Pest Center
5201 Marchant Drive
Nashville, TN 37211-5112
(615)832-5850

FORAGE TEST RESULTS

Sample #	1	2
Sample Type	Bermudagrass	Fescue/Orchardgrass
Moisture (%)	10.62	12.54
Dry Matter (%)	89.38	87.46
	AS-FED BASIS	AS-FED BASIS
Protein (%)	14.55	10.84
Fat (%)	1.76	1.48
Fiber-ADF (%)	31.64	35.08
Fiber-NDF (%)	63.97	58.62
Calcium (%)	0.44	0.59
Phosphorus (%)	0.34	0.25
Magnesium (%)	0.17	0.19
Potassium (%)	2.22	1.40
TDN	55	49
Net Energy Maint (MCal/lb)	0.56	0.48
RFV	95	85

Supplement Recommendations

Sample 1 – Bermudagrass
155 pound ewe, late-gestation, twins: Feed 0.75 lbs. corn (or equivalent energy source) with this hay.

Sample 2 – Fescue/Orchardgrass Hay
155 pound ewe, late-gestation, twins: Feed 1.5 lbs. corn (or equivalent energy source) with this hay.

The analysis for these two samples shows that if a ewe is carrying twin lambs during gestation, the Bermuda hay will need to be supplemented with an additional ¾ pounds of corn or a feed of similar energy values to meet her gestating needs. The Orchardgrass/fescue hay, being lower in nutrient value, will have to be supplemented with 1 ½ pounds of corn to meet her gestating needs.

This simple example shows the value of a forage test in determining what the ewe needs depending on her stage of production. Underfeeding can have deleterious effects on the developing lambs and over feeding can be costly to the producer in the form of wasted feed dollars.

Tennessee and Kentucky Hay Forage Testing Program

Tennessee Soil, Plant & Pest Center
https://ag.tennessee.edu/spp/Pages/forage.aspx

Kentucky Department of Agriculture- 502-782-9210; Kimberly Field and Jim Wade

Dairy Goat Nutrition: Feeding for Two

(How to properly feed the goat and her rumen.)

By Robert J. Van Saun, DVM, MS, PhD

Part 2- Forage

Feed costs account for more than 60% of dairy or meat goat production costs. As a result, many producers have become engrossed in reducing the cost to feed a goat per day rather than optimizing their feeding efficiency. The cheapest ration is not usually the most production-efficient ration. This statement may sound like a contradiction, but relates to the understanding of how the goat and its rumen interact from a nutrient requirement perspective. In Part 1 of this article (HoofPrint Winter 2017), the exquisite interrelationship between the goat and the microbial population in its rumen was described laying the foundation for understanding appropriate feeding practices. This discussion focused on the importance of forage feeding to support microbial fermentation, rumen health and productive efficiency. The objective of this article is to better define forage quality through sensory and feed testing methods in order to provide the goat producers with the information necessary to better evaluate the use of forages in their feeding program.

Understanding Forage Quality

From the Dairy Goat Nutrition: Feeding For Two (How to properly feed the goat and her rumen) Part 1 in the Winter 2017 HoofPrint, we discussed how the goat digestive tract is designed to utilize forage materials. Goats require a wide variety of nutrients, including energy, protein, minerals and vitamins, to support bodily functions. Feeds are not equal in their ability to support animal functions of maintenance, growth, reproduction and lactation. Feed nutritive value is a function of the availability of energy and essential nutrients in support of animal performance. Three components of nutritive value are:

1. Digestibility - ability of the animal to break down the feed in the digestive tract;
2. Intake - how much of the feed the animal is able to consume, limited by fiber content (measured as neutral detergent fiber [NDF]) as well as other factors; and
3. Energetic efficiency - ability of the animal to obtain energy from the feed that can be used for production and maintenance purposes.

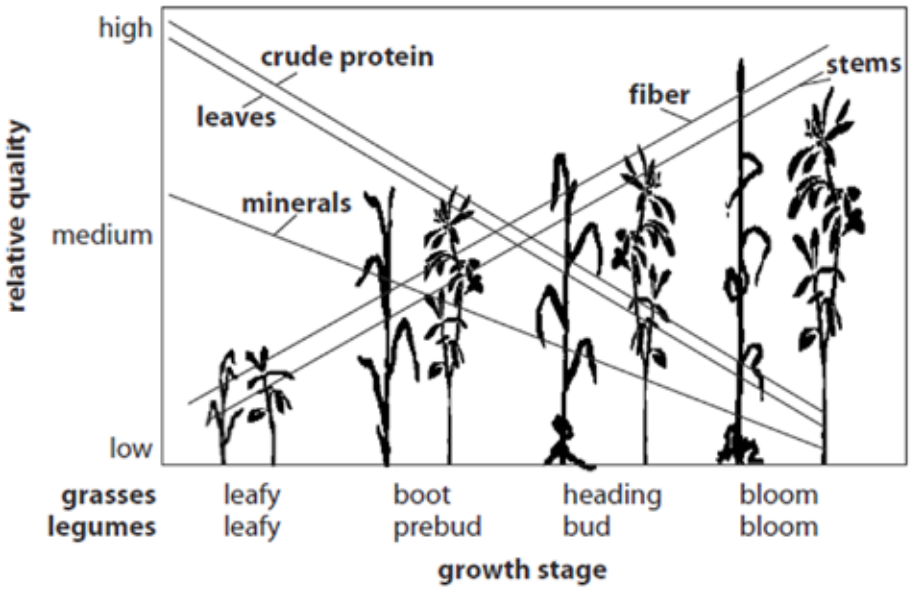

***Figure 1*. When grasses or legumes grow from leafy to bloom growth stages, protein and mineral contents decline dramatically with leafiness. Concurrently, stems and cell wall materials increase rapidly as canopies grow to a mature bloom stage.**

How well a particular forage meets these nutrient needs will determine the amount and composition of supplements, if necessary, to meet the goat's nutrient needs. High quality forages will require minimal supplementation compared to poor quality forages.

Forages, whether hay, silage, or pasture, have always provided the foundation of the goat ration. Most forages fed to goats are either grasses or legumes, but given their browsing preferences they may also consume a wide range of plant materials. Forage quality, irrespective of source, varies tremendously and will tremendously impact the feeding program. A multitude of factors can influence forage quality including: plant species, plant maturity, environmental conditions, fertilization, water availability, time of cutting, and storage practices. As a result, hay harvested from the same farm and field can vary within a year and among years. Also, it cannot be assumed that hay bought from the same person year after year will be the same quality each time! Unfortunately, hay quality does not necessarily direct the price. Often good and poor quality hays are sold for the same price, especially in years where hay production was limited. Your feed dollar is best spent on good quality hay. Factors that affect forage or feed ingredient quality include the following:

1. Plant species - legume hay generally higher in protein (16-20%), energy (NE_l = .63 Mcal/lb) and minerals (1-2% Ca) than grass hays (8-13% protein, NE_l = .49 Mcal/lb, .3-.75% Ca)
   a. Leaf-to-Stem Ratio - since leaves contain more energy and protein than stems, leafy hay of any type is desired.
   b. Reserve substances - seeds and plant starches, highly available and digestible
   c. Resistant substances - cell wall material and other compounds (lignin, tannins, cutins) that help the plant survive in the environment; poorly digested and reduce feed quality
   d. Nutrient content interrelationships - ratios between energy, protein, fiber in the feed relative to specific nutrient requirements.
2. Stages of maturity or date of cutting. Plant maturity is the single most important factor that determines

forage quality. The later the date of harvest, the lower the protein and energy content of both legume and grass hays, but the higher the dry matter content (Figure 1). Best time to harvest varies, but end of budding to early bloom stage is a good rule for most species.

3. Environmental Effects - environmental temperature and daylight are the two most important factors influencing plant growth. Sunlight increases digestible carbohydrate content of the plant, while temperature increases plant cell wall formation and lignification. The interaction between temperature and daylight can explain the differences from cutting to cutting.

4. Methods of Processing - a variety of methods can be used to increase the availability and digestibility of a feed source. Fiber sources are usually ground and pelleted to increase intake. Cereal grains may be ground, flaked, popped, or steam-flaked to increase the digestibility of the starch in the grain.

5. Storage practices - exposure of feed ingredients, especially forages, to moisture and oxidation (light, minerals) will result in a variable rate (3 to 40%) of nutrient loss. Most of these losses are highly available carbohydrates resulting in dramatic decreases in feed digestibility.

Forages are necessary to provide sufficient effective fiber to maintain rumen function and health. Fiber becomes a serious limitation to meeting energy needs with ever increasing levels of milk production. Feeding more grain to compensate for poor quality forages is not a feasible solution to maintain rumen or animal health. How do we determine quality of forage? This can be accomplished primarily through chemical analysis of the forage and sensory inspection. Sensory inspection can be helpful in distinguishing between poor and high quality forages, but, it cannot predict nutrient content. Chemical or nutrient analysis is the best method to estimate forage quality.

Sensory Evaluation of Forages

Although sensory evaluation of any given forage will not provide guidance as to the actual nutrient content of the forage, a careful evaluation process can provide some insights as to expectations for maturity, which will reflect nutrient content and potential risks (foreign objects, noxious weeds) (Table 1). It is recommended you visually inspect the forage for presence of mold and, if present, refrain from smelling as you might be inhaling mold spores that could initiate an allergic response. Smell of the forage is an important criterion, but one needs to be cautious in using this sense.

Table 1. Sensory evaluation in assessing forage quality.

Sensory Evaluation	Description/Comments
Visual Stage of maturity	Look for the presence of seed heads (grass forages) or flowers or seed pods (legumes), indicating more mature forages
Leaf to Stem ratio	Look at forage and determine whether stems or leaves are more obvious; high-quality legume forages will have a high proportion of leaves; stems will be less obvious
Color	Color is not a good indicator of nutrient content, but bright green color suggests minimal oxidation; yellow hay indicates oxidation and bleaching from sun; hay will have lower vitamins A and E content
Foreign Objects	Look for presence and amount of inanimate objects (twine, wire, cans, etc.), weeds, mold, or poisonous plants
Touch	Feel stiffness or coarseness of leaves and stems; see if alfalfa stems wrap around your finger without breaking; good-quality hay will feel soft and have fine, pliable stems
Smell	Good quality hay will have a fresh mowed grass odor; no musty or moldy odors; carmel or tobacco smell to hay indicates heat damage; silage should have slight pleasant fermented smell; vinegar, sweet, alcohol, tobacco, or rancid milk odors to silage indicate an abnormal fermentation has taken place and further diagnostic testing should be completed.

1. Stage of Maturity refers to the growth stage of the plant at the time of harvesting. As with all living things, specific changes occur with aging. As a plant becomes more mature, the cell wall portion increases (Table 2). All other nutrients will decrease with the increase in cell wall. Many nutrients can become unavailable as a result of being bound to the cell wall. More mature plants will have larger and thicker stems and either seed heads or blooms.

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Table 2. Typical test value of temperate and subtropical alfalfa and grass hays harvested at various stages of plant maturity (all values on dry matter basis).[1,2]

Hay Type and Maturity Stage	CP % DM	ADF % DM	NDF % DM	ME Mcal/lb	TDN % DM
Temperate Forages					
Alfalfa *					
Pre-bloom	> 19	< 31	< 40	1.03 - 1.13	63 - 66
Early bloom	17-19	30-35	40-46	0.98 - 1.02	60 - 62
Mid bloom	13-16	36-41	46-51	0.92 - 0.97	56 - 59
Late bloom	< 13	> 41	> 51	< 0.90	< 55
Grass **,+					
Prehead	> 18	< 33	< 55	0.98 - 1.07	60 - 65
Early head	13-18	34-38	55-60	0.85 - 0.91	52 - 56
Head	8-12	39-41	61-65	0.75 - 0.84	46 - 51
Post-head	< 8	> 41	> 65	< 0.75	< 46
Subtropical Forages					
Alfalfa*					
Pre-bloom	25-30	30-32	33-41	1.03 - 1.13	63 - 65
Early bloom	19-27	34-37	40-47	0.95 - 1.02	58 - 62
Mid bloom	18-23	35-39	46-51	0.90 - 0.93	55 - 57
Late bloom	17-18	>41	>51	< 0.89	< 54
Grass** ,++					
Prehead	18-19	32-33	64-69	0.84 - 0.98	51 - 60
Early head	8-18	34-40	64-79	0.74 - 0.82	45 - 50
Head	6-11	39-43	70-80	0.66 - 0.72	40 - 44
Post-head	4-9	39-47	71-81	< 0.66	< 40

[1]Adapted from Van Soest PJ: *Nutritional Ecology of the Ruminant*, ed 2, Ithaca, 1994, Cornell University Press and National Research Council, Subcommitte on Feed Composition, Committee on Animal Nutrition: *United States-Canadian Tables of Feed Composition: Nutritional Data for United States and Canadian Feeds*, rev ed 3, Washington, DC, 1982, National Academy Press.

[2]Abbreviations: CP = crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; ME = Metabolizable energy; TDN = total digestible nutrients; DM = dry matter.

*Alfalfa growth stages: pre-bloom = bud to first flower; early bloom = up to 1/10 of plants in bloom; mid bloom = 1/10 to 2/3 of plants in bloom; late bloom = >66% in bloom.

**Grass growth stages: prehead = late vegetative to early boot stage; early head = emergence of seed heads (inflorescence); head = further emergence of seed heads, seeds become well formed; post-head = seeds fully matured and released.

+Summary analysis from orchardgrass, reed canarygrass, smooth bromegrass, and tall fescue.

++Summary analysis from Bahiagrass, Pangola, and Bermudagrass at 2-3 (Prehead), 4-6 (Early head), 6-8 (Head) and 10 (Post-head) weeks of growth.

2. Leafiness is an important factor in evaluating hay since most of the digestible nutrients, especially protein, reside in the leaf. As the plant matures the leaf-to-stem ratio will decline. If the plant is not cured and handled properly many leaves will be lost due to shatter, especially for alfalfa hays.

3. Color of forage can indicate when the plant was cut and how well it was cured and stored. Bright green color indicates high vitamin A content and generally high quality. Yellowing color to the hay may indicate excessive sun curing, overly mature forage or both. Brown to black discoloration usually indicates heating from fermentation and moisture damage. These forages have the highest potential for molding and are unacceptable feeds. Silages may be a yellow color or greenish color as a result of abnormal fermentations.

4. Odor of high quality hay should be similar to newly-mown grass. Hay should not have a musty, mildew or rotten smell. Be cautious in smelling forages for risk of mold spores. Silages that smell like vinegar, ethanol, or rancid butter all have abnormal fermentations, which can result in depressed feed intake. Heat-damaged feeds will smell like tobacco, caramelized, or burned.

5. Foreign Material is anything which does not belong in hay. Harmless foreign material would include certain weeds, other plants, sticks or dirt. Other materials that could harm the goat can also be found in forages. These materials may include poisonous plants, awns, metal objects, insects and molds. High quality forage should be free of foreign material.

Feed Nutrient Analysis

A forage, or any other feed, can be analyzed for its nutrient content by two methods: wet chemistry or near infrared spectroscopy (NIR). A wide variety of tests can be completed by most forage testing service labs (Figure 2). The most common tests run are listed and detailed below:

1. Dry Matter Content is determined by heating a weighed sample of the feed in a drying oven until a constant weight and is expressed as a percentage of weight of the wet sample. Example: a forage which contains 10% water has a dry matter content of 90%. Hay and other dried feeds should contain less than 15% moisture, otherwise they are prone to molding. Silages will vary from 70% to 50% moisture. Pasture may contain anywhere from <15% to 25% dry matter.

2. Crude protein is determined by measuring the nitrogen content of a sample of the feed and multiplying by 6.25 (assumes all nitrogen in the sample is protein nitrogen and that protein is approximately 16% nitrogen). Protein content of a forage will depend upon

Figure 2. Comparison of essential nutrients, feed chemical composition, and analytical testing procedures.

Essential Nutrients		Chemical Components	Analytical Procedures	
Fatty acids, fat-soluble vitamins		Lipids, pigments, sterols	Ether Extract	
Protein, amino acids		Nitrogen-containing compounds - protein, nonprotein nitrogen	Kjeldahl Procedure (Crude Protein)	
Inorganic minerals		Ash	Ashing (complete combustion)	
Carbohydrates	Glucose	Sugars	Nonstructural Carbohydrates‡	Nonfiber Carbohydrates+
		Starches		
	Dietary fiber	Soluble fiber		
		Hemicellulose		Neutral Detergent Fiber
		Cellulose	Acid Detergent Fiber	
		Lignin*		

*Lignin is not truly a carbohydrate compound but is so intimately associated with cell wall carbohydrates that it is often included as such.
‡Enyzmatic methods used to determine sugar and starch content.
+Determined by difference (100 - CP - EE - NDF - Ash).

the plant species. Protein content from lowest to highest for common forages will be: corn silage (7-9%), grass (8-14%), and alfalfa (15-22%). A grass forage containing less than 8% crude protein is not desired for a feeding program.

3. Fiber analysis is a measure of the plant cell wall and other less digestible or fermentable components of the plant. The original measure of fiber is Crude Fiber (CF). However, crude fiber does not define the total cell wall fraction (indigestible or slowly digestible material) of feedstuffs very well. This results in overestimation of the energy values for forages in comparison to concentrates. As a result, a newer procedure to determine cell wall content was developed.
   a. Neutral Detergent Fiber (NDF) contains hemicellulose, cellulose and lignin, which better represents the total cell wall portion of the plant. NDF content of a plant has been associated with intake. The higher the NDF the more mature and lower quality the plant (Table 1).

   b. Acid Detergent Fiber (ADF) contains cellulose and lignin. The difference between CF and ADF is that the ADF fraction more closely estimates the poorly digestible carbohydrate fraction than does CF, which excludes some poorly digestible components. Low quality forages have higher ADF values (Table 1).

3. Minerals - both macromineral (e.g., calcium, phosphorus, magnesium, potassium, sodium and sulfur) and micromineral (e.g., iron, copper, zinc,

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manganese and molybdenum) content can be determined. Mineral analysis is not always done since it is the most expensive test. Mineral content of forages will depend upon plant species, soil conditions and fertilization practices and are very variable. Interpretation of forage mineral is provided in Table 3.

Table 3. Interpretation of forage mineral content

Macromineral	**Deficient**	**Marginal**	**Adequate**	**Excessive**
Calcium, %	< 0.2	0.2 – 0.3	0.35 – 0.8	> 1.5
Phosphorus, %	< 0.1	0.1 – 0.18	0.2 – 0.4	> 0.5
Magnesium, %	< 0.05	0.05 – 0.1	0.1 – 0.25	> 0.4
Potassium, %	< 0.4	0.4 – 0.6	0.6 – 0.8	> 1.5
Sulfur, %	< 0.10	0.1 – 0.14	0.15 – 0.20	> 0.35
Micromineral	**Deficient**	**Marginal**	**Adequate**	**Excessive**
Copper, mg/kg	< 4	4 – 7	8 – 12	> 20
Iron, mg/kg	< 50		50 – 200	> 400
Manganese, mg/kg	< 20	20 – 39.9	≥ 40	> 300
Molybdenum, mg/kg			< 1.0	> 3.0
Selenium, mg/kg	< 0.1	0.1 – 0.2	> 0.2	> 5.0
Zinc, mg/kg	< 20	20 – 29.9	≥ 30	
Cu:Mo ratio	< 4.0:1	4.0 – 4.5:1	> 4.5 – 6:1	> 16:1

Energy is derived from carbohydrate, fat and protein. Energy content of a feed (i.e., digestible energy, total digestible nutrients [TDN]) is not directly measured like other nutrients but, derived through regression equations. ADF and CP values are used to predict energy value. Most labs report energy values based on cattle equations, which are reasonably close estimates for goats.

The cost of nutrient analysis is variable with a range from $15 for limited information up to $95 for a more extensive report. As with hay prices, a high cost does not necessarily mean a high quality report. Lower cost packages typically use NIR analyses, which are limited in accurately determining minerals, compared to wet chemistry. However, wet chemistry is usually more expensive. Many forage testing laboratories are providing mixed analytical testing using both NIR and wet chemistry on minerals to provide a lower cost, comprehensive forage analysis. One needs to contact a number of labs and ask questions concerning methods used, quality control validation, retesting procedures and costs. The National Forage Testing Association (www.foragetesting.org) provides a listing of certified laboratories by state and information on proper forage sampling. With an analysis of the feed, one can better address the nutritional needs of the rumen and goat to minimize health problems and maximize milk production.

In this second article we focused on improving your ability to recognize forage quality to better provide more nutrients to goats, thus minimizing the need for additional supplements. Mother Nature has developed an exquisitely orchestrated interrelationship between goat and rumen bacteria. This relationship allows the goat to utilize feed materials that could not have used without the aid of the rumen bacteria. In our agricultural production systems we should be taking full advantage of this system rather than trying to work against it or attempt to ignore the rumen and its function. Our feeding programs should be formulated to address daily nutrient needs for both goat and rumen in order to maximize milk or meat yield for minimal total feed costs and maintain animal health and longevity, thus making milk or meat production more efficient. Quality forage is the cornerstone of a goat feeding program. Through both sensory and feed testing assessments informed decisions can be made on providing the most appropriate forage to a specific feeding program.

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.*

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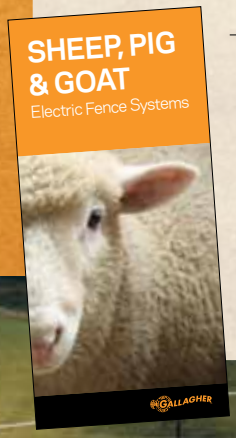

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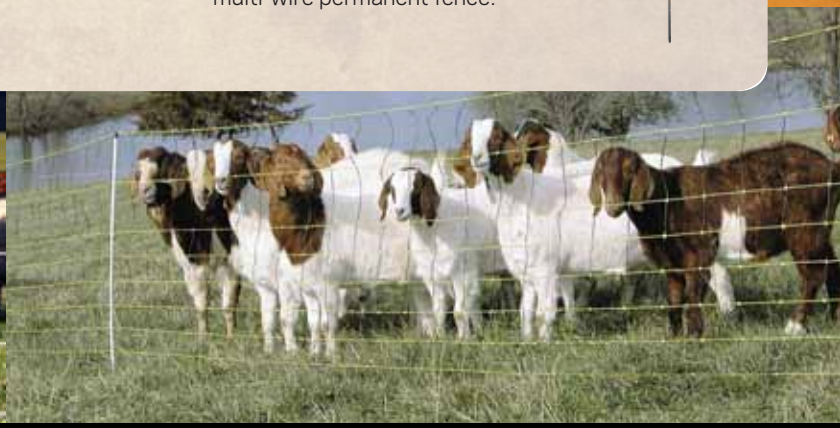


GALLAGHER

Navigating to a Balanced Ration

Part 2: Balancing for Protein

By Dr. John Johns, Nutritionist
Burkmann Nutrition

In Navigating to a Balanced Ration Part 1: Balancing for Energy (Winter 2017), we explained, 1) why a balanced ration should be fed to sheep and goats, 2) the nutrient requirements for animals of differing weights and stages of production, and 3) the importance of and an example of a feed/forage analysis. We also provided an example of using the Pearson Square to balance for energy (TDN). At the end of the article, we pointed out that just balancing for energy is not enough. We must also balance for the second largest nutrient required -- crude protein.

Importance of Crude Protein

To complete a balanced ration, we must determine if our forage and concentrate mixture meets the animals' crude protein requirements. Failure to meet these requirements, particularly in the last third of gestation, can result in several severe problems. For example, when females are shorted on protein late in gestation, newborns may be born weak and unable to rise and nurse even after being cleaned by their mother. Mortality can be high even with producer intervention. Secondly, colostrum quality may also be compromised. Adequate protein in the mother's diet is essential for the production of the immunoglobulins put into the colostrum and passed to the newborn in the first 24 hours of life. When dietary protein is inadequate, immunoglobulin production will be decreased and the newborn may not receive adequate transfer of passive immunity to disease. The newborn is dependent on this passive transfer for disease protection during the first few weeks of life. When it fails, increased sickness and mortality rates can result. Even in the survivors, growth rate will be significantly decreased.

Review

Before we begin the process of balancing for protein, let's review the scenario from Part 1: Balancing for Energy. Our scenario was balancing a ration for a 66-lb replacement female that required the ration dry matter to be 15.8% crude protein and 65% TDN.

We also provided the crude protein of our hay based on a forage analysis:

The female was fed hay, as well as a purchased concentrate supplement that was **24% protein and 80% TDN** on a dry matter basis.

From the calculations in the Part 1, we learned the **hay/concentrate mixture for the 66-lb female needed to be 68% hay and 32% concentrate, on a dry matter basis,** to meet her energy needs.

Calculating Crude Protein

Now, we must determine the crude protein content of our mixture and compare this to the animal's needs.

Table 1: Nutrient Requirements for Small Ruminant Replacement Females, % of Ration Dry Matter					
Weight, lb	DMI, lb	CP %[a]	TDN %[a]	Calcium %[a]	Phosphorus %[a]
66	**2.6**	**15.8**	**65**	**.54**	**.23**
88	3.1	12.8	65	.42	.19
110	3.3	9	57	.33	.15
132	3.3	9	57	.3	.15
154	3.3	9	57	.3	.18

[a]Percent of ration dry matter.

Table 2: Example Forage Analysis, Percent		
	As Received Basis	Dry Matter Basis
Moisture	12.0	
Dry Matter	88.0	100
Crude Protein	12.5	**14.2**
RDP, % of CP		55
TDN	51	**58**
Calcium	.44	.50
Phosphorus	.26	.30

Step 1: Multiply the crude protein percentage of the hay (14.2% from hay analysis; Table 2) by the percent hay in the mixture (68%).

Hay 14.2% crude protein X 68% = 9.5% crude protein

Step 2: Multiply the crude protein from the concentrate (24% crude protein from concentrate) by the percent concentrate in the mixture (32%).

Concentrate 24% crude protein X 32% = 7.6% crude protein

Step 3: Add the two percentages to obtain the percent crude protein of the mixture.

Hay crude protein 9.5% + concentrate crude protein 7.6% = 17.1% crude protein

Our hay and concentrate/supplement mixture is 17.1 % crude protein. Comparing this with the animal's needs of 15.8% of ration dry matter (Table 2) means that we are meeting the crude protein needs and our ration is balanced. The only step left is to meet the vitamin and mineral requirements and this can be done by providing free choice access to a high quality commercial vitamin/mineral supplement.

Troubleshooting

In real life, the hays we feed may not be as high in crude protein content as the one in our example. When that is the case, what do we do?

Let us assume that our hay tested 10% crude protein on a dry matter basis. Now, we follow the same procedure as shown above.

Step 1: Multiply the crude protein percentage of the hay (10%) by the percent hay in the mixture (68%).

Hay 10% crude protein X 68% = 6.8% crude protein

Step 2: Multiply the crude protein from the concentrate (24% crude protein from concentrate) by the percent concentrate in the mixture (32%).

Concentrate 24% crude protein X 32% = 7.6% crude protein

Step 3: Add the two percentages to obtain the percent crude protein of the mixture.

Hay crude protein 6.8% + Concentrate crude protein 7.6% = 14.4% crude protein

Comparing the mixture value of 14.4% crude protein to the animal's need of 15.8% crude protein (Table 2) reveals a shortage of 1.4% dry matter crude protein. A protein supplement will be necessary.

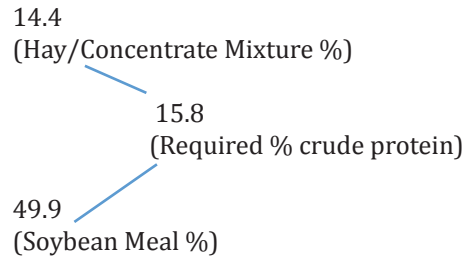
Soybean meal would be the common protein supplement used as its crude protein value is 49.9%. Going back to the Part 1: Balancing for Energy, a second Pearson Square is needed to balance the hay/concentrate mixture with soybean meal to reach a 15.8% protein ration (Table 1).

Step 1: Place the protein values of the hay/concentrate mixture and soybean meal from the scenario above on the left diagonals of the square.

14.4
(Hay/Concentrate Mixture %)

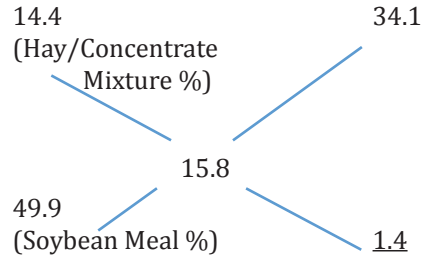
49.9
(Soybean Meal %)

Step 2: Place the required protein value in the center of the square.



Step 3: Subtract across the diagonal, placing the differences on the right diagonals.

14.4 (Hay/Concentrate Mixture %) – 15.8 crude protein required= 1.4
49.9 (Soybean Meal %) - 15.8 crude protein required= 34.1

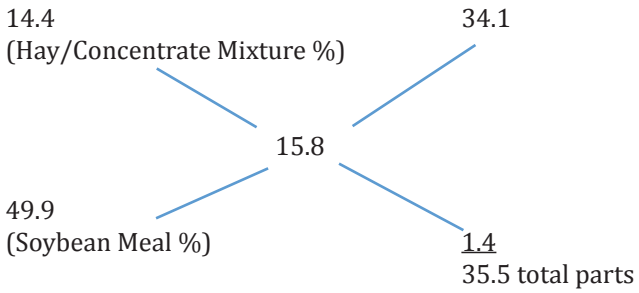


Balanced Ration continues on pg. 20

Balanced Ration continued from pg. 19

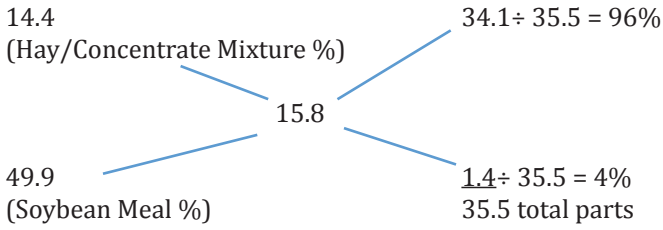
Step 4: Add the values on the right diagonals and this is the total parts of the complete ration.

34.1 + 1.4= 35.5 total parts



Step 5: Divide each number on the right diagonal by the total parts in the ration to determine the percentage of the mixture composed of the hay/concentrate mixture and the soybean meal.

34.1 ÷ 35.5 = 96%
1.4 ÷ 35.5 = 4%



Now we know that soybean meal will be 4% of the final mixture and the hay/concentrate will be 96% of the final mixture.

Step 6: To determine what we will feed we must determine the pounds of dry matter that each feed ingredient contributes to the total. This is done by multiplying the pounds of daily dry matter consumed (Table 1) by the percentage each ingredient contributes to the total (calculated in Step 5). Always calculate the protein supplement first.

Daily dry matter 2.6 lb (Table 1) X 4% (Step 5)= .11 lb soybean meal dry matter

Step 7: Subtract the soybean meal protein supplement dry matter from the total consumed.

2.6 lb (total consumed) – .11 lb (Soybean meal dry matter) = 2.49 lb hay/concentrate mix

Step 8: Remember from the first Pearson Square that our hay concentrate mixture is 68% hay and 32% concentrate. Multiply the pounds of dry matter remaining **(Step 7)** by the percent hay and concentrate from the first Pearson Square (68% hay and 32% concentrate).

2.49 X 68% = 1.69 lb hay dry matter
2.49 X 32% = .80 lb concentrate dry matter

Step 9: Now, convert pounds of dry matter to an as fed basis so we will know how much of each ingredient to actually feed. We do this by dividing the pounds of ingredient dry matter (1.69 hay, 0.80 concentrate) by the percent dry matter of the ingredient. Hay is 88% dry matter. The concentrate mixture is assumed to be 90% dry matter and soybean meal is 89% dry matter.

Hay = 1.69 lb ÷ .88 (Table 2) = 1.92 lb
Concentrate = .80 lb ÷ .90 = .89 lb
Soybean meal = .11 lb ÷ .89 = .13 lb

Putting It All Together

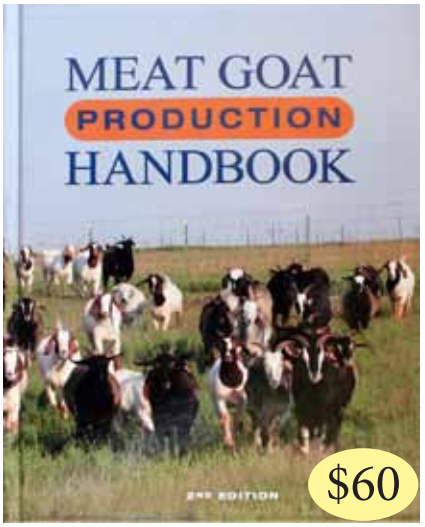
In whole numbers, the producer would feed 2 lb of hay, .9 lb of the purchased concentrate and .15 lb of soybean meal to the 66 lb female daily to have a balanced ration.

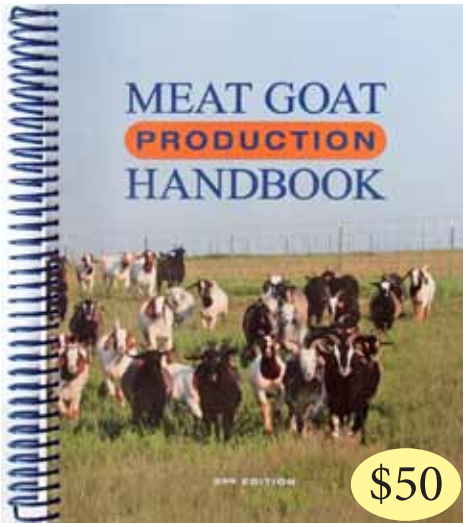
Remember

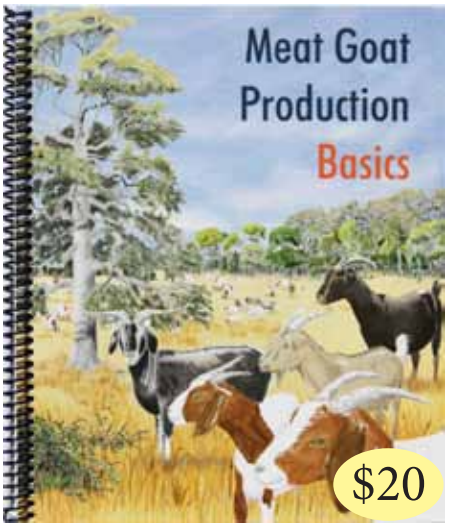
Providing a balanced ration to our animals in any state of production will ensure that they do the best their genetics will allow. This will optimize production and minimize the cost.

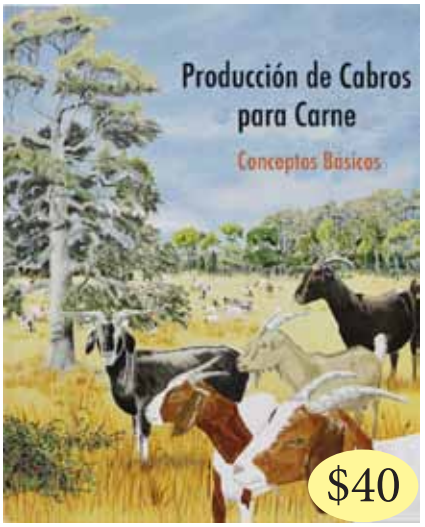
Dr. John Johns, *received his Bachelors in Science form Western Kentucky University and earned his Masters Degree and Ph.D. from Michigan State University. Dr. Johns taught at the University of Kentucky as an Extension Professor from 1974 until his recent retirement. Upon retirement from the University of Kentucky, Dr. Johns has joined his expertise with the Burkmann nutrition family.*

Goat Production Handbooks



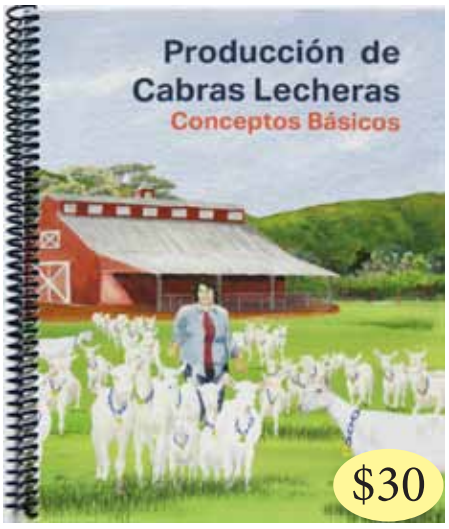


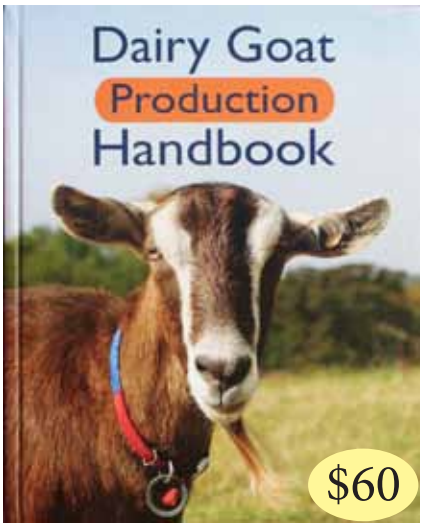


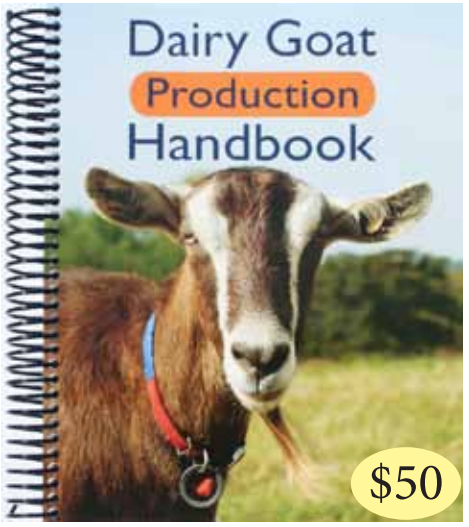


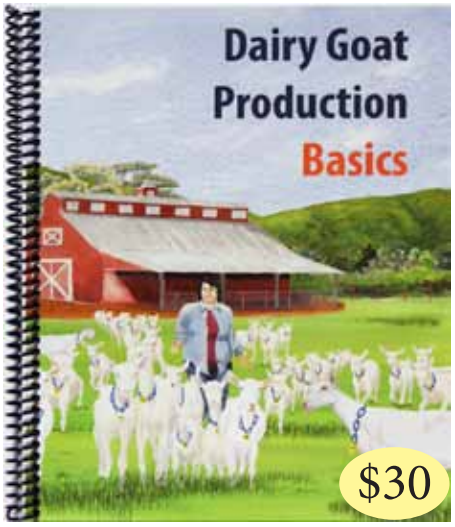
Books available from the American Institute for Goat Research, Langston University

Price includes domestic shipping. Find order forms and additional information at the American Institute for Goat Research website. Go to http://goats.langston.edu and enter the Library section.









NEWS TO EWES

A Hay for Every Season

By Dr. Donald G. Ely, University of Kentucky

Introduction

Webster's New Collegiate Dictionary and the internet has the same definition of **Hay. Both sources say it is herbage, and especially grass, mowed and cured for fodder**. Fodder is coarse feed for cattle, horses, sheep, and goats. This broad definition allows for many descriptions of hays, probably as many as there are types of hays. For example, I have heard hay called legume, grass, grass-legume, good, sorry, low-quality, medium-quality, high-quality, stemmy, leafy, bright, bedding, bed and breakfast (Figure 1), sheep, cattle, goat, weedy, moldy, wet, rained on, tobacco, and dusty. There is a connection attached to each of these descriptions. That is, each description relates, either directly or indirectly, to the quality of the hay.

Figure 1. Bed and Breakfast Hay

Hay Quality

The first factor that affects hay quality is **palatability**. Sheep are superb evaluators of hay quality. If they readily consume it, it is high-quality. If they use it for "bed and breakfast", it is low-quality. Hay consumption depends on its smell (sweet vs. musty), feel (soft vs. hard), and taste (sweet, sour, or salty). Animals must consume their allotted amounts if they are to perform to the producer's goal(s). **Intake** of palatable, high-quality hay will always be greater than lower quality, which will allow producers a better chance of achieving the goal(s) they have set for their animals. **Digestibility** is the extent to which complex chemical compounds (protein, starch, cellulose, hemicellulose, minerals, and vitamin complexes) of the consumed hay dry matter are reduced to simple compounds in the digestive tract so they can be absorbed into the blood for use by all body cells. Leafy hay, harvested in the vegetative stage of maturity, can be 80 to 90% digested and absorbed. On the other hand, allowing this same forage to become mature and "stemmy" will result in a hay that may be only 40 to 50% digested and absorbed. In the latter case, 50 to 60% of the components (protein, starch, cellulose, hemicellulose, minerals, and vitamins) of the consumed dry matter passes out of the digestive tract, as feces, without providing any benefit to the animal.

Nutrient Content

The nutrients in hay are all located in the dry matter. This usually makes up 85 to 92% of every bale. The dry matter is made up of either plant cell contents (center of each cell) or structural components that make up each cell wall. The cell contents (nonstructural components) include protein, sugars, and starch. Sugars and starch provide energy. Higher quality hays contain a higher percentage of cell contents and typically are a brighter, greener color than those that are lower quality. The structural components (cell walls) contain cellulose, hemicellulose, and lignin. These provide energy, too, but less than sugars and starch. When grouped together, they are the "fiber" component of plants (neutral-detergent fiber = NDF and acid-detergent fiber = ADF). These "fiber" components are less digestible than the cell contents; thus, lower quality hays are harvested when forages are mature and stemmy. These hays contain higher

percentages of cell wall components and will have a lighter green color than those of higher quality. They may even be a tan color if excessively mature and stemmy.

The presence of **anti-quality factors**, such as tannins, nitrates, alkaloids, cyanoglycosides, estrogens, and mycotoxins, can significantly reduce animal performance even though the hay may appear high-quality. Care should be taken during the growing and harvesting of hay to prevent any accumulation of these anti-quality factors. Weeds can also decrease the quality of hay by diluting out the cell contents and/or fiber components. Animal performance will be reduced because of the presence of unpalatable weed infestation.

Animal Performance

This is the ultimate test of hay quality. **Different levels of animal performance require different hays. Or, different hays produce different animal performance.** For example, lactating ewes require the highest quality hays (maximum palatability, intake, digestibility, nutrient content, and freedom from anti-quality factors) because they need the hay protein, energy, minerals, and vitamins to be transformed into maximum milk production and still be able to maintain their other bodily functions. In contrast, dry, open ewes need less protein, energy, minerals, and vitamins than lactating ewes because all they have to do is maintain their body. They can do this by consuming lesser amounts of lower quality hays that have less protein, energy, minerals, and vitamins. This simple scenario indicates that for maximum performance and efficient production, producers need at least two different quality hays.

Stage of maturity at harvest is the most important factor that affects hay quality. This effect is illustrated through intake and digestibility values shown in Table 1. These data were accumulated over a period of years, were analyzed by researchers (J.B. Stone, G.W. Trimberger, C.R. Henderson, J.T. Reid, K.L. Turk, and J.K. Loosli) at the University of Wisconsin, and were published in the Journal of Dairy Science in 1960. The fact that this research has not been duplicated, but has been used many times over to illustrate the effect of stage of maturity on hay quality, justifies its description as "classic research".

Even though the data in this table were collected from dairy cows, the results can be directly applied to sheep. The data illustrate how the plant growth stages change during the 5-week period from June 3 to July 10 and how the animals responded to these changes when they were offered the hays. Cows consumed over 2.6% of their body weight (BW) daily when they were fed the hay harvested in the vegetative stage. It was clearly highly digestible (63.1%). Consumption level and digestibility, together, indicates this hay was high-quality. If so, it must have been leafy and must have contained a high percentage of nonstructural cell components (cell contents = protein, sugars, and minerals) and a low percentage of cell wall components (structural components = cellulose, hemicellulose, and lignin = fiber). Cows fed the late-bloom hay harvested on July 9/10 ate only 74% as much (1.95% BW) and digested only 82% as much of the hay as those fed hay harvested in the vegetative stage. The relationship between nonstructural (cell contents) and structural (fiber) components in this hay could not support performance near that of the vegetative hay because the cows would not eat it and could not digest a high percentage of what they did eat.

Table 1. Intake and Digestibility of Cool Season Grass Hays by Lactating Dairy Cows[a]

Cutting date	Growth stage	Hay intake/d, % of BW[b]	Hay digestibility, %
June 3/4	Vegetative	2.64	63.1
June 11/12	Early boot	2.36	65.7
June 14, 15	Late boot	2.45	62.6
June 16 - 18	Early head	2.28	58.5
July 1	Bloom	2.30	52.7
July 5	Bloom	2.13	52.2
July 7, 8	Bloom	2.09	52.5
July 9, 10	Late-bloom	1.95	51.5

[a] Summary of several studies using different grasses.
[b] BW = body weight

Table 2. Leaf and Stem Quality of Alfalfa and Timothy Components

Plant component	% of whole plant	CP, %[b]	NDF, %[b]	ADF, %[b]
Alfalfa				
Upper leaf [a]	31	24	28	18
Lower leaf	13	22	26	16
Upper stem [a]	6	13	53	39
Lower leaf	50	9	68	53
Timothy				
Leaf	30	18	49	26
Stem	70	5	73	43

[a] Upper leaf and stem taken from last 5 internodes on each stem.
[b] CP = crude protein; NDF = neutral detergent fiber (synonymous with cell wall constituents); ADF = acid detergent fiber (cell wall constituents minus hemicellulose).

Dr. Mike Collins, formerly of the University of Kentucky Plant and Soil Science Department, published the data in Table 2. This table shows how the leaf-to-stem ratio is a major player in the decline of forage quality as plants mature. Leaves are higher quality (higher protein and lower NDF and ADF) than stems (lower protein and higher NDF and ADF) in both alfalfa and timothy. The proportion of leaves decreases as the proportion of stems increases when the plant advances toward maturity. If the goal is to obtain maximum animal performance from hay feeding, the data in Table 2 show the hay must have maximum leaf content whether it is a legume, like alfalfa, or a grass, like timothy.

Feeding Hay to Ewes

Hay is traditionally fed to sheep (especially ewes) during the winter (November/December to March/April). However, it may be fed during other seasons of the year. For example, ewes that lamb in September/October may be fed a lactation diet of hay and concentrates rather than

News to Ewes continues on pg. 24

News to Ewes continued from pg. 23

allowing them to graze forage being stockpiled for winter grazing. Or, a late gestation diet of hay and concentrates may be fed prior to lambing in April, although ewes and lambs may graze spring forage later. So, the production phase (Table 3), rather than the season of the year, may be the main factor that determines when hay is fed. **Then, the type and quality of hay to feed depends on the job the ewe has to do**.

Table 4 shows the pounds of dry matter required per day for ewes of different weights to produce efficiently during each production phase. Within a weight class (Example: 150 lb), dry matter requirements are lowest at M (2.6 lb/hd/d), increase 1.5 times during F/B (4.0 lb), drop during EG (3.1 lb), increase again in LG (4.2 lb), and are highest during L (6.2 lb). Once the dry matter requirements are determined, the next step is to decide which hay fed alone or which hay/concentrate combination, and amount of each, will meet these requirements most efficiently.

Remembering the factors affecting hay quality and using the daily feed requirements for different production phases (Table 4), one can quickly surmise that ewes at M and during EG can be fed the poorest quality hay (daily gains of 0.02 and 0.07 lb/hd). If hay has to be fed when ewes are open and dry (M),

Table 3. Production Phases in an Annual Management Program for Ewes

Phase	Length, days
Flushing	14
Breeding[a]	54
Early gestation[a]	110
Late gestation	28
Lactation	60
Maintenance (open, dry)	129

[a] Breeding and early gestation overlap so total days will be greater than 365.

Table 4. Daily Dry Matter Requirements of Ewes[a]

	Production phase[c]				
Ewe weight, lb[b]	M	F/B	EG	LG	L
110	2.2	3.5	2.6	3.7	5.3
130	2.4	3.7	2.9	4.0	5.7
150	2.6	4.0	3.1	4.2	6.2
175	2.9	4.2	3.3	4.4	6.6
200	3.1	4.4	3.5	4.6	7.0
Daily gain, lb	0.02	0.22	0.07	0.50	-0.13

[a]To convert these dry matter values to "as-fed", divide by 0.90 (average).
[b]All weights are based on ewe weights when they are dry, open, and in moderate condition

M = maintenance; F/B = flushing/breeding (2 weeks before and 3 weeks into the breeding season); EG = early gestation; LG = late gestation with 1.80 to 2.25 lambing rate expected; L = lactation (first 8 weeks nursing twins).

feed the daily amounts of the lowest quality (late-bloom or mature grass) as shown below. Feeding larger amounts will be wasteful.

If hay has to be fed during F/B, it should be medium-quality (early-boot for grass or mid-bloom for legume) to produce a daily gain of 0.22 lb/hd (Table 4). Feeding hay alone will not produce this gain because the fiber contained within is more undigestible than is the starch/sugar provided through concentrates (grains). Therefore, extra dietary energy is needed to produce the needed gain. Usually, this will be provided by shelled corn or a corn-based mixture. The following amounts of hay and corn should be fed to ewes of different weights during F/B.

Ewe weight, lb	Hay/hd/d, lb
110	2.75
130	3.00
150	3.25
175	3.50
200	3.75

More hay than the amount required for ewes to do their job can always be fed.

Ewe weight, lb	Medium-quality hay,lb/hd/d	Corn, lb/hd/d
110	3.0	.60
130	3.1	.70
150	3.3	.80
175	3.4	.90
200	3.5	1.00

However, feeding excess is wasteful from the standpoint that ewes may use it for bedding or they may get too fat. Because hay is the most expensive feedstuff consumed by ewes, on an annual basis, correct amounts should be fed during each production phase if economic efficiency is a production goal. **Also, any hay (grass or legume) of any quality (Table 1) can be fed in any production stage (Table 3). But, amounts fed must be flexible and depend on type of hay, its quality, and the production stage of the sheep that will consume it.**

Ewes gain 0.07 lb/hd/d during EG (Table 4). This is only 0.05 lb/hd/d more than for M ewes. EG ewes can be expected to gain this amount if the low-quality hay fed during M is replaced with medium-quality grass (early-head to bloom: Table 1) or late-bloom legume. If the same hay, fed during M, has to be fed during EG, supplementing with 0.25 lb/hd/d (110-lb ewes) to 0.50 lb/hd/d (200-lb ewes) shelled corn will be necessary to produce 0.07 lb/hd/d gain.

Nutrient requirements increase dramatically during LG and become even higher during L (Table 4). The second highest quality hay (boot for legumes to early-head for grass and mid-to late-bloom) should be fed during LG with the highest quality (vegetative to boot stage for grass and early-bloom to mid-bloom for legume) reserved for L. Even medium-quality hay fed in LG and high-quality fed during L will require energy supplementation (usually shelled corn or a corn-based mixture) to stimulate the needed body weight gain in LG (0.50 lb/hd/d) and to prevent ewes from losing more than 0.13 lb/hd/d during L (Table 4). Some suggested daily rations for ewes of different weights in LG and L are shown in Tables 5 and 6, respectively. The hays described in these tables can be grass, grass/legume, or legume. **Legume hays are preferred for LG and L**. In the event low-quality hays (headed out for grass or full-bloom for legume) have to be fed during these production stages, supplementation with soybean meal (0.25 in LG and 0.5 lb/hd/d in L) will be required to meet protein requirements. Do not feed any more low-quality hay or corn. Simply feed the soybean meal in addition to the amounts of hay and corn shown in Tables 5 and 6. **Still, for best performance, feed the second highest quality hay in LG and the highest quality in L**.

Provide ewes ad libitum access to loose, complete mineral, manufactured specifically for sheep, every day of the year.

Table 5. Daily LG Rations (lb/hd/d) for Ewes of Different Weights and Expecting a 1.8 to 2.25 Lambing Rate

	Ewe weight, lb [a]				
	110	130	150	175	200
Ration ingredient					
Medium-quality hay [b]	3.5	3.7	4.0	4.0	4.2
Shelled corn	0.5	0.7	0.8	1.0	1.0

[a] All weights taken when ewes are dry, open, and in moderate condition.
[b] Boot to early head stage for grass; mid- to late-bloom for legume.

Table 6. Daily L Rations (lb/hd/d) for Ewes of Different Weights and Suckling Twins (First 8 Weeks Lactation)

	Ewe weight, lb [a]				
	110	130	150	175	200
Ration ingredient					
High-quality hay [b]	4.5	4.7	5.0	5.5	6.0
Shelled corn	1.5	1.8	2.0	2.0	2.2

[a] All weights taken when ewes are dry, open, and in moderate condition.
[b] Vegetative to early boot stage for grass; early bloom for legume.

Summary

If we don't know the quality of hay we plan to feed to our sheep, all we have to do is feed it and see if they eat it. If they readily consume it, the hay is palatable, digestible, will have a high percentage of plant cell contents in relation to structural (fiber) components, and will be free from anti-quality factors. The resultant hay will be green, leafy, soft to the touch, and will smell and taste sweet.

Although hay is traditionally fed to sheep during winter, it can be fed during any production phase of the calendar year. Hay is also the most expensive feedstuff we feed. Therefore, the quality of hay to feed depends on the job the sheep are expected to do. In other words, there is "a hay for every season". Feed ewes the lowest quality during maintenance and the second lowest quality during early gestation. Feed higher quality during flushing and breeding. The second highest quality hay needs to be fed in late gestation. Save the highest quality and quantity for lactation.

Hay can be fed to any sheep during any season of the year. Its successful use, however, depends on how efficiently the qualities and quantities are coordinated with the production phases the sheep progress through during the year.

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

POLIOENCEPHALOMALACIA

A NUTRITIONAL DISEASE WITH MAJOR NEUROLOGICAL COMPLICATIONS

by Dr. Beth Johnson

Commonly referred to as "polio" in the ruminant world, polioencephalomalacia (PEM) is a metabolic disease resulting in neuromuscular clinical signs as a result of a lack of thiamine, Vitamin B1. Sheep, goats, camelids, cattle and other ruminants are all susceptible to this condition at any age but seen more often in young animals less than one year of age. Polio is usually found in ruminants on a high concentrate/lush pasture ration. Thiamine molecules are normally produced in the "healthy" rumen by naturally occurring bacteria and protozoa. Any change in this rumen environment may affect production of thiamine, increase the degradation of thiamine or prevent thiamine from functioning properly in ruminant animals. When this change occurs, thiaminase enzymes, which are enzymatic proteins that catabolize thiamine, may be produced by several bacteria within the rumen. Thiaminase I is produced by *Bacillus sp.* and *Clostridium sporogenes*. Thiaminase II is produced by *Bacillus aneurinolyticus*. Thiamine is a cofactor in the metabolism of carbohydrates (CHO's) and when it is not available there is a depletion of carbohydrates which causes alterations of the mechanism of action of the nervous system and neuronal death in the brain. A deficiency of CHO supply to nerve cells will cause central nervous system disorders, polioencephalomalacia and death if left untreated.

Polio is often seen when there is a sudden diet or environmental change, but can also be seen in ruminants that have consumed poisonous plants, animals which have been treated with antiprotozoal drugs, i.e. Amprolium, been recently dewormed, animals grazing lush highly fertilized pastures and/or animals exposed to high levels of sulfur.

CLINICAL SIGNS:

Clinical signs seen in ruminants affected with polio are a result of damage to the cerebral cortex of the brain. In the very early stages, a producer may notice that the animal is dull, lethargic, depressed, grinding its teeth and exhibiting a base wide stance or reluctance to move. This is due to gastrointestinal upset and bilateral blindness. The affected animal does not have a normal pupillary light reflex due to blindness. The clinical signs quickly progress to seizures, lateral recumbency, nystagmus (rapid involuntary movement of the eyeballs) and opisthotonus, where the animal's head is thrown backward and rigid. This posture is also seen with tetanus. Body temperature, pulse and respiration rates are usually elevated and rumen motility may be present or absent.

DIAGNOSIS:

As with any other disease, a thorough physical examination including body temperature and neurological assessment is extremely important in the diagnosis of PEM. Unfortunately, too many of these cases are diagnosed on the autopsy table when histopathology of cerebral tissue confirms the disease. A simple procedure can be done by producers to check for eyesite when presented with an animal with PEM. Quietly walk up to the animal and slowly bring your hand up to the animal's eye without touching the head. If the animal does not blink on either side then there is a high probability of PEM.

Some diseases with similar symptoms that should be ruled out are listeriosis, enterotoxemia, pregnancy toxemia, rabies, tetanus, or poisoning by chemicals or toxic plants.

TREATMENT AND PREVENTION:

As with many diseases, the sooner treatment intervention occurs the better prognosis for complete recovery. Response to treatment is highly correlated with the extent of brain lesions. If treatment is initiated in the early stages of thiamine deficiency, i.e. animal is still ambulatory with or without blindness, then response to treatment occurs relatively quickly. Thiamine is administered IV or IM at the dose of 4.5-10mg/lb body weight. I highly recommend that only veterinarians administer thiamine IV since if administered improperly can result in death. An IM dose can be repeated every 3-6 hours as needed for treatment. If treatment is delayed, a full recovery may not occur so it is imperative that treatment be initiated as soon as signs develop. In non-pregnant animals, a dose of dexamethasone may be beneficial to reduce the edema/inflammation occurring in the brain. In pregnant animals, use nonsteroidal anti-inflammatory medicines. Also dextrose should be administered orally or subcutaneously to provide carbohydrates to the brain tissue as soon as possible. A good broad spectrum antibiotic should also be administered to prevent septicemia.

One should also evaluate the diet of the ruminant animals affected. Consider increasing the amount of roughage the animal is receiving and provide a good quality pasture or hay. Evaluate the amount of sulfur in the diet, i.e. does the water source contain high sulfur levels. What about the forages being consumed-are they high in sulfur content? Also be sure to monitor ruminants that are being treated for coccidiosis and recently dewormed. If necessary a diet with levels of thiamine at 1.5-4.5 mg/kg of feed can be fed to animals at risk of developing PEM.

Hopefully you will never have to experience this metabolic disease in your herd. If there was one drug to have on hand at all times, it would be a bottle of thiamine. You will never know when you will need it, but one thing is for certain in livestock production, you sure want to be prepared. Always consult with your veterinarian for treatment, control and prevention!

References:

Polioencephalomalacia (Goat Polio), Alabama Cooperative Extension Service bulletin #UNP-65, Alabama A&M and Auburn Universities. http://www.aces.edu/pubs/docs/U/UNP-0065/UNP-0065.pdf

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.*

The Livestock Guardian Dog

An Peischel, PhD – Goats Unlimited
Ashland City, Tennessee

I recently had an individual call and want to discuss the training of livestock guardian dogs. For a while I listened and at the same time, thinking to myself - train ?? - I don't "train", I facilitate success. Everything I do beginning with the selection of breeding stock, whelping, exposure to different classes of goats, other livestock species and topography, to a range of different predators, the situation is managed so each individual pup is given every chance to succeed. Every experience for a pup has to be positive, the pup needs to feel in control, and their intense natural instinct to guard needs to be self-expressed.....then, the big day comes when they are sent miles away to guard the goats by themselves; they're on their own. My dogs have never let me down, I sleep peacefully. Goats Unlimited has been fortunate to never have lost a goat to predation with the use of livestock guardian dogs.

Goats Unlimited is located in rolling hardwood hills situated in the northern middle section of Tennessee. Our major predators are coyotes, bobcats, fox, hybrid wolves, buzzards and domestic pack dogs. Recently, a mountain lion was caught on a game camera nearby. We do land cleaning and enhancement, restoration of marginal lands and riparian areas and weed abatement with our Kiko meat goats. Our type of business puts the dogs in situations where they could be guarding in a neighborhood type setting with people around or in densely forested areas where they will rarely encounter a human.

Breeding Stock:

The dogs used for breeding purposes are selected from ranches/farms that are using dogs as livestock guardians. The breeds we selected as livestock guardians were selected for specific breed characteristic traits that fit our environment, predation pressure and management program.

The Pyrenean Mountain dog is mentioned in documents hundreds of years old owing its origin to the plateau of Tibet. They have a natural guarding instinct, protecting with their very lives those placed in their protection. Pyreneans are large and powerful, have great stamina and a coat providing protection from foe and climatic elements. They express an air of quiet confidence and tolerance.

The Pyrenean is well suited to the neighborhood land cleaning, restoration and weed abatement projects as project size can vary from 20 to 160 acres. They are more people tolerant, therefore, less aggressive toward humans. For our conditions, their coat protects them from the winter rain, hail and occasional snow. The dogs are expected to find their own shelter and protect themselves from the elements. Summer heat and humidity necessitates shearing their fibre to prevent hotspots and matting. They also need shearing if vegetation consists of blackberry vines, burdock and cocklebur.

The Akbash originated in western Turkey centuries ago for the guarding of sheep. White in color, their shorter length double coat is shed annually. They have a fleet appearance built for speed and stamina (long legs, muscular, strong) with keen eye sight and hearing. They are ideal for forest/brush and rangeland operations. Akbash are more aggressive to predators, have a strong maternal and guarding instinct, and a forceful independent nature in their guardian behavior.

The Akbash crossed with the Great Pyrenean reduces the dense coat of the Pyrenean. The hair coat of the cross is much shorter and has proven advantageous in hot, humid climates. The cross is exceptionally athletic like the Akbash yet the personality and the bone structure of the Pyrenean has been maintained. The crossbred guardians have the same black pigmentation around the eyes, nose and mouth as do the originating breeds.

The Anatolian Shepherd originated in Anatolia (central Turkey) descending from powerful hunting dogs from Mesopotamia. They are rugged, large bodied and strong, with superior sight and hearing. The breed is agile, high speed and extremely independent and sports a thick double coat. Anatolian Shepherd's have been used to guard livestock against wolves, bear, jackals and cheetahs.

The Kangal originated in the Sivas Province of the central Anatolia region of Turkey and is of an early Mastiff type dog. They are protective, loyal, gentle, courageous and very independent. Their tactic is to intimidate their intruders (usually wolves), and when necessary, using their agility and high speed to attack. Kangal's have a dense under-layer coat for insulation in severe winters and an outer-layer that repels snow and water.

Whelping and Feeding

We do not breed our guardians until they have proven successful as livestock guardians in their own right, have OFA's (Orthopedic Foundation for Animals) confirming no evidence of hip dysplasia, OCD's (osteochondritis – noting no inflammation of bone or cartilage) and are at least 2 years of age. The bred females are used for guarding on acreage close to homebase so they can be monitored daily as whelping day approaches. They are whelped out in the brush with the goats (management style pending). It is up to the bitch to provide a "safe" area for her pups and to guard them. If the above scenario is not practical due to pending weather or pasture rotations, I whelp in an area with a stable flooring surface and fresh wheat straw. The dams want to dig and nest and the opportunity for suffocation or burying a pup becomes possible. The does come by and eat some of the straw; they like to hang in there with the bitch and the pups get attached to the goats real fast. Pups are born in litters of 5 to 10 with an average birth weight between 1.5 and 2.5 pounds.

Photo: Candace Kough, Kough Farms, Graves County, KY

The pups will be twice their birth weight by day 5 - they grow exceptionally fast and need high levels of nutrients for the rapid long bone growth that occurs. Their eyes begin opening about 12-14 days of age and they are immediately started on warm goat milk. At three weeks of age, the pups start eating a more solid cooked diet (mashed rice, puppy chow soaked in goat milk, shredded cooked goat meat, vitamin/mineral supplement). By the time they are 5 weeks old they are chewing on dry puppy chow still receiving a cooked meal a day with cooked meat. Once they are 6 weeks old, they are consuming dry food daily and an evening meal of dry food soaked in goat milk with cooked meat. Because the large breed of dog experiences rapid bone growth, it is vitally important to provide a balance of calcium, phosphorus and vitamin D3 until about 18 months of age. Between three and six months of age they may grow from 30 to 100 pounds.

Preventative Health Care

1. At 2 days of age, both the front (single) and rear (double) dewclaws are removed from the Pyrenean pups.
2. All pups receive a parvo virus vaccination at 5 weeks of age, a 7-way vaccination (canine distemper, adenovirus type 2, coronavirus, parainfluenza, parvovirus and leptospira bacterin)
3. At 8, 12, 16, and 20 weeks of age all dogs receive another parvo virus vaccination.
4. At 12 and 16 weeks of age they receive lyme vaccine (consult your veterinarian about your specific demographic area)
5. 16 weeks they are vaccinated against rabies. They begin a life long monthly heartworm prevention program at 3 months of age.
6. Males are neutered at 5 to 6 months of age and females spayed before first heat, about 6 to 7

months of age. They are microchipped at this time.

7. All of the dogs, upon reaching one year of age, are on an annual vaccination program for 7-way, lyme and rabies.

Guarding Management

The pups are born within the same time frame as kidding (February/March/April and October/November/December) so during any year several litters of guardian pups are born. When pups open their eyes there are many "kid" eyes staring back at them, checking them over. The kids are cautious around the pups and are tolerant when the pups start waddling around, interrupting the kids' nap time. Kidding takes place in solar powered electric fencing (4 to 5 strand polywire or electronetting) so the pups learn at a very early age where they are to stay. They have a great respect for the electric fence - it only takes one time of contact and their memory is imprinted forever.

The pups need to be COMPLETELY bonded with the goats for them to be successful guardians. I do not pet the pups nor do I let anyone else pet them. They are handled when receiving vaccinations or heartworm medication. The pups will come around and "check in" when someone goes into the pasture to check the goats. The pups' presence is acknowledged with a quick "pat" on the head and they are encouraged to "get back to the goats". Once they are completely bonded, then an extended head pat and neck rub, which is an acknowledgement to them, is given. They are usually about 4 to 6 months old when this begins to happen. However, each pup is an individual, maturing at a different rate than littermates, so take care that they are totally bonded before befriending. And remember, the guardians are for the goats.

Weaning the Pups

By the time they are 8 weeks old, they have weaned themselves. We leave the bitch with the pups if self-weaning has been successful. This allows the pups to travel with their mother and start learning the ropes of becoming a successful guardian. Should self-weaning not succeed, the bitch is removed from the pasture, and an older, neutered male is placed with the pups as "teacher/mentor". The pups stay with the kids to weaning; weaning the kids at 3 to 3 1/2 months of age.

The weanoffs are separated into two groups; the doelings (disbudded) and the wethers/bucklings (horned). At weaning, the pups and their "teacher/mentor" go with the doeling weanoffs. The pups will stay with the doelings until they are approximately as tall as the doelings. It is important to keep the pups with a group of goats that are just slightly larger than the pups. This prevents the pups trying to "play" with the goats. When they try to become too aggressive or assertive, the goats are large enough to convince the pups they do not want to proceed with bad actions. Once the pups reach a point where they need to be removed from the doeling mob, they are taken to the wethers/buckling group along with their "teacher/mentor". It is also at this time when they learn to eat from self-feeders.

The wethers/buckling mob is physically larger and the bucklings less tolerant of "playful" pups; they straighten the pups out right away. It is at this point in "facilitation time" that the litter of pups is separated. Only 2 pups are kept together with an older (mentor) guardian. When the 2 pups are almost as tall as the goats, they are moved to either a doe mob, or in with a group of yearling bucks. These mobs are each being guarded by a minimum of three experienced dogs. They will stay with this size of goat until they are a year old. But, they will be exchanged every few weeks so that all the pups will be with other mature guardians and other pups. Do not keep the same two pups together. I prefer to only have one pup with other guardians but sometimes we have as many as 10 to 12 pups at a time and it makes logistics difficult. I like my dogs to be able to work together with any dog they may be placed with in the future. This is especially true when the main predator will be the wolf pack. They have to be adaptive in acceptance to all livestock guardians and all classes of goats.

Evaluating the Maturing Dog

Up to this point, the maturing dogs have been in an area that has coyotes, bobcats, buzzards, fox, hybrid wolves and domestic pack

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dogs as predators. They will be in this setting as yearlings. Between one and two years of age the guardians will participate in at least three kiddings. They are observed for their active guardianship of the young kids and does. Their personalities and temperaments are critically assessed. This is a major turning point in time when any guardian not "passing the test" will be culled. At about two years of age, they go into densely forested areas to guard and now in their guarding career will be faced with the possibility of encountering bear, mountain lions and wolves. Here they are guarding in higher elevation vegetation; lots of dense brush, blackberries, downed timber (or harvested area) and trees. Guarding in the mountains will round out their guarding experiences and I now consider them mature, experienced livestock guardians. The goats they are guarding under these vegetative conditions are mature wethers and mature does.

Summary

It takes time and a sincere effort to facilitate the success of a livestock guardian dog. They will save you many dollars and heartaches. A mature, experienced guardian is irreplaceable and commands respect. Goats Unlimited would not be successful without them. And it is to the "livestock guardian dog" that I am grateful.

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