

A Guide to Katahdin Hair Sheep

Special Edition of The Katahdin Hairald



Special Edition

www.katahdins.org

2020 Edition



In recognition of the founding of Katahdin Hair Sheep International in 1985

We celebrate Katahdin sheep and all of the producers, past and present, who have contributed to the growth and success of our breed. This Guide to Katahdin Hair Sheep is being provided as a courtesy to KHSI members, new owners of registered Katahdins and to those interested in raising Katahdin sheep in the future. The purpose of this publication is to promote Katahdins and serve as an educational resource for marketing, management and selection. We are grateful to the many members who have promoted our breed and helped to educate and mentor new producers since 1985.

A Brief History and Description of the Katahdin Breed

Katahdins are a shedding sheep dominated by a hair coat and do not require shearing, crutching or tail docking. They are a moderately framed, maternal breed with improved parasite resistance and consistently twin in most management systems that lamb in the spring. In the past 30 years, Katahdins have increased in popularity throughout the Western Hemisphere and are especially popular in regions where standard wool breeds are less adapted.

Although originally developed in Maine, Katahdins have had a large impact in the southeastern part of the USA where raising sheep was not common. The attributes that make Katahdins popular in these regions are their improved parasite resistance, shedding and their ability to

breed in hot, humid areas of the Southeast.

Katahdins are also popular throughout the Eastern US and on farms with smaller acreages in the Pacific Northwest. In the Rocky Mountain region, Katahdins are being raised by producers with less access to shearers. Another growing trend is the adoption of Katahdins by cattle ranchers in the Southern Plains where the focus is easy care and productivity.

Katahdins are a great choice for producers interested in aseasonal breeding or for those targeting non-traditional meat markets that reward a lighter lamb. Katahdins also work well in commercial crossbreeding programs targeting traditional lamb markets.

After 30 yrs of proven production, the popularity of Ka-

tahdins continues to grow. Katahdins are one of the most represented breeds in the National Sheep Improvement Program, evaluating important performance traits such as ewe productivity and parasite resistance. In 2013, Katahdins were added to the North American International Livestock Exhibition in Louisville Kentucky with increased interest.

The original selection goals of Michael Piel, the breed founder, continue to drive breed utility and popularity. These traits include: shedding, easy care, profitability, ability to have and raise multiple lambs, parasite resistance, moderate size and adaptability. In our fourth decade, the motto of Katahdin Hair Sheep International rings true: "The Breed Whose Time Has Come."



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Contributing authors for this publication include sheep researchers, extension specialists, veterinarians and producers. The expressed views and perspectives are solely the authors'; KHSI, Xpressions and The Herald, Inc. limits liability for any omissions, errors, or misprints. This publication was compiled and all articles were edited and/or reviewed by the KHSI Promotions and Publications committees: Roxanne Newton, Kathy Bielek, James Morgan, PhD, and Lynn Fahrmeier. Ideas for future topics should be directed to KHSI Operations.



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Additional copies of
"A Guide to Katahdin Hair Sheep"
can be ordered by sending \$3.00
per copy to KHSI Operations
(address below). A digital version
is available at
www.katahdins.org/magazine/

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Editor's Note: All photographs in this publication were submitted by members of Katahdin Hair Sheep International. All photographs, charts, and illustrations are printed with permission.

Questions Frequently

KHSI Education Office

HOW DO I BECOME A MEMBER OF KATAHDIN HAIR SHEEP INTERNATIONAL (KHSI)?

Download a membership application by visiting our website: www.katahdins.org. Click on the "Membership" tab on the menu bar, then choose "Join KHSI". You can submit the form electronically paying with your credit card through PayPal or you can download the application and mail it directly to KHSI Registry at KHSI Registry, Box 231, Wamego, KS 66547. Call 717-335-8280 ext 3 to request a KHSI Membership Form.

WHAT IS THE DIFFERENCE BETWEEN KHSI REGISTRY AND THE OPERATIONS AND EDUCATION OFFICES?

The KHSI Registry processes all registrations, recordations, transfers, upgrading and naming of animals. The Registry also processes memberships and approves flock identifications. The KHSI Operations and Education Offices answer questions about Katahdins and benefits of being a member. KHSI Operations places ads, manages promotions, updates the KHSI website, and provides resources and marketing materials. The KHSI Education Office edits the Katahdin Hairald magazine, answers questions for new members and arranges hair coat inspections.



WHAT ARE THE MAJOR BENEFITS OF BECOMING A MEMBER OF KHSI?

- flock listing on the KHSI website increases exposure for both registered and commercial flocks;
- free classified advertising on the KHSI website and in the magazine;
- quarterly subscription to the Katahdin Hairald publication;
- opportunity to socialize, network and participate in the annual Katahdin Expo Educational Workshop and National Sale, as well as regional Katahdin events.

DO I HAVE TO BE A MEMBER OF KHSI TO REGISTER OR TRANSFER MY SHEEP?

Membership is required. Effective May 1, 2020: only KHSI members can register Katahdin sheep. Sheep cannot be registered or recorded without a KHSI Registry approved flock identification.

WHAT IS THE DIFFERENCE BETWEEN REGISTERED AND RECORDED?

A registered Katahdin is listed in the KHSI flock book

as 100% Katahdin. A recorded Katahdin is an animal that is listed as a percentage animal by the KHSI Registry and Flock Book. The percentage is listed on the Certificate of Recordation (i.e., 50%, 75%, 87.5%).

WHAT IS A FLOCK IDENTIFICATION? HOW DO I GET ONE?

Prior to May 1, 2020 all sheep registered with KHSI used a unique 2 or 3 letter prefix as part of their tag/ID. As of May 1, 2020, KHSI members can now use a flock identification (Flock ID) which can be a unique flock prefix (as in the past) OR a unique flock name, OR both, to identify animals born in their flock. Briefly, a prefix is a unique 2 or 3 letter sequence, approved by the KHSI Registry in cooperation with the shepherd, which is used to identify the flock that a sheep is born in. This is part of every registered animal's ID and appears on registration and recordation certificates. Example: XYZ-023, where XYZ is the approved

flock prefix and 023 is the individual animal's numeric ID that is assigned by you. Members can also use their unique flock name. Example: Best Sheep Farm 023 where Best Sheep Farm is the approved flock name and 023 is the individual animal's numeric ID. Shepherds can also use both: if so, the animal in this example would be Best Sheep Farm XYZ 023. No two registered animals can have the same ID.

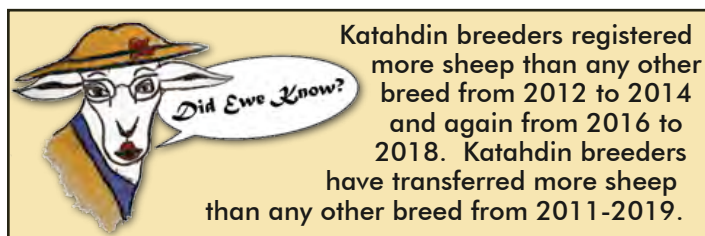
Contact KHSI Registry at 717-335-8280 ext 3 or email registry@katahdins.org to receive approval for flock identification. All flock identifications **must** be approved by the KHSI Registry to be valid.

WHAT IF MY REGISTERED KATAHDIN LOSES THEIR TAG?

The ID on an animal's registration or recordation certificate is their official KHSI Identification for life. It cannot be changed. If an animal loses their tag, it will need to be retagged with the exact same tag identification and number. Handwriting the animal's original ID onto a blank tag is acceptable.

WHAT IS AN OWNER/MEMBER NUMBER AND HOW DO I GET ONE?

The Owner Number, also called "Member Number" is an



Asked by New Members

account number assigned and used by the registry to track registrations, transfers, and recordations. Both members and non-member owners will receive an "Owner Number" once animals are registered or transferred in their name. If you do not have an Owner Number or can't find it, you may submit your work order and/or registration application without it.



not familiar with the process. **Note** that transfers need to be sent to the Registry within 60 days or transfer prices double.

WHAT TYPES OF IDENTIFICATION DO MY SHEEP NEED?

All registered animals must have an ear tag or tattoo that has at least the numerical portion of their ID on the registration certificate but may also contain the flock ID. For example, if your sheep is registered

HOW DO I REGISTER MY LAMBS?

Registration and Work Order forms can be downloaded and printed from the KHSI website, www.katahdins.org. Click on the "Membership" tab, then choose "Register Sheep". These forms can be filled out and submitted online with payments made electronically using PayPal (credit card), or the printed form can be completed and mailed to KHSI Registry with a check or credit card number. With either method, the registration form needs to be filled out completely including lamb ID (with approved flock ID), date of birth, sex, birth type (single, twin, triplet), breeding type, and the ID and registration numbers of both the sire and dam. The registry cannot issue a certificate if any of this information is missing. The registration form should be accompanied by a work order form that reflects the number of registrations/recordations/or transfers of ownership enclosed. When simultaneously registering and transferring the ownership of a sheep, the name and address of the new owner must be included.

HOW DO I TRANSFER OWNERSHIP OF MY SHEEP?

If the animals are already registered, simply fill out the back of each registration certificate with the buyer's information, date and sign in the space provided. Then mail the original certificates to the registry with a work order form reflecting the type of transaction and the appropriate fees. If the animal being sold has not yet been registered, follow the steps outlined above for registering sheep and include the name and address of the new owner on the form. In this case, you will pay a fee for both the registration and the transfer of ownership.



KHSI recommends that as the seller you should complete the paperwork and pay for the transfer of ownership since many new owners are

with the ID of XYZ 023 or Best Sheep Farm 023, the tag needs to have at least the numerical part of the ID on the tag, that is 023. Shepherds are encouraged to include the flock ID as well as the digit 023 on the tag. Any lambs born on your farm that you plan to register or record through KHSI Registry should be tagged soon after birth. Tags can be purchased with preprinted individual sheep number (required) and flock ID (recommended) or you can purchase blank tags and write the ID on the tag with non-fading ink. Identification tags required by KHSI are for identifying registered or recorded sheep and may or may not meet the requirements of the Canadian or USDA Scrapie Eradication Programs. Scrapie tags are **required by law** for any sheep that leaves your farm for any reason (for sale, slaughter, shows, display, as pets). Scrapie tags provide APHIS (Animal and Plant Health Inspection Services) trace-back capabilities in the event of a Scrapie outbreak. To order free Scrapie tags, call 1-866-USDA-TAG. For more information on the Scrapie Eradication Program, go to: www.aphis.usda.gov.

I HAVE COMMERCIAL KATAHDINS, CAN I REGISTER THEM?

Only offspring of a registered Katahdin sire and dam can be registered. However, offspring of a registered Katahdin and an unregistered Katahdin or other breed, can be recorded and their offspring graded up to fully registered in three generations with a hair coat inspection (see section on grading up on page 6).

WHAT IS A HAIR COAT INSPECTION AND WHEN IS IT NEEDED?

The Katahdin breed standard states that Katahdins should have a hair coat, preferably one that is free of wooly fibers. Although some sheep will have a smooth hair coat year-round, others will get a "winter coat" that sheds naturally in spring. For an animal to upgrade to registered status, the animal must have a hair coat inspection by a certified inspector. Once the animal has passed the hair coat inspection, is of sufficient percentage, and has the proper paperwork and fees submitted, the recordation certificate is reissued as a registration certificate through the Registry.

Are Your Katahdins Correctly Identified?

KHSI Education Office

Katahdins that have KHSI certificates of registration or recordation must be permanently identified with the proper ID to be in compliance with the KHSI Registry. What does this include? Proper ID means a readable tattoo or ear tag. The tag or tattoo must match the numeric portion of the “Animal ID” that is on the registration or recordation certificate. This is a permanent number and cannot be changed. As of May 1, 2020, the tattoo or ear tag **may** include the Flock ID (prefix or flock/farm name). For example, if the ID that the sheep is registered with is one of the following XYZ 023, Best Sheep Farm 023 or Best Sheep Farm XYZ 023, the “**023**” must be on the tag. Shepherds are encouraged to include the Flock ID as well.

Collar tags are not considered permanent ID. The most common errors are the tag has been replaced by a different number that does not match the certificate or only has the Scrapie ID and not the KHSI ID. Replacement and/or initial tags may be handwritten on a blank tag with a designated tag marking pen. Check handwritten tags regularly to be sure they remain legible. The Scrapie tag number does not have to be the same as the Animal ID.

Common Tagging Systems

KHSI allows flexibility so that members can use their preferred ID system and preferred ear tag style. The flock identification, prefix or flock name, must be approved by KHSI Registry before any sheep born in that flock can be registered. Members are strongly encouraged to include the flock ID on the animal's tag, but it is not required. Only the numeric portion of the ID is required to match the certificate of registration.

Tags can be ordered from several sheep and/or animal health supply companies. Some of these will also provide preprinted tags which are more legible and last longer than handwritten tags. These are typically sold in lots of 20-25.

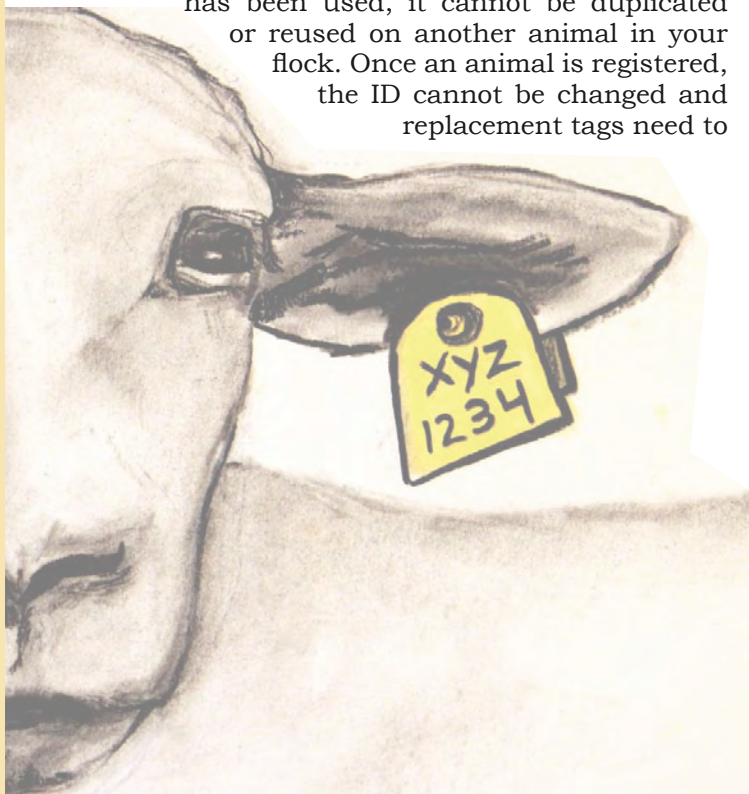
There are several logical numbering systems in use. KHSI has no preference other than once an ID number has been used, it cannot be duplicated or reused on another animal in your flock. Once an animal is registered, the ID cannot be changed and replacement tags need to

include the same ID that is on the KHSI registration certificate. In the examples below, the flock ID ‘XYZ’ will be used only as an example. The same numbering system works for flock/farm names used as flock IDs. Common numbering systems include:

- Including year of birth in the ID. In flocks with less than 100 lambs, the first lamb born in 2020 is tagged XYZ 2001, second would be XYZ 2002 and so forth. For 100 lambs or more, the sequence would begin with XYZ 20001.
- Running numerical sequence. The first lamb born on the farm is XYZ 001, second would XYZ 002 and so forth for the entire lamb crop. The following year, tagging would begin in sequence starting with where you left off the previous year.
- Using alpha characters to denote year of birth. For example, if E is used to denote 2017, then the first lamb born in 2017 would be XYZ 001E, the 2nd would be XYZ 002E and in 2018, the first lamb would be XYZ 001F. The advantage of this system is that only one alpha character is used to represent a 2 digit year. It is important to avoid using letters like I or O since they can be confused with the numbers 1 and 0.
- As mentioned above, only the numeric portion of the ID is required. In the examples of the first lambs in a, b and c above, the numeric portion required would be 2001 in a), 001 in b) and 001E in c).

Blank tags can also be hand written with special tag markers. However, hand written tags will fade over time. Tags can be ordered with just the flock ID printed, so that if a sheep loses their tag, only the sheep's individual ID number needs to be handwritten.

Additional Tag & ID Requirements. Both the USA and Canada require that sheep leaving their original premise have a government issued tag/ID that enables tracking movements of sheep. Contact your state/provincial animal health offices or in the USA, the state APHIS office (USDA Animal Plant Health Inspection Service) to enroll, determine requirements, comply and/or obtain IDs/tags for your state/province/country.



Sustaining Momentum as a Breed

**David S. Redwine, DVM,
Katahdin Producer, Virginia**

My parents were born in the 1920's, before television, automobiles, and indoor plumbing. For over fifty years, I listened to their stories and tried to imagine the magnitude of change that they witnessed during their lives. Recently at a sheep symposium, as I educated new sheep producers on the history and development of Katahdin sheep, it occurred to me that I am participating in the evolution of an industry that is no less remarkable than that of my parents' lives.

My sheep production class in 1984 basically introduced me to the major wool breeds, and the traditional production and marketing methods. There was no mention of hair sheep, ethnic markets, or natural disease resistance. The three P's, as I call them, (predators, parasites, and price) left most shepherds with a facial expression that resembled the Great Depression. Even in the early 90's, I remember attending a sheep

"Why are Katahdins so magnetic? In a moderate environment, they practically train new shepherds. They breed efficiently, deliver a 200 percent lamb crop, claim and raise them, and provide a highly palatable product."

other breeds, and fit perfectly into the "small acreage" program of today. By selecting for traits that increase the bottom line, we have developed the "angus cow" of sheep breeds, the animal that is superior in almost every category.

We are smart to remember that as a meat breed, carcass traits and ewe efficiency in a commercial production system should guide our selection and management. Traits such as muscling, depth of rib, capacity, and length of body should be paramount in our programs. Twinning, maternal characteristics, parasite tolerance and resistance, as well as longevity make our sheep superior to other breeds. Unlike the shepherds of the past century, we are now "market driven", seeking the needs of our customers, and striving to grow exactly what they desire. This may vary from place to place in our country, but we know that Katahdins can adapt and perform in most any system.

One popular debate with breeders is that of the show ring. There is no denying the value of exhibition

meeting, where wool producers laughed at the hair sheep folks, treating them as outcasts for considering Katahdins as a meat breed. I prophesied that day that those who refuse to adapt to change would die alongside their foolish pride.

Since those days, I have watched with amazement as Katahdin meat sheep, powered by their ease of management, efficient performance, and booming popularity, have left some shepherds in their wake on their way to becoming the most popular breed in America. Gone are the days of confusion with goats, discounted market prices, and lack of recognition. We as producers are to be congratulated for our guidance and promotion during the climb to the top.

Let's take a moment to reflect on how we got here. Why are Katahdins so magnetic? In a moderate environment, they practically train new shepherds. They breed efficiently, deliver a 200 percent lamb crop, claim and raise them, and provide a highly palatable product. They require less labor, feed, and management than

in spreading the popularity of Katahdins. However, if we continue to lead the industry, the show ring MUST reflect the type of Katahdin that performs on the farm. Many breeds have already been ruined by evolving into a separate "show type" conformation, which falls apart in a production setting. By developing a breed standard, and selecting for it, we can all exist together for the betterment of the breed.

Our challenge in the next twenty years will be maintaining our spot at the top, and preserving the traits that make Katahdins so popular. As my old football coach used to say, we must "dance with who brung us". We must maintain maternal and carcass traits, as well as performance. We have an obligation to educate producers and promote the breed at every opportunity, and involve our youth whenever possible. I challenge you to keep it going. Talk to fellow producers, learn from each other, help each other, and let's raise the bar even higher. Our next twenty years looks extremely bright.

Frequently Asked Questions on Grading Up and Recording Katahdins

KHSI Education Office

KHSI HAS AN "OPEN FLOCK BOOK". WHAT DOES THIS MEAN?

Since its establishment in 1985, KHSI has had an open flock book, which means that percentage-blood Katahdins can be recorded in the KHSI registry and registered Katahdins can be generated through the use of registered rams or ewes mated to non-registered animals. In the most common upgrading and recordation method, a registered Katahdin ram is bred to any group of ewes and the offspring are recorded in succeeding generations at 1/2 (50 percent), 3/4 (75 percent) and 7/8 (87.5 percent). To become a registered animal, the 87.5 percent or greater animal requires a hair coat inspection.

IF I HAVE A PUREBRED KATAHDIN THAT HAS NO REGISTRATION PAPERS, CAN I GET HIM/HER INSPECTED AND THEN REGISTERED?

No. If registration or recordation papers on the animal or its parents cannot be located or were never issued, for registry purposes the animal is treated the same as if it were a different breed. No matter how much a sheep "looks" like a pure Katahdin, without registration papers its ancestry is unclear.

I HAVE A FLOCK OF COMMERCIAL WOOLED EWES. WHAT GENERAL ISSUES SHOULD I KEEP IN MIND IN USING KATAHDIN RAMS TO "BREED THE WOOL OFF" AND RECORD OFFSPRING?

Select rams whose performance and conformation reflects what you are aiming for in your eventual high-percentage Katahdin ewe flock. Use of rams with clean-shedding "A" coats is advised in order to reduce non-shedding wool in offspring. Breeders in upgrading programs should also be mindful of preserving and enhancing Katahdin signature traits for reproductive efficiency, such as fertility, prolificacy, mothering ability and parasite resistance. For recordation, the registry will require a birth date and type of birth (i.e., single, twin, triplet), as well as the registration and tag numbers of the ram used and the tag numbers (and recordation numbers if applicable) of the dams.

HOW MANY GENERATIONS DOES IT TAKE TO GRADE-UP OFFSPRING FROM A NON-REGISTERED ANIMAL (AN ANIMAL WITHOUT A PAPER) TO A REGISTERED ANIMAL?

It takes at least three generations of mating to registered Katahdin rams to create a fully registered Katahdin, provided that the 7/8 animal is inspected with an A or B hair coat as a yearling. As of June 2020, rams being graded up to 100% no longer need their dams inspected with an A Coat.

IF I USE A 75 PERCENT RECORDED KATAHDIN RAM AND BREED HIM TO REGISTERED KATAHDIN EWES, WILL THE OFFSPRING BE REGISTERABLE?

The offspring can be recorded at 87.5 percent and following a hair coat inspection by a KHSI certified inspector, the offspring can be fully registered. This is just the same as if a registered ram had been bred to 75 percent recorded ewes. If the 75 percent ram is bred to 75 percent ewes, the offspring can be recorded as 75 percent.

CAN I USE A RAM FROM ANOTHER BREED ON MY REGISTERED KATAHDIN EWES TO IMPROVE A PARTICULAR TRAIT IN MY FLOCK?

Yes, KHSI recordation policy allows the use of a ram of another breed. In the case of registered Katahdin ewes bred to such a ram, the crossbred lambs can be recorded as 50 percent. A 50 percent recorded son bred back to registered ewes results in 75 percent offspring.

WHEN DOES AN ANIMAL NEED INSPECTION?

Animals of 7/8 or greater Katahdin blood, if born prior to November 1st of the previous year, are eligible for registration following inspection with an A or B coat. Sheep may be inspected from March 1 to September 30. If born after October 31 of the previous year, the sheep can be inspected in the spring or summer after their second winter. 7/8ths or greater Katahdins must be classified with a coat type A or B to be registerable. If they are classified as coat type "C," they can be identified in the flock book as recorded. As of June 2020, rams no longer need their dam classified as type A coat to grade up.

HOW DO I REQUEST AN INSPECTION?

Inspections are requested through the KHSI Education Office. It is recommended that this request be made by May 15 so that the Education Office can arrange inspections to be completed by September 30. The KHSI inspector verifies the animal's identity, checks it for any gross defects, and classifies the coat and poll type. The owner submits the papers to the registry office with a fee payment for a permanent registration certificate.





How Do I Market My Katahdins?

Roxanne Newton, Katahdin Producer, Georgia

IDENTIFY YOUR MARKET:

If you're new to raising livestock, the first thing you need to consider is where you are going to sell your lambs and who the target customer is. Knowing your available markets will drive all your other decisions, including where to purchase your foundation stock. So whether you're selling lambs directly off the farm, grass fed lambs to high-end restaurants, weanlings to the local sale barn, finished lambs through the slaughterhouse or cull ewes and lambs, you have to know what your customers are looking for and select your breeding stock to meet those marketing goals.

CHOOSE SHEEP THAT FIT YOUR MARKET:

When purchasing foundation stock, often it's a good idea to buy from someone who manages their sheep the way you plan to manage. Whether raising quality lambs for show or pasture-raised commercial meat lambs, the sheep you choose must be able to perform in your system and meet your marketing goals as well as your customers' expectations.

QUALITY BREEDING STOCK SALES:

There is a good market for selling quality seedstock, but with it comes a higher level of expectation, commitment, time and expense. Only quality animals that reflect the breed standard for Katahdins should be marketed as registered breeding stock. Animals that do not meet these standards due to poor conformation or defects, including animals that do not perform as expected, should be culled. Recordkeeping is the cornerstone of seedstock production. Health and performance records should be maintained on all animals. Just because an animal is registered, doesn't mean that animal meets the standard as a "breeding" animal.

MEAT LAMBS:

Marketing quality meat lambs requires selection and planning, too. Determine your target market and purchase seedstock animals that will produce those market lambs in the management system you use. If your market demands heavier, more muscled lambs, a commercial cross-breeding program using a terminal sire may produce the type of lambs that will help you reach your goals faster and/or more efficiently.

SET GOALS:

As with any successful endeavor, setting goals provides a way to evaluate your progress. Identifying which measurable short-term and long-term objectives will help you achieve your goals within the expected time frame is necessary to track progress. For example, a simple goal for lamb meat producers might be: increase the pounds of quality lamb marketed per ewe by 5% annually.

PROFITABILITY:

Raising livestock is a business. Providing a quality product with good customer service is the best recipe for any successful business and will result in increased profits and personal satisfaction. Efficient management and successful marketing require continuous evaluation of animal performance and behavior, production records, and resource allocation. Develop a reputation for producing quality lambs with your customers or local sale barn. Promote and market your Katahdins by taking advantage of e-commerce opportunities, website development, social media networking, as well as advertising in the KHSI classifieds and/or the Katahdin Hairald. Choosing stock to fit your management style and available markets, setting realistic goals and objectives and continually evaluating your progress toward those goals, will keep you on the road to success.



Meat Lamb Marketing Options for Seedstock Producers

Jim Morgan, PhD, Katahdin Producer, Arkansas

Most seedstock producers will have surplus lambs to sell; lambs that just don't make the cut as quality breeding stock for one reason or another. Just because a lamb *can* be registered doesn't mean it *should* be. Ideally, only the top 10-25% of ram lambs out of registered parents should be sold as breeders. The rest, including some ewe lambs, should be sold for meat.

So, how and where does one market these excess lambs? Markets for meat lambs can vary regionally based on sale opportunities and buyer preferences for age, size, degree of finish, and time of year marketed.

GENERAL POINTS:

- Determine what size lamb is preferred in your area. Market preferences for live lambs can vary between weanlings to lambs weighing 140-160 lbs.
- Poorly conditioned lambs typically bring less per pound than fleshier lambs.
- Local or regional sale barns typically operate on commission. Call the sales manager before you plan to bring lambs. Often they are eager to help you get a higher selling price and will notify buyers in advance that lambs will be available for sale.
- Prices for meat lambs are typically higher from Thanksgiving to Easter. However, selling for less per pound in the summer or early fall may still be more profitable if it saves you the cost of extra feed and labor.
- Target ethnic markets by selling your animals prior to key religious holidays when prices for lambs are generally higher.

Examples of profitable marketing opportunities Katahdin producers are using to sell surplus meat lambs include:

COMMERCIAL OR TRADITIONAL LAMB MARKETS:

- Buying Stations will post the price/lb that will be paid for sheep based on "Grade" for a specific range in weights. In most cases, the seller pays a small commission per animal.
- Local or regional sale barns typically auction lambs in the sale ring and the seller pays a commission based on the price paid per lamb or per lot.
- Lamb buyers or brokers will fill customer orders



in bulk by buying lambs directly off the farm/ranch. Prices may be lower per animal, but saves on the cost of transportation and commissions.

NICHE MARKETS:

- Direct marketing USDA/State Inspected lamb by the cut or whole via the Internet, farmers markets, restaurants, co-ops and through some local grocers.
- Capitalizing on value-added labeling, such as organic, grass-fed, or humane certified.
- Selling pasture raised lambs weighing 60-80 lbs to a Halal butcher.
- Selling lambs at weaning to a local farmer to finish for his/her own meat customers.
- Direct marketing whole lamb and delivering to a local processor for customer pick-up.

Research your marketing options well in advance and be prepared to market the size and type of lambs your buyers prefer. Don't be afraid to think outside the box; value-added niche marketing can be very profitable. Keep in mind that some options are subject to federal or state regulations (USDA inspection/labeling) or specialty certification (organic). Most seedstock producers will have surplus lambs or lambs that don't make the grade for breeding stock. By determining your markets ahead of time, you can maximize the prices received for your product.



Marketing Venues for Katahdins are Expanding!

The major Katahdin Sales are listed on this page and many have existed for several years. They change from time to time and in 2020 many were cancelled or modified due to the Pandemic. Please check each year.


Jim Morgan, PhD, Katahdin Producer, Arkansas

Katahdin seedstock producers have enjoyed record sales over the last decade, many selling out in spring. It's never too early to contact breeders to get your order in for quality Katahdins. In addition, there are other opportunities for buyers to find high quality Katahdins and the number of venues is expanding each year. Below are some of the types and locations of sales and auctions with the approximate dates for each. Please contact the event manager or seller for exact dates, sale listings and terms. Many auctions/sales accept phone bids.

- 1. Annual Katahdin National/Expo Sale:** Offering 100 or more rams and ewes for sale in July or August. Location varies annually. Includes production data and/or EBVs. For more information, go to www.katahdins.org or 717-335-8280 ext 1.



- 2. Midwest Stud Ram Sale:** Offering 100 or more registered Katahdin rams and ewes for sale the second week following Memorial Day. Located in Sedalia, MO. For more information, go to www.midwestsale.com.
- 3. Virginia Tech Foraged-Based Ram Test and Sale:** Testing 100+ rams for growth and parasite resistance. The top performing (25-45) rams are offered for sale. Sale rams are scanned for loin-



The 3 major Katahdin sale venues from 2015-2019 – Katahdin National/Expo Sale, Midwest Stud Ram Sale and the Virginia Tech Pasture Ram Test Sale – generated more than \$200,000.00 in sales for participating Katahdin breeders.



eye depth and evaluated for breeding soundness. Located at the SWAREC station in Glade Spring, VA. Sale takes place in late September. Contact Supervisor Lee Wright, lrite@vt.edu or 276-944-2200.

- 4. Virginia Tech Steel's Tavern Ram Test:** Performance tested rams and ewes of various breeds, <10 head of Katahdins on test. Evaluates average daily gain, loin-eye, and breeding soundness. Sale takes place in late August in Steel's Tavern, VA. Contact Dr. Scott Greiner at sgreiner@vt.edu.
- 5. Indiana Katahdin Ewe Sale:** Offering 10+ head of quality ewe lambs in late April; early enough for youth show season. Contact John Dyer (812-362-8012).
- 6. Ohio Showcase Sale.** Replaced "Big Ohio Sale" in 2020 and moved to the Drake County Fairgrounds in Greenville, Ohio. In 2020, the sale was managed by Select Livestock Sales, Inc.
- 7. NSIP Sales.** All rams and ewes consigned are from flocks in National Sheep Improvement Program and have EBVs. The Center of the Nation NSIP has been held every year since 2006 the last weekend in July in Spencer, Iowa. NSIP plans to add a new online sale starting in 2021. For more information go to www.nsip.org.
- 8. Internet Auctions:** A handful of Katahdin breeders are offering quality rams and ewes for sale via online farm auctions during the summer months.
- 9. Regional Katahdin Associations:** Offering private treaty sales of Katahdin rams and ewes. Locations and dates vary according to region. For more information, see the KHSI Calendar of Events at www.katahdins.org for meetings in your region.
- 10. Midwest Hair Sheep Sale:** Offering registered and commercial rams and ewes of hair breeds in Salem, IN the first weekend of October. Contact Washington County Extension Office at 812-883-4801 or dhowellw@purdue.edu.

Showing Katahdins: Value Added Marketing

Henry Shultz, Katahdin Producer, Missouri

Marketing of Katahdins through shows and sales can be both fun and profitable. You need to follow a few simple practices when attending shows and sales.

1. Sheep should come from a good nutritional diet with high quality forage or a combination of forage and grain.
2. The producer should choose animals that are structurally correct with good mouths.
3. Consigned sheep will normally be shown before the sale to establish a sale order.
4. It is very helpful if sheep are broke to lead. The best training tool is a web sheep halter with a small chain that goes under the chin. These can be purchased from most sheep supply catalogs or at farm stores. We normally tie the sheep up for the first few times, and then start leading them.



5. Sheep should have feet trimmed and should be washed before the show. Any livestock soap or dish soap will work.
6. Washing and brushing should be done at least one day before the show. No trimming of the hair coat is allowed in Katahdin shows, just brushing and combing.
7. Before entering the show ring, give all animals a last minute brushing, and be sure to clean areas around the face, nose and eyes with a wet cloth. Applying fly spray can also be helpful around the feet and bellies if you are showing during the summer.

Preparation is your key to success along with a well-planned breeding program. Talking to other breeders at

these events is a good way to pick up new tips about showing. If you have never shown before, be sure to watch some classes to get an idea about how classes are placed. We have met many new and old friends at these shows and sales, and this can make attending very fun as well as profitable.



Management Options for Katahdins

Roxanne Newton, Katahdin Producer, Georgia

Katahdins are an excellent fit for many management systems. Most producers choose to raise sheep, or any other livestock, to take advantage of available resources and marketing opportunities. What works best for producers in one region of the country may not work as well for another. Several factors go into determining what system or combination of systems works best for each shepherd:

1. Marketing goals and available markets;
2. Resource availability (i.e., labor, barns/shelter);
3. Environmental challenges;
4. Feed/Forage availability and requirements.

Coordinating the needs of the flock with the available resources is an important goal of management. Re-evaluate your options from time to time as resources and markets can and do change. No matter which system is chosen, the shepherd must meet the nutritional, predator protection and health needs of the flock.

INTENSIVE MANAGEMENT SYSTEMS (HIGH-INPUT):

Typically this system is geared towards heavier lamb markets (120-140lb lambs) or in regions where pasture prices are too high for light lamb markets. Lambs are generally provided free-choice rations with little or no access to pasture. In this system, lambing usually occurs in a barn setting. Advantages: higher growth rates in lambs; little or no exposure to parasites; more sheep per acre. Disadvantages: more purchased feed inputs; increased labor; shelter requirements.

EXTENSIVE MANAGEMENT SYSTEMS (LOW-INPUT):

Sheep are raised on pasture with no grain supplementation. This system requires good pasture management and access to quality forage. Lambs are typically born and raised on pasture. Advantages: decreased labor and purchased feed costs; efficient utilization of pastures; improved soil quality. Disadvantages: requires high quality forage for optimal lamb growth; increased exposure to parasites; limited by seasonal availability of forage.

MIXED MANAGEMENT SYSTEMS:

Most systems fall somewhere between “intensive” and “extensive” and here are referred to as “mixed management systems.” One common mixed system is to supplement forage during late pregnancy and lactation when nutritional requirements of the ewes are high, especially if forages are marginal or deficient. In addition, lambs may be supplemented with grain to meet marketing goals or resource gaps. Some producers maintain ewes on pastures, while weaned lambs, especially the meat lambs are in confinement. Advantages: allows producers the flexibility to supplement based on economics/resource availability; keeps meat lambs on an increasing plane of nutrition when pasture/forage is unavailable; increases milk production in ewes raising multiple lambs. Disadvantages: parasite exposure; labor requirements and costs fall somewhere between intensive and extensive systems.



Farm Biosecurity

**Rory Lewandowski, Extension Educator,
Wayne County, Ohio**

How easy or difficult would it be to introduce an infectious disease into your flock? Do you know the factors that increase the risk of introducing an infectious disease into your flock? Farm biosecurity is about risk management; understanding where, how and when an infectious disease might be introduced and then developing management practices to prevent that from occurring. The greatest risks for introducing an infectious disease into your flock come from:

- Bringing a new animal(s) on to your farm that has been exposed to animals in other locations. The risk is greatest if that animal came from a flock with an infectious disease. Bringing an animal into contact with your flock that came out of an auction barn is also very risky, or even from the show circuit.
- Visitors to the farm. This includes not only the persons themselves but potentially the vehicles they bring on to the farm as well. Some visitors that have no contact with other livestock are low risk while visitors that have contact with livestock from multiple locations or that have had recent contact with livestock in foreign countries are higher risk.
- Farm equipment. Two common risk situations include any equipment that is used to haul or



transport livestock carries risk, especially if that equipment is shared between farms. Equipment used to haul or mix feed is also a source of risk.

A farm biosecurity plan to manage these risks should focus on three main areas:

1) **Cleaning/sanitation and disinfection:**

This can include practices such as foot baths and cleaning and disinfecting pens where sick animals have been housed and treated. Pouring or spraying a disinfectant on a manure covered surface is not disinfecting an area. Most disinfectants will not work if the surface to be disinfected is not clean because organic materials like soil, manure, straw, blood, pus etc. inactivate some disinfectants.

2) **Isolation and quarantine:**

All new or sick animals, and animals returning after expo-

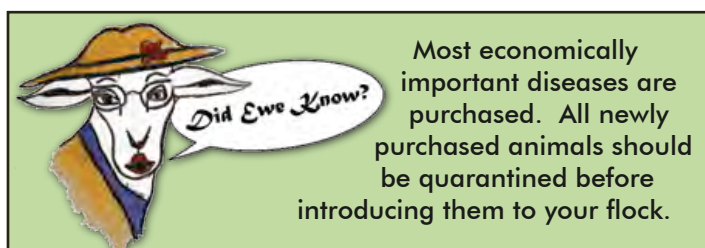
sure to outside the farm should be isolated from the flock for at least 2 and preferably 4 weeks. The isolation area should be several hundred yards from the rest of the flock and that area should have its own separate equipment and feeding containers.

Outerwear/footwear used while caring for animals at this unit should stay at this unit.

3) **Traffic regulation:**

Visitors to the farm should arrive with clean clothing, boots, and equipment. If in doubt, keep a supply of disposable plastic booties for visitors. Vehicles should be clean and free of visible manure. Some farms may want to institute a "no visitors without permission beyond this point" policy to better assess risk and make decisions on a case by case basis.

Farm biosecurity does not need to be overwhelming. Start with an assessment of where the greatest threat to introducing an infectious disease to your flock might be. Design a simple plan based on some of the principles contained in this article and be realistic about what you can control.



Tips on Parasite Management in Sheep

Kathy Bielek, Katahdin Producer, Ohio

Gastrointestinal nematodes (GIN) or parasites are one of the most serious challenges to sheep. While there are no one-size-fits-all or easy answers, due to the large variability between animals, seasonal challenges and management systems, there are excellent options to consider.

Many flocks now have dewormers that no longer work. The American Consortium for Small Ruminant Parasite Control (ACSRPC) recommends the following guidelines for all flocks to keep dewormers working as long as possible:

DO NOT deworm all sheep before moving to a clean pasture.

DO NOT deworm all ewes prior to breeding.

DO NOT deworm all ewes at lambing.

DO NOT deworm all lambs every few weeks during the summer.

DO NOT rotate dewormers on a yearly basis or between each usage.

DO know which dewormers are effective on your farm.

Prior to 2000, the recommendations of many veterinarians and parasitologists were to eliminate all worms in the sheep frequently. The current recommendation is to **“deworm only the sheep that need it.”**

In most cases, changes in management can reduce exposure to parasites and decrease the frequency of dewormings. The following are some of the factors that influence the level of parasite challenge:

SEASONAL CHALLENGES

- In a spring-lambing flock, pasture contamination starts increasing in early spring and continues to increase (often quickly) over the summer.
- Overwintering of larvae on pasture can be an issue, even in northern states.

STAGE OF PRODUCTION

- Lactating ewes and young lambs are most susceptible to parasites, shed the most parasite eggs, and cause the most pasture contamination.

AGE OF ANIMAL

- Mature rams and non-lactating ewes are typically less susceptible to parasites.
- Lambs that are older and in good body condition usually fare better than younger and smaller lambs when first challenged by parasites.

NUTRITION

- Adequate or improved nutrition (good forage and/or supplemental feed) increases resilience.
- Amount and quality of milk has a direct impact on lambs:
 - Single lambs typically resist parasite challenge better than multiples.

- Twin lambs out of mature ewes often are less stressed by parasites than triplet lambs or twin lambs out of yearling ewes.

GENETICS

- Some individual sheep are more resistant and/or resilient than others.
- Identifying and selecting less susceptible animals as replacements and culling more susceptible animals will increase resistance of the flock over time.
- If a flock goal is to improve parasite resistance, buy rams with better (lower) EBVs for fecal egg count.

STOCKING DENSITY

- Parasites are a density-based health issue; high stocking densities increase parasite load.


STRESS

- Stress increases susceptibility to parasites, especially in lambs and lactating ewes.
- Examples of stressful situations include: weaning; relocating and/or transportation; change in diet; change in contemporary group of animals; extreme temperatures and weather.

Pasture management plays a significant role in parasite management. In summer, roughly 95% of the parasites on the farm are on the pasture; only 5% are in the animal. Several pasture management options for decreasing parasite issues include:

- Avoid grazing paddocks that were used by lactating ewes and young lambs for several months, or until the following year;
- Avoid grazing grasses lower than 2”;
- Delay grazing until dew has dried off;
- Reduce stocking rates;
- Employ mixed species grazing;
- Use intelligent rotation to create “safe” pastures;
- Try plants with anti-parasitic properties (chicory, sericea lespedeza);
- Offer supplemental feed on pasture at times of high parasitic worm pressure;
- Use hay fields and/or annuals as forage to reduce exposure to worms;
- Parasite larvae cannot survive on straw or on drylot; consider weaning lambs early and moving off pasture (finish in drylot or sell).





Dosing one 75 lb lamb with Cydectin costs approximately 50 cents. Deworming 100 lambs every 4-6 weeks throughout the warm season will cost you approximately \$250-\$350. If you selectively deworm only the lambs that need it based on FAMACHA scoring you could save about \$200 per year.

Feeding Sheep

**Steven H. Umberger, Extension Animal Scientist,
Virginia Cooperative Extension**

The following has been excerpted from an article by the same name. The entire article can be found at: <https://pubs.ext.vt.edu/410/410-853/410-853.html>

Nutrition plays a major role in the overall productivity, health, and well-being of the sheep flock. Because feed costs account for approximately two-thirds of the total cost of production on most sheep farms, it is important that producers consider nutrition management a top priority.

Nutrient requirements of sheep vary with differences in age, body weight, and stage of production. The five major categories of nutrients required by sheep are:

- 1) water,
- 2) energy,
- 3) protein,
- 4) vitamins, and
- 5) minerals.



During the grazing season, sheep are able to meet their nutrient requirements from pasture and a salt and mineral supplement. Hay is provided to the flock when forages are limited, and grain may be added

to the diet at certain stages of production when additional nutrient supplementation is required. Small grain pastures or stockpiled fescue can supply up to one-half of the feed requirements of the ewe flock during the winter.

For winter-born lambs, creep diets and diets for early-weaned lambs are formulated from high energy feed grains and protein supplements to promote accelerated growth. During the grazing season, pastures of mixed grass and clover, alfalfa, small grain and turnip serve as excellent sources of nutrition for growing lambs. A source of clean, fresh water is provided to sheep at all times.

FEEDING THE EWE FLOCK

Ewe body weight does not remain constant throughout the year, but changes with stage of production. Nutrient requirements are lowest for ewes during maintenance, increase gradually from early to late gestation, and are highest during



lactation. Decisions affecting feeding management are improved significantly by knowing ewe body weight and condition score at three distinct stages of production:

- 1) three weeks before breeding,
- 2) mid-gestation, and
- 3) weaning.

Condition score is a subjective measure of body fat that is most easily determined by handling ewes down their back. It is the best method available to monitor nutritional status and overall well-being of the sheep flock. Condition scores range from 0 to 5, with 0 being extremely thin and 5 being very fat. Condition scores at either end of the scale are undesirable. Ideally, ewes should range from a condition score of 2.5 at weaning to a 3.5 at lambing. When necessary, thin ewes are separated and fed additional energy to increase body condition. Conversely, obese ewes are separated and fed a lower energy diet at a stage of production when body weight loss is acceptable.

RAM FEEDING

Rams should have a body condition score of 3.5 to 4 before the beginning of the breeding season. Once turned in with the ewes for breeding, rams spend very little time eating. They can lose up to 12 percent of their body weight during a 45-day breeding period. That equates to 30 pounds for a 250 pound ram. Poor nutrition is a major cause of ram mortality.

As the sheep industry has moved away from smaller framed, earlier maturing types of sheep to larger framed, later maturing types of sheep, they have increased the rams' mature body weight. In many cases, forage alone is not adequate nutrition for placing rams in proper body condition for the breeding season. At the very least, rams should be evaluated for body condition six weeks before breeding. Thin rams should receive grain supplementation as a means to increase body weight and condition. It takes 50 days and approximately 2.5 pounds of corn per day in addition to a ram's normal diet to move him from a weight of 225 pounds to 250 pounds. Mature rams, not in breeding, can be maintained on pasture or wintered on good quality hay. Six to eight pounds of mixed grass and clover hay is sufficient to meet the daily energy requirements of a 250 pound ram. A free choice source of water, salt, and minerals should be available at all times.



Can I Manage My Katahdin Sheep

Jim Morgan, PhD, Katahdin Producer, Arkansas

Adding sheep to a cattle enterprise can increase forage utilization and product diversity, leading to increased profitability. In general, one sheep can be added for every cow/calf pair, without affecting stocking density. Most cattle producers will find that in most ways sheep are like little cows. Because their rumens function in similar ways, growing lambs and calves need similar inputs on a per pound body weight basis. Forage management for efficient production and intake as a percent of body weight (depending on the stage of production) are basically the same in sheep and cattle.

A word of caution is needed, however. There are some significant differences between sheep and cattle. Most cattle producers will need to make a few changes in management to be on their way to a rewarding and successful sheep venture. The key differences in management include: fencing requirements, predator protection, climate concerns, shelter, parasite management, USDA Scrapie tag requirements, different vaccination protocols, lambing management and nutrition.

Fencing: The standard fence requirement for sheep is woven wire. A 4 or 5 strand barbed wire fence won't keep a hungry sheep in, or a hungry predator out. Adding a well-maintained low-impedance 2-3 strand electric fence offset from the 4-5 strand barbed wire cattle fence can work well.

Predator protection: Depending on your location, predators can include domestic dogs, coyotes, wolves, bears, bobcats, mountain lions, black vultures and eagles. Good predator protection usually includes a combination of good fencing, night corrals and guardian animal(s) (female donkeys, female or neutered llamas or guardian dogs).

Climate: Katahdin ewes are excellent mothers and typically do well lambing on pasture. However, lambing in freezing rain or deep snow can increase mortality in newborn lambs. An 8 pound newborn lamb has much less thermal mass than a 90 pound newborn calf, and a greater risk of hypothermia. In severe climates, many producers choose to lamb in the barn or breed ewes to lamb in spring when milder temperatures are the norm.

Shelter: Sheep typically need a little more protection from the freezing winter winds than cattle. How-

ever, the winter coat of sheep in many cases allows them to handle more extreme cold than many cattle when wind velocities are low. A shelterbelt, a row of trees, or a two sided shed is often enough protection.

Parasites: Sheep eat closer to the ground, will graze closer to manure and, because they evolved in dry climates, in general are less resistant to internal parasites than cattle. Many sheep dewormers no longer work on the key worm species affecting sheep, the barberpole worm, so good pasture and parasite management are important. Poor management and nutrition can compromise immunity. As a breed, Katahdins are more resistant to parasites than most sheep breeds,

although levels of resistance vary among individual sheep. Purchasing sheep with documented parasite resistance can help.

Tagging: Sheep are required by law to have a USDA Scrapie ear tag when they leave the premises. In addition, producers are required to keep records of the tag number and where the sheep was sold or dispersed for five years. To order free tags, call 1-866-USDA-TAG.

Vaccines: Sheep are more prone to tetanus than cattle.

To avoid tetanus, it is important to use more care with castration. Use tetanus anti-toxin and booster the ewe in the last month of gestation with CD&T, to provide the young lambs with passive immunity via colostrum. The lambs will also need to be vaccinated and boosted. The CD&T vaccine also protects from over-eating disease (see below).

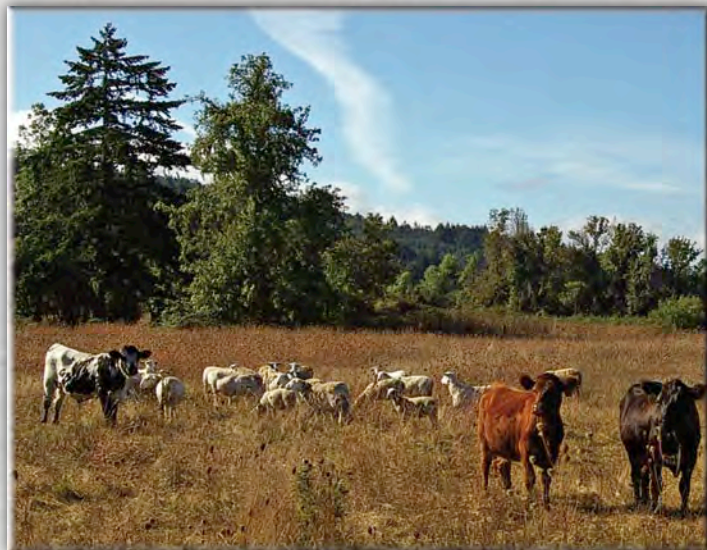
Lambing Management: Most ewes lambing on pasture or in a roomy barn will require little if any assistance. However, if sheep are lambing in a crowded barn or small corral, there will surely be issues. Crowded conditions increase the risk of other ewes interfering during the birthing process or while bonding, especially with twins or triplets. A producer will benefit from buying seedstock from a breeder whose lambing management system is similar to their plan.

Nutrition and Feed Preferences: There are a few nutritional differences and foraging habits that are important to understand:

1. Sheep are intolerant of added copper. Feed and minerals containing copper labeled for other species (goats, cattle or horses) are toxic to sheep. The excess copper will accumulate in the liver eventually leading to liver failure and death.



... Like Little Cows?



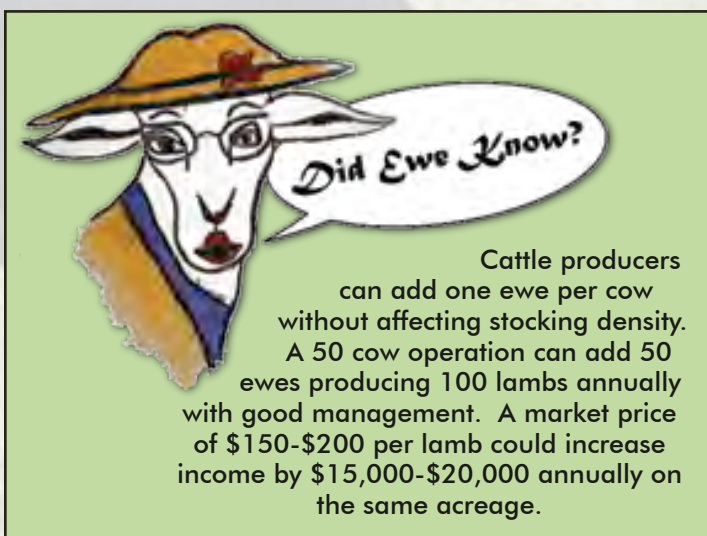
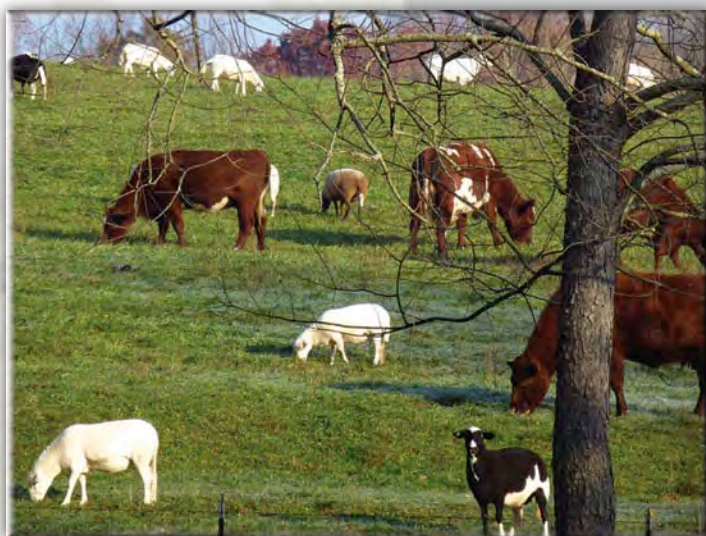
rather than cracked or ground, to slow the rate of digestion

2. Sheep are selective grazers. Cows use their tongue to pull grass into their mouth, whereas sheep use the teeth and lips to be more selective. Sheep prefer more forbs than cattle and can decrease the need for mechanical or chemical control of pasture/range weeds.
3. Sheep are less likely to eat over-mature grasses or stemmy hay than cattle. They will pick through the hay or forage and leave behind more waste than mature cows. Sheep are more sensitive to molds than cattle, so avoid feeding moldy hay.
4. A sheep's rumen has faster throughput and faster digestion. Although not as common in forage-based programs, Clostridial disease occurs from rapid changes from a lower to higher starch/energy diet. Lambs are especially prone to over-eating diseases and should be vaccinated with CD&T as outlined under vaccines above. To prevent over-eating disease, acidosis or bloat, grain is best fed whole,

5. A ewe only needs high nutrition for 3-4 months of the year, from late gestation until a few weeks before weaning. Improving nutrition during gestation and when raising twins or triplets is more important in sheep than cattle. Otherwise, ewes can be kept on a maintenance diet similar to cattle.

Markets: At most sale barns, buyers will pay a fair price for cattle. This is not always the case for sheep, so it is worth doing your market homework.

Summary: Although sheep share many similarities with cattle, there are a few differences to be aware of. The addition of sheep to a cattle operation can improve pasture utilization with the added benefit of weed control. Adding sheep to an existing cattle operation can increase profits by as much as 40% since twinning sheep produce more meat per acre on a pound for pound basis than cattle. With decent markets and some adjustments to management practices, a cattle producer can take advantage of the increased efficiency of sheep.



Ideas for Managing Newly Purchased Lambs

Roxanne Newton, Katahdin Producer, Georgia

Many new shepherds feel slightly overwhelmed after buying their first breeding lambs and are often unsure how to keep them healthy and growing. The following are a few tips to make the transition easier and avoid problems.



1. If you already have sheep or goats on the property, isolate the new lambs in a separate area for 30 days to prevent the possibility of disease transmission. If you've purchased sheep from different sources, keep those groups separated as well.
2. Develop a record keeping system. Start with identifying each animal: write down their tag numbers, registration numbers, vaccination dates, weights, health treatments, etc. Record keeping is important to track future production: lambing data, number of lambs born and weaned, weaning weights, etc.
3. Design a handling system. Buy or build either a chute system or catch pen and get the lambs used to being handled. Buy a scale; it's the best investment you'll ever make. The more you handle them, the calmer both you and the lambs will become. When handling, check their body condition, trim hooves if necessary, look for signs of parasitism and/or weigh them. Record any treatments.
4. Avoid treating ram lambs as pets. Friendly ram lambs can become aggressive as they mature.
5. Transition their feed. If the lambs you purchased were supplemented with grain, it is a good idea to make the transition to a different feeding program as slow and stress free as possible. A general rule of thumb is not to increase or decrease grain by more

than ¼ lb at a time and maintain that amount for 2-3 days before changing again. Often new shepherds will over feed lambs, which is not only costly but can negatively affect future production. Meet their nutritional needs but don't overdo it.

6. Pasture species and forage can be different in most regions and may take some getting used to. In addition, the stress of transport and adjusting to a new environment can leave some lambs more susceptible to parasites. Lambs need to be monitored closely for signs such as: anemia, weight loss, sluggishness, and diarrhea.
7. Environmental needs should be met before lambs arrive: a clean water source, hay/feed/adequate pasture space, minerals (for sheep), secure fencing, and shelter or shade. If you're using guardian animals, allow them to become accustomed through the fence before mixing.
8. Breeding ewe lambs. Most Katahdin ewe lambs will cycle for the first time around 7-10 months of age. Ewe lambs should have reached 90 lbs or approximately 70% of their mature weight before breeding.



Using Hay to Meet Sheep Nutritional Needs

Rory Lewandowski,
Extension Educator, Wayne County, Ohio

Sheep are ruminants so outside of a feedlot situation the majority, if not all, of their nutrient requirements should be met from forages. For most sheep owners this means that hay is an important component of the ration through at least the winter months and possibly even longer. There are two critical questions to answer when using hay to meet sheep nutritional needs:

- **What is the nutrient content and quality of the hay?**
- **What are the nutrient requirements of the sheep?**

The number one factor affecting the quality and nutrient content of hay is the maturity at which it is harvested. As the maturity increases and the forage plant passes from vegetative stage to reproductive growth with seed head formation and on to seed development, quality steadily declines. The rate of quality decline is generally steepest during the first cutting in the spring through early summer. Other factors that play a role in determining hay quality include forage species, rainfall during the drying and harvest process, soil fertility, and storage conditions.

Although visual assessment can provide some clues as to hay quality and can help to separate hay into general categories, it will not be able to provide a specific quantitative value regarding crude protein, energy content, fiber content and minerals. To get that information requires a chemical analysis from a qualified forage testing lab. Most sheep owners should at least know the crude protein (CP) and energy content of their hay. Energy content as total digestible nutrients (TDN) is a calculated value derived from a formula that uses the fiber content of the forage.

Knowing the nutrient content of your hay is interesting but it is only useful if compared or matched to the nutrient requirements of your sheep. The national research council (NRC) has determined the nutrient

requirements of various production stages of sheep. Some examples of those production stages include stage of gestation, last 4 weeks of gestation with 180-225% expected lamb crop, early lactation with twins, early weaned lambs with moderate growth expectation, finishing lambs, replacement ewes, etc. For each production stage the NRC tables list nutrient needs in terms of crude protein, energy as TDN, some of the major minerals such as calcium and phosphorus along with vitamin A and E requirements. These requirements are minimum requirements and higher levels, especially in regard to energy, may be required depending upon the environmental and physical circumstances of the animal.



The next step is matching hay nutritional content to our sheep nutrient needs. Which production class does this hay match up best with? Are there limitations to intake because of high fiber content that need to be considered? For example, if my hay has a CP content of 10% with 55% TDN, where is that hay best used? If I look at NRC tables I will see that it can meet the requirements of ewes through the first 15 weeks of gestation, but if I want to use it for the last 4 weeks of gestation or into early lactation, I will need to supplement with additional crude protein and energy. On the other hand if I have hay with 16% CP and 67% TDN I could use this hay and meet nutritional requirements of all stages of ewe production.

Much more could be said about using the information from a hay test and the NRC requirement tables to calculate sheep rations, but these basics will get you started in the right direction. Remember to let the animal's body condition score tell you if nutrient needs are being met.



When Should Lambs Be Weaned?

Jim Morgan, PhD, Katahdin Producer, Arkansas

When to wean is not a one-size-fits-all management decision. It includes evaluating nutritional resources, biology of sheep and flock production goals. The standard age for weaning lambs can range from 60 days in flocks using high quality supplements to 120 days when raising sheep on lower quality forage. The goal of weaning is to match the nutritional needs of growing lambs with available resources.

The biology of sheep has three important components: the development of the lamb's digestive system, the lamb's efficiency of growth from feed inputs, and the ewe's milk production. Understanding these will help a shepherd design a weaning program that is financially efficient, minimizes flock health issues and keeps the lambs growing.

Most grazing systems lack the quality needed for a 60 day old lamb to acquire adequate nutrition from forage alone. For young lambs to remain healthy and grow, they will need additional high quality nutrients provided by milk and/or creep (grain).

A lamb's rumen develops slowly, so for lambs to grow well on forage alone at 60 days of age requires a pasture of very high quality. If nutrition is not adequate, parasitism can become an issue, resulting in sick or unthrifty lambs. Good management is essential for successful early weaning.

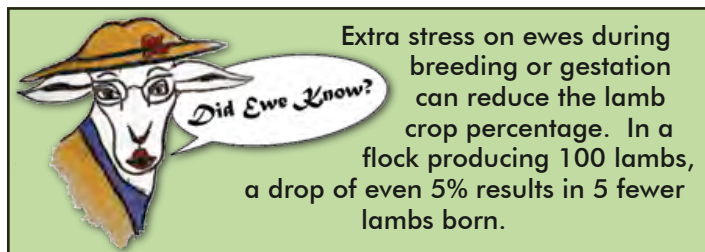
Ewes reach peak milk production at 30 days post-lambing and then drop to about 30% of peak by 60 days. This matches the development of the lamb's rumen. As the lamb's rumen becomes more functional, it produces more of the nutrients needed for growth. This typically occurs at the same time milk production slows. However, that small amount of high quality, easily digestible milk continues to supplement the lamb's intake of moderate or lower quality forage.

Sheep are most efficient at converting feedstuffs to pounds of meat in the first few months of life. Therefore, designing a system for weaning that keeps lambs growing while matching the farm's resources, management and marketing goals is paramount. Common scenarios include:

- **Moderate forage quality with little or no supplement.** "Moderate" forage means that it is not high enough quality to wean lambs at 60 days of age. By delaying weaning until lambs are 75-90 days of age or older, the lamb's rumen will have developed enough to perform and remain healthy on moderate quality forage.

"The goal of weaning is to match the nutritional needs of growing lambs with available resources."

- **Limited quality or quantity of forage, hay or supplement.** This situation can be caused by a drought, a tight feed budget or limited grazing options. Since it is more efficient to directly feed the lambs if forage is limited, a shepherd can wean at 60 days, save the best grass for the lambs or provide supplement to just the lambs instead of the ewes.
 - **Abundant forage.** There is less reason to wean lambs prior to 90-120 days of age. The little bit of milk (very high quality nutrients) still being produced will increase lamb growth and the ewes will continue to "educate their offspring" about grazing.
 - **Forage only (grass fed); no grain.** In most systems, this means stocking fewer ewes and lambs per acre on moderate to high quality forage. Weaning between 90-120 days of age results in a healthy lamb with little drop in performance associated with weaning stress. Therefore, producing 60-80 pound market lambs can be accomplished. However, marketing heavier 100-110 pound lambs becomes more difficult without high quality forage and excellent management.
 - **Grain readily and economically available.** In this system, it is more efficient to wean the lambs at early ages. Rations have been developed to wean lambs at or before 60 days of age. In this system, ewes are provided lower quality hay at about 35-40 days post-lambing to slow milk production which forces lambs to eat more creep.
- Mastitis is an important health concern for the ewes at weaning. The younger the lambs when weaned, the more important it is to manage the ewe to prevent mastitis. Weaning prior to 75 days of age increases the risk of mastitis if feed for the ewe is not limited. Most weaning protocols recommend no feed to the ewes for 24-48 hours before weaning followed by low quality hay for 7-14 days. Ewe udders should be evaluated frequently during the dry off period for evidence of mastitis.
- In summary, evaluate your feed resources, land resources and flock production goals to select a weaning system that is profitable and healthy for your sheep and meets your marketing goals.



LOW STRESS ANIMAL HANDLING

Jim Morgan, PhD, Katahdin Producer, Arkansas

*Author's Note: Ideas for this article were inspired by Burt Smith's **Moving'Em: A Guide to Low Stress Animal Handling**, published by the Graziers Hut, Kamehula, Hawaii in 1998.*

Decreasing the stress level of sheep during handling and management will improve your bottom line. Handling includes feeding procedures, moving sheep between pastures or to market, and working them for weighing, vaccination, or hoof trimming.

Extra stress to ewes at breeding and during gestation can result in fewer lambs born and decreased milk production. Extra stress to animals in winter will require more feed in order to maintain body weight. Repeated stress to lambs between birth and marketing will result in decreased weight gain. Sheep that are stressed are more susceptible to internal parasites and disease.

FLIGHT ZONE

One of the keys to handling and moving animals is understanding the "flight zone". This is the distance that a predator can approach before the animal flees. It varies with each individual animal and the type of predator. While defined by scientists in terms of predator-prey interaction, for shepherds, it describes the response of a sheep to the approach of the person or dog while herding them.

When moving sheep, the shepherd approaches and then encroaches on the flight zone which causes the sheep to respond by moving. If the shepherd rushes the flight zone quickly or moves deep into the flight zone, the sheep will have greater stress and be less predictable in the direction of movement. Gently approaching the flight zone will encourage sheep to move slowly and deliberately in the preferred direction.

Driving sheep relies on the instincts of grazing animals to move away from predators, and predator-prey interactions by definition are stressful. A poorly trained herding dog can greatly increase the stress of the animal being herded. If used, herding dogs should be trained to be slower and less aggressive; faster movement is rarely better.

MOVING SHEEP

As shepherds, we have to handle sheep, whether it is to weigh, vaccinate, wean, or take them to market. Burt Smith ranks the following methods of moving animals from highest stress to lowest stress:

- 1) mechanical (trailer/truck),
- 2) driving (by horse, dog or humans on foot),
- 3) leading (training sheep to follow) and
- 4) sheep moving themselves between pastures or into the working area.

Within each category, there can be a wide variance in stress levels in the animal. For instance, long hauls

in a trailer are more stressful than short trips. Driving sheep by chasing, yelling, moving animals too fast, or using an aggressive herding dog is much more stressful than gently guiding from behind the flock. In general, leading sheep using a bucket of grain or a bale of hay to lure sheep into the corral, handling pen or the next pasture is less stressful than driving them.

HUMAN BEHAVIOR AND EMOTIONAL STATE

Several studies with dairy cattle have shown that the emotional state of the handler has significant impacts on daily milk production. It's been documented that milk production by a dairy herd can drop 1-5% on a day the milking parlor person is stressed. Emotions like anger that result in quick, jerky and less predictable movements by the shepherd can stress animals.

CONDITIONING/TRAINING

Sheep that are accustomed to moving through working chutes and corrals without being handled experience lower stress levels than they do when they are being worked for vaccinations, deworming or foot trimming. Spending the time to condition the sheep by occasionally moving them through the handling system without working can pay dividends in terms of pounds of lamb to market.

LENGTH OF STRESS

It's important to keep the time on the truck/trailer, or in the corral and working areas to a reasonable minimum.

NUMBER OF ANIMALS

Sheep are a flock animal and are most comfortable in groups of three or more. Keeping one sheep alone for any reason, even for a short period of time, is stressful for that individual. Always keep a companion animal, even if it's a different species.

SUMMARY

Minimizing the stress your sheep experience during handling, moving and transporting will result in better weight gains, more lambs born and better milk production, all of which add up to better profitability.

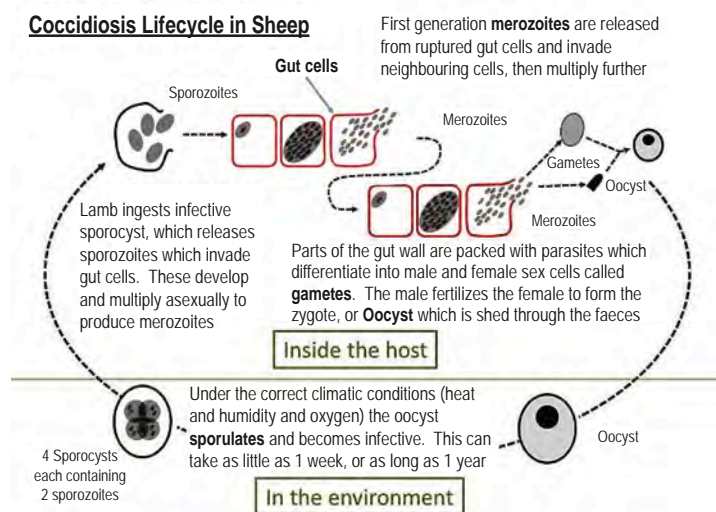


Coccidia: The Other Parasite

Dr Lynn Tait DVM, Veterinarian & Katahdin Producer, Alberta, Canada

Coccidiosis can be a severe, debilitating disease in lambs. Preventative therapies are recommended and in many operations mandatory for control. A working relationship with a veterinarian is required for implementing effective pharmaceutical treatments of clinical disease.

This parasitic disease is caused by the protozoa, coccidia (*Eimeria* spp) which are present in the adults of nearly all species of livestock. Coccidia develop in the lining of the intestinal tract of the animal and produce oocytes instead of eggs. Infected sheep will develop natural immunity, or resistance, with age but continue to shed oocysts (eggs) in their feces as adults and become a source of infection for the lambs.



The life cycle of coccidia generally takes 14 days and coccidia thrive in warm, moist conditions. Therefore, dirty, wet pens and contaminated feed and water containers are often associated with outbreaks in lambs. Oocysts are very resistant to environmental conditions and cannot be killed by ordinary disinfectants. Extreme desiccation or direct sunlight are the only environmental factors which are damaging to the oocytes.

Coccidiosis is most often seen in confined or housed lambs, but can also be a problem on pasture if the environmental conditions are favorable. Lambs one to six months old are most susceptible but clinical cases can be seen in older sheep that had little or no exposure as young lambs. Most sheep acquire low levels of coccidia as lambs without ever showing symptoms or becoming ill and rapidly build a lifelong immunity. Conditions that can increase the risk of clinical coccidiosis include: poor nutrition, overcrowding, nutritional changes and stress, particularly around weaning time. In severe outbreaks, producers can lose 10-30% of their lamb crop in a few weeks but subclinical produc-

tion losses are probably the most important economic aspect of this disease.

SYMPTOMS

Lambs with subclinical coccidiosis may not show symptoms other than poor weight gain or ill-thrift. Other symptoms include hunched appearance, depression, and sudden death. The most common symptom of clinical coccidiosis is watery diarrhea, often streaked with blood. Lambs that survive a severe case of coccidiosis may never fully recover due to intestinal cell wall damage and continue to be poor doers as adults. Occasionally, coccidia can invade the nervous system of lambs and result in neurological signs with or without diarrhea.

PREVENTION

Prevention of coccidiosis is aimed at managing conditions that increase risk of infection: avoid unnecessary stress and overcrowded conditions; keep water buckets and feed troughs clean and free from fecal matter; improve sanitation and improve nutrition. It is most efficient to use anticoccidial drugs in creep feed to prevent the disease rather than treat lambs in the face of an outbreak. The use of coccidiostats allows lambs to experience low levels of exposure and develop immunity in the face of a greater challenge. They can be added to creep rations or feeder pellets. Adding coccidiostats as a top dressing or in loose mineral is not as effective in controlling the disease as each animal is not assured of ingesting adequate levels of the drug. Drugs used to deworm sheep are not effective against coccidia.

TREATMENT

In a clinical outbreak the disease is often severe before clinical signs become apparent and producers can lose a significant percent of the lamb crop (20 percent or more) in less than two weeks. In cases where clinical signs are observed, early consultation with a veterinarian is critical to developing a treatment and control strategy that will minimize both immediate and long term production losses in the affected animals.



Keeping barns clean and uncrowded can reduce the risk of coccidia transmission.

Some Key Diseases That Affect Sheep

**Susan Schoenian, Extension Specialist,
Sheep & Goat, University of Maryland**

Sheep can be affected by many diseases. This article gives an overview of some of the most common diseases. For a more complete list of sheep diseases go to <http://www.sheep101.info/201/diseasesa-z.html>.

CASEOUS LYMPHADENITIS (CL, CLA)

Caseous lymphadenitis (CL) is an infectious, contagious disease of sheep (and goats). It is caused by the bacteria called *Corynebacterium pseudotuberculosis*. CL causes the formation of internal and external abscesses. Internal (visceral) abscesses form in different organs, resulting in a debilitating (wasting) disease, often referred to as “thin ewe syndrome.” Subcutaneous (external) abscesses form near the lymph nodes, mostly around the head and neck region. If/when these abscesses rupture, they release pus into the environment, providing the vector of transmission to other animals.

While not all abscesses are CL, until proven negative by culture, they should be treated as if they are. Bacterial culture is the most reliable test for determining the CL status of an animal, whereas blood tests can determine if a flock is infected. While abscesses are often surgically drained and flushed (with iodine), draining the abscesses increases the risk of transmission, and there is no guarantee that an abscess will not reappear. There is no treatment or cure for CL. Affected animals should be isolated (minimum) and culled (preferably). Vaccination has been shown to reduce the number of abscesses in infective flocks. It should only be used in flocks in which CL is already present.

FOOT SCALD AND ROT

Foot rot and foot scald are the two most common diseases affecting the hooves of sheep (and goats). Lameness is the primary symptom. Foot scald is an infection of the tissues between the sheep's toes, whereas footrot is an infection of the underlying tissue of the hoof. Footrot has a characteristic foul odor. Foot scald is caused by the bacteria (*Fusobacterium necrophorum*) that is a normal inhabitant of sheep farms, whereas footrot is caused by the introduction of a second bacteria (*Bacteroides nodosus*) which usually walks onto the farm in the hooves of an infected animal. Unlike foot scald, foot rot is highly contagious.

Foot rot can be one of the most difficult diseases to control and/or eradicate. Typical control measures include hoof trimming, topical treatments, foot soaking, isolation of infected animals, and administration of antibiotics (usually Rx). Culling is the most powerful tool for eradicating foot rot. Animals which do not respond to treatment or have re-occurring infections should be removed from the flock. Some animals are more resistant to foot rot; they (especially rams) should

be favored for breeding. In addition to the costs associated with footrot (and scald), hoof disease is an important welfare issue.

MASTITIS

Mastitis is an infection or inflammation of the udder (or mammary gland). The most common cause is a bacterial infection. When both halves of the udder are affected, the cause may be OPP (see below). Mastitis is most common in flocks that practice early weaning and among heavy-milking ewes. It is the most common reason for culling, especially young ewes.

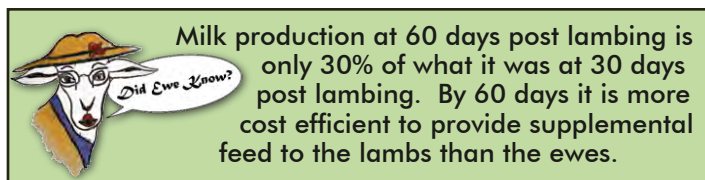
Mastitis may be acute or chronic. The first sign may be lameness or hungry or poor-performing lambs. The ewe's udder may be hard, warm, or discolored. The milk may or may not be normal. In extreme cases (gangrenous, “blue bag”), mastitis can be life-threatening. On the other hand, ewes with chronic mastitis may go unnoticed. In fact, sub-clinical mastitis is probably the most costly form of mastitis.

Treatment of mastitis usually involves antibiotics (systemic and/or intramammary, Rx) and anti-inflammatory drugs (Rx). While some ewes respond to treatment, ewes with spoiled udders should not be retained for breeding. Proper management during the drying off period is essential to preventing mastitis in flocks that practice early weaning. Good hygiene is especially important for housed flocks.

OVINE PROGRESSIVE PNEUMONIA (OPP)

Ovine progressive pneumonia is a viral infection that affects many body systems and causes a variety of symptoms. OPP is a common cause of wasting in ewes. Hard bag is another symptom that is frequently observed. Hard bag is mastitis that affects both sides of the udder, usually resulting in little or no milk being produced. The primary cost of OPP is lost production and premature culling of affected ewes. OPP is transmitted laterally from infected sheep to uninfected sheep. It is also transmitted to offspring via the milk from infected dams.

There is no treatment or cure for OPP. It is difficult to control and/or eradicate. Ewes can be blood tested for OPP and positives can be isolated or culled. Another strategy is to remove lambs from infected dams and feed them heat-treated colostrum and milk. Scientists recently discovered genes which code for reduced susceptibility to OPP. Use of rams with desired haplotypes should reduce incidence of OPP in an infected flock and offers an alternative to culling and/or rearing lambs artificially.



Ram Management for Small & Beginning Flocks

Jim Morgan, PhD, Katahdin Producer, Arkansas

Rams are an essential part of any flock, but can pose management challenges for small and beginning flocks. One concern is what to do with the ram once the ewes are bred. A basic understanding of ram behavior is important before considering different management options.

- NEVER trust a ram and never turn your back on one. They may seem friendly, but rams can be unpredictable and powerful especially during breeding season.
- Sheep are flock animals and being kept alone is stressful. A ram kept alone can become stressed and potentially aggressive and dangerous.
- Rams often fight with each other to establish dominance. Often a difference in size and/or age reduces the time it takes to work things out.
- When introducing a new ram, removing the dominant ram from the group, or putting rams back together after breeding season, confine them to a tight pen until they quit fighting. A small pen prevents the rams from backing up and charging each other at full speed, causing injury or death.

Leaving the ram with the ewes year around may seem like an easy way for a small flock to manage, but there are significant drawbacks.

- The ram may become aggressive toward the pregnant ewes or newborn lambs and cause injury.
- When rams are in with the ewes year-round, more ewes will single rather than twin, resulting in fewer lambs born since the ewe's first cycle in late summer is more likely to be a single egg ovulation.
- When lambing is stretched out over several months, much higher feed costs are incurred. If all ewes are kept together and lamb over the course of 3-8 months, some of the ewes will be overfed (wasting money on feed) or underfed (resulting in small unthrifty lambs). The ram requires a maintenance diet most of the year, feeding him alongside lactating ewes will result in an obese ram and will waste money on feed.
- Rams will often become possessive of "their" ewes which can be dangerous, especially for children, when caring for the ewes and lambs.

Several options for management are discussed below. The option that works best for you will depend on the flock goals. For instance, do you only plan to raise meat for your own family or do you plan to double the size of your flock, keep replacement ewe lambs and/or sell registered breeding stock? The type of ram you buy and how he is managed will likely be different

for each scenario. Also consider if you have separate facilities (fencing, shelter) to maintain rams separate from the ewes.

- Buy two unrelated rams. Two rams usually work well as companions for each other during the non-breeding season, although there is still a small risk of them injuring each other. Unrelated rams can be used as service sires on each others' daughters, delaying the need to purchase a new ram.
- Buy a ram lamb just prior to breeding each fall and at the end of breeding season sell or butcher him. A 9-10 month old Katahdin ram will not be strong flavored. Depending on how much money you paid for the ram, you may lose money on your purchase, but you won't have to maintain a ram all year.
- Keep a wether (neutered male sheep) as a companion. Wethers can usually be purchased at meat lamb prices, and require only a maintenance diet, so are inexpensive to maintain.



- If it is your first year, consider buying exposed ewes. They usually cost more, but it saves buying and maintaining a ram the first year. This option usually requires an agreement between buyer and seller if the ewes are not settled. Buying unrelated ewes that have been exposed to two or more unrelated rams will often result in one or two unrelated ram lambs from the matings to use for breeding the following year.
- Buy a good quality ram the first year then trade him with another breeder who shares similar goals.
- Lease a ram. In addition to the lease price, this requires an understanding between the two parties about how much the ram is worth if he is injured or killed. There is also the risk of introducing potentially contagious diseases carried in by the leased ram or carried back to the original flock.
- Co-purchase or share a ram with another breeder with similar goals and management. Split the breeding season; for example you use the ram for the first month and the other flock uses him for the next 30 days. Agreements should be in place beforehand on bio-security, maintenance and how injury or death of the ram will be handled. There also should be a firm understanding of how the ram will be sold when he is no longer needed by one or both of the co-owners.

In summary, there are several ways that small flocks can manage rams. Setting your breeding and flock goals and selecting the best option for your operation and budget is time well invested. When leasing, sharing, or co-owning animals, a well thought-out plan that is agreed upon by both parties is paramount.

Selection and Development of Ewe Lambs

**David S. Redwine, DVM, Katahdin producer,
Virginia**

One of the most effective tools available to a shepherd to improve the genetics, efficiency and profitability of a flock is the selection and development of superior ewe lambs. The rate of improvement is determined by how well you identify the best replacement ewe lambs and your success depends on how well you manage them during the first eighteen months of their lives.

The selection of "keeper ewe lambs" is one of the most important jobs you have, yet most shepherds don't have a plan or a structured method for retaining ewes. Through the years I have heard everything from "Grandma loves that one" to "I've always wanted one that color". While these reasons may please you (and Grandma), they really have no bearing on improvement of the flock, or the bottom line. You must have a plan in place and stick with it no matter how high the temptation.

Replacements should be offspring of the flock's most productive ewes. Identifying these dams requires good record keeping. Only brood ewes that perform in the top 30% of the flock every year should be considered. We must measure and record data on the number of lambs born, pounds of lamb weaned (a reflection of the dam's milking ability), lambing interval, longevity, and growth of lambs after weaning. Only twin or triplet lambs from ewes that receive high marks in every category should be selected. If you are a flock that measures EBVs, then this is the time to use them. However, they should be one of many factors used in the process. Selection based only on recorded data, or EBVs, or only on visual appraisal, is not enough.

Frame size is also very important. Ewes must have enough frame and capacity to carry twin lambs and forage, yet not so large as to hurt feed efficiency and conversion. It is a documented fact that frame size is directly related to the cost of maintenance. We must find that moderate ewe that performs without unnecessarily elevating feed costs.

Once you make the first selection of candidates, you must evaluate them for structural soundness and presence of genetic flaws. Any ewe lamb found with a visual abnormality that fails to meet your predetermined goals should be eliminated from the group. Culling should be rigorous, merciless and well documented.

Once your replacement ewe lambs have been chosen, they should be managed as a separate group. Ewe lambs have different nutritional requirements than the adults and require additional energy and protein. They are smaller, more timid and do not compete well in a flock of older ewes. Research shows that ewes that lamb as yearlings are more productive throughout their lives. In order to breed in the fall and lamb by twelve to fourteen months of age, they will need special attention and care. Health maintenance, including

vaccinations and parasite management, throughout the first year to insure proper growth and performance is important.

Ewe lambs should reach 70% of their mature weight by breeding time. This will generally require exposure to good pasture after weaning, with possible supplementation of grain during their first summer. It is important to know the difference between feeding for growth and fattening. When using body condition scoring of 1- 5, with 1 being emaciated and 5 being obese, a target BCS of 3.0-3.5 should be used to keep them in desired condition. Ewe lambs that are overfed will deposit fat in the udder, which may reduce milk production throughout their lifetime. In most cases, supplementation of one pound of 12-14% protein concentrate while on pasture will continue growth without over fattening. In addition, the importance of providing quality mineral at all times can't be overemphasized.

They should be fed to continue growth throughout pregnancy, in order to increase their body size, support one or more unborn lambs and prepare for lactation. During late pregnancy there is a huge increase in energy and protein requirements. Poor nutrition during this period will hurt your flock in many ways. Underfed pregnant ewe lambs will lose body condition and are more prone to pregnancy toxemia. If feeding low quality hay, they are also more prone to vaginal prolapse. Their newborn lambs will likely be small and weak at birth, leading to higher death losses. Compared to mature ewes, their milk production will be less and of poorer quality resulting in lower weaning weights and higher mortality. Finally, the ewes will often remain thin after weaning lambs and during their second summer, which can affect their ability to breed back.

Ewe lambs that are selected according to the methods described above, separated and maintained under a complete health plan, and fed at a level of nutrition based on their age and stage of pregnancy, should lamb and perform at the highest possible level. This program requires effort and attention to detail, but will pay dividends as they move into production. By following this plan, the overall quality and profitability of your flock should steadily improve each year.



Ewe Body Condition Scoring

Scott P. Greiner, PhD, Extension Animal Scientist, Sheep, Virginia Tech

Body Condition Scores (BCS) are a practical management tool to be used in conjunction with nutritional and other management strategies to optimize production of the flock. Condition scores are subjective in nature and utilize a five point scoring system (1-5) to classify sheep according to body fatness. BCS can be determined by either visual appraisal in short-fleeced sheep, by palpation in sheep with significant fleece length, or a combination of the two. The five BCS are as follows and relate to the figure below:

BCS 1- emaciated, very thin

BCS 2- lean

BCS 3- average, "nice shape"

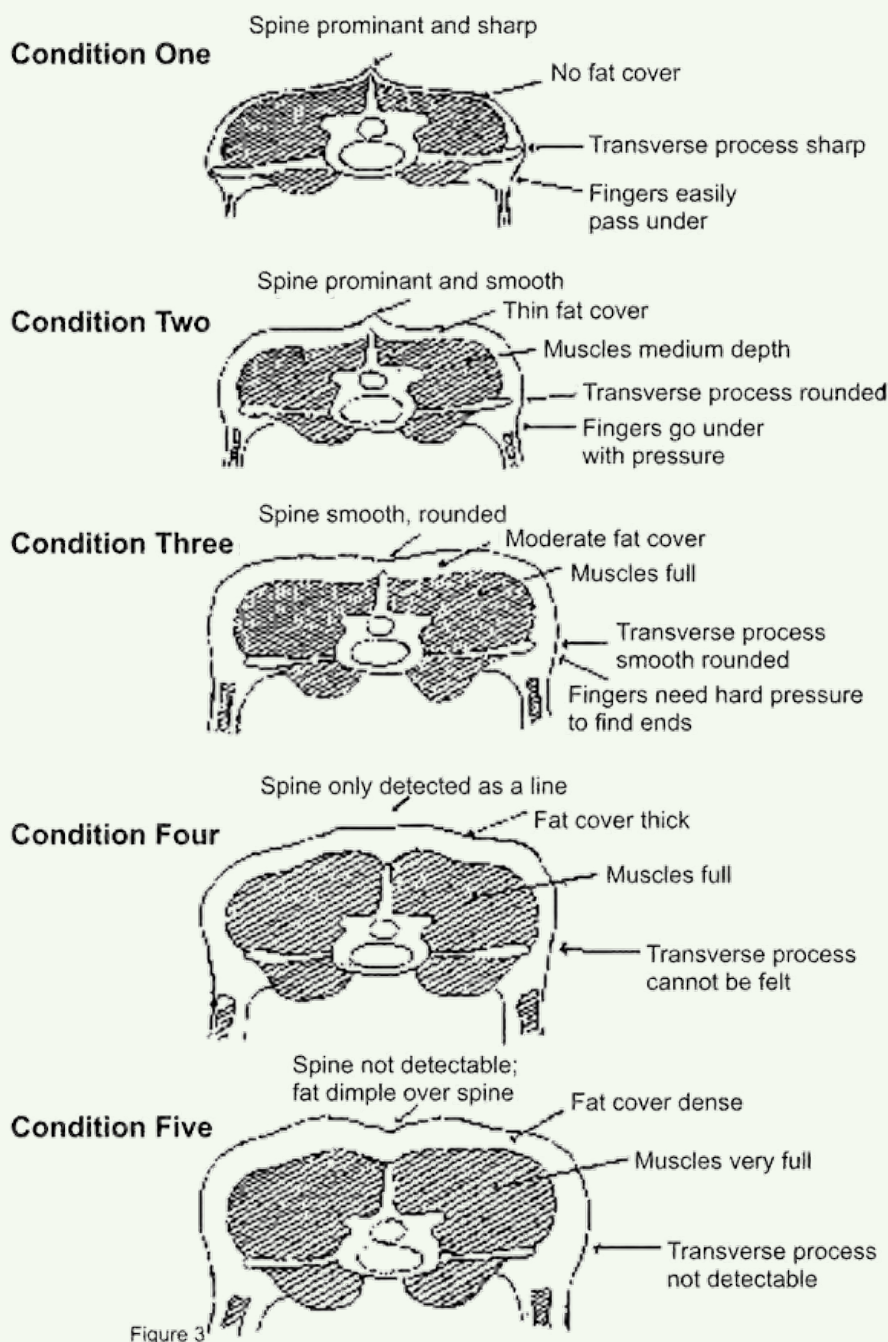
BCS 4- fleshy, "bloomy", fat

BCS 5- obese, very fat

Ewes can be handled over the spine, loin and rib to assess BCS. Corresponding fat depots in the breast, crotch, and topline can also be visually estimated in sheep with minimal fleece. Most relevant is the ability of the shepherd to relate BCS to optimum given the stage of production of the ewe and utilize this BCS to guide other management decisions and actions.

Stage of Production	Optimum BCS
Maintenance	2
Breeding	3
Early Gestation	2+
Late Gestation	3
Lambing	3+
Weaning	2

As shown above, optimized productivity is associated with differing BCS for various stages of production. Flushing is the practice of increasing energy intake, and therefore body condition, during the 10-14 days prior to breeding. This practice has been shown to be effective in increasing ovulation rates, and thereby increasing lambing percentage by 10-20%. The response to flushing is affected by several factors, including the body condition of the ewe. Ewes that are in lower body condition (2 or less) will respond most favorably to the increase in energy, whereas fat ewes (BCS 4-5) will show little if any



CONTINUED ON PAGE 27


response by increasing dietary energy preceding and during breeding season.

Ewes should be in their best BCS at lambing. BCS 3+ is considered ideal, which provides the ewe adequate energy reserves to call upon during lactation. Additionally, ewes moving upward towards BCS 3+ the last third of gestation are less prone to metabolic disorders (ketosis, pregnancy disease) compared to excessively fat ewes or thin ewes which may have low lamb birth weights and lamb vigor. Furthermore, reducing BCS at improper times such as the last third of gestation frequently results in ketosis and poor lamb survival.

The most critical time to assess BCS and make use of it as a management tool is 4-6 weeks pre-lambing. Remember that ample time is needed to see results of nutritional changes. A second important time to assess BCS is a month prior to breeding. Application of BCS at this time will allow for changes to be made

which can impact breeding success and percent lamb crop. While these two times are important, BCS is best utilized as an everyday assessment of the current status of the flock to help guide decisions.

In summary, it is important to assess potential reasons for ewes with poor BCS at various stages of production. Poor/low BCS can be the result of inadequate nutrition, parasite load, or disease. Body condition scoring the ewe flock is an important aspect of total flock management. Efforts to provide adequate, cost-effective nutrition and management strategies rely on accurate use of BCS.



Monitoring body condition scores of your ewes can save you money. Ewes entering winter with a body condition score of 3.5-4 require 30% less feed than those with a BCS of 2.5. Pregnant ewes that are over-conditioned or under-conditioned are at a higher risk for lambing problems equating to more labor input, higher vet bills and increased mortality of ewes and/or lambs.





Symbiotic Grazing of Sheep and Cattle: Benefits of Mixed Species Grazing

**Bob Nusbaum, PhD, Katahdin Producer,
Wisconsin**

Most of us in the livestock business are really grass farmers that use ruminants to harvest our main product which is grass. Unfortunately, most U.S. farms raise exclusively cattle or sheep. However, cattle and sheep can coexist peacefully and profitably on the same range or pasture. Some have called this joint pasturing “multi species grazing” but I prefer to call it “symbiotic grazing” (SG) since symbiosis is the association of two parties where each benefit from the presence of the other.

“Add one ewe per cow” has been the economic battle cry of sheep production educators for the past 50 years. More recent research has found that reluctant cattlemen should seriously consider this statement. A preliminary study by Keith Neary at Purdue University compared three grazing treatments (groups) which showed a significant advantage for grazing sheep and cattle together. In the study, Group 1 had cows and calves only, Group 2 had ewes and lambs only, and Group 3 had both sheep and cattle together. Each group grazed an eight acre paddock and all calves and lambs were weighed at the beginning and end of the trial which lasted 103 days.

The results were very promising. When compared, the mixed group produced 33% more gain on average than the groups that were exclusively sheep or cattle. Other research also shows that total gain and net profit increase by grazing cattle and sheep together rather than either species alone, and this is all accomplished without increasing the grazing acreage or diminishing the carrying capacity of the pasture.

Forage control also improves with Symbiotic Grazing. Pastures are grazed more uniformly because only about 35% of sheep and cattle diets overlap. Sheep are more selective grazers and tend to prefer weeds to grass and cattle prefer grass to legumes. Cattle will eat more mature grass that is less palatable to sheep. Manure distribution is more uniform in hilly pastures as sheep prefer elevated resting or ruminating places and cattle generally opt for flat ground. Parasitism is reduced for both species because there is no cross contamination and the cattle and sheep will consume and destroy the infective worm larvae detrimental to the other. Over time, the durability of the plant species in a pasture will improve with SG.

While the benefits of mixed grazing systems (SG) are well documented, it is important to understand that some differences in fencing, water, working facilities, mineral or grain feeding and predator control need to be considered.

- Woven wire fences are the “Cadillac” for sheep and cattle although both can be contained successfully with two to three strands of electric wire if the fence energizer is properly grounded to deliver the necessary punch.
- Cattle and sheep can share a watering system provided the height of the tank is reachable by the ewe and lambs.
- Handling facilities for cattle can be adapted to sheep use with minimal modifications. A sorting headgate and a few panels would be minimal, helpful investments.
- Sheep can’t have access to cattle mineral due to copper toxicity. This mostly can be managed by feeder height. Cattle can be kept from sheep mineral with a single electric wire but cattle can eat sheep mineral without consequences. Feeding grain is difficult because sheep will try to get into anywhere grain is fed to calves or cows.
- Cattle will sometimes protect sheep from predators if the older ewes and cows form bonds. However, the safest bet is to run guard dogs, llamas or donkeys with the group.
- With pasture lambing, some cows may be too inquisitive and disrupt the birthing process so it is advisable to separate the groups until the lambs are older.

It is generally easier and less expensive for a cattle operation to add sheep than vice versa. Cattle producers already have a large investment in their cattle and a good commercial ewe can be added for a fraction of the cost of a cow. Also, cattle handling facilities can be adapted to handling sheep easier than sheep facilities to cattle which would be a costly investment for most shepherds. Although many cattle producers have little knowledge of how to raise and handle sheep, they can be convinced to pursue this venture utilizing a low maintenance breed such as Katahdin Hair sheep. Katahdin sheep are easy care, require no shearing, have good mothering instincts, and are more resistant to parasites. After castrating males shortly after birth, lambs should need very little labor until weaning with their counterpart calves.



Breeding Selection for Flock Improvement

Roxanne Newton, Katahdin Producer, Georgia

In nature, *selection* occurs when animals with certain genotypes that are more adaptive to an environment survive and reproduce. In husbandry, breeders decide which animals will reproduce based on the traits the shepherd deems important. Determining which traits are important will depend on flock goals. While some traits are more heritable, others are more attributed to environment. Selection not only refers to which animals are used for breeding, but also which animals will be culled. Flock improvement involves identifying those animals that excel in performance and production and are well matched for the environment in which they are being raised.



IMPORTANT TRAITS TO CONSIDER

- Reproductive efficiency is the most important economic trait for meat lamb production. Regardless of eye appeal, genetics, or success in the show ring, if a sheep doesn't reproduce, that animal is worth no more than its price at the sale barn. Maternal traits that affect profitability include: age at first lambing, litter size, milk production, mothering ability and ewe longevity.
- Adaptation to environment and management can affect productivity and performance. Parasite resistance may not be important to breeders in the extreme north, but developing a good winter coat might be. Sheep that adapt well to the environment and management system they are raised in will reduce labor, costs, and make more efficient use of resources.
- Conformation/Carcass quality: Structural soundness is necessary for both mobility and

performance. Selecting for superior carcass quality and muscling is important in meat animals.

- Growth: Measuring weaning weights is important since it evaluates both lamb growth and milk production. Weaning weights should be adjusted based on the age and sex of the lamb, ewe age, birth type and weaning type. Since twins born out of a yearling are expected to weigh less than twins out of a mature ewe, adjusting weights allows for better comparisons of the genetic growth potential of individual animals.
- Katahdin-specific Traits: Katahdin *hair* sheep are a medium-framed maternal meat breed. Sheep with woolly coats that don't shed, or sheep that lack muscling, are too large-or small-framed, lack adequate mothering skills or milk, should be culled.

TOOLS FOR SELECTION

Once the selection criteria have been identified, there are many tools available to evaluate progress and it starts with good record keeping. Whether it's weights, treatments, observational notes, or lambing data, a shepherd needs to track the production and performance of their sheep. Tools available that can increase the accuracy of selection include:

- EBV's: Estimated breeding values are a tool that predicts the genetic merit of an animal for economically important production traits. In Katahdins, the EBVs evaluated are: milk, growth, parasite resistance, loin-eye depth, scrotal circumference and number of lambs born and weaned. By selecting herd sires with EBVs, you can more accurately select the traits that will help you reach your breeding goals.
- Record Keeping: Good records are an integral part of any breeding program. Documenting relevant information such as weights, health treatments, mating and lambing records allows shepherds to evaluate production traits, as well as events and behavior that could impact selection and culling decisions.
- Observation: It's amazing how much information is gleaned by simply watching the flock. For instance, a ewe's mothering instincts can be evaluated by simply observing her behavior and her interaction with her lambs. Keep a pocket notebook and refer to it when it's time to make selection and culling decisions.
- Pedigree: The pedigree is a tool used to determine relatedness, identify superior ewe lines and track

CONTINUED ON PAGE 31

genetic defects. The accuracy of a pedigree is dependent on the accurate recording of sire and dam and the accurate identification of lambs at birth.

DECISION MAKING AND SETTING GOALS

When setting flock goals, it's important to know the market you are targeting, which traits are needed to reach those goals and the best tools to measure performance so that you can more accurately select the animals that possess those traits. The ultimate goal of a breeding program is genetic improvement. To achieve this, one needs to identify and select the best animals as parents to produce the next generation. Ideally, each successive generation will be better than the last. Goals for genetic improvement are best accomplished by:

- 1. Selection of Rams.** The ram contributes half of his genes to his offspring. Growth potential, parasite resistance, prolificacy, and milk production are all heritable traits that can improve one's flock by careful selection of the ram. Since ram selection is responsible for most of the genetic change, tools that assist in identifying superior rams (including production records, weights, fecal egg counts, and EBVs) are critical in determining the genetic worth of an animal and minimizing the role chance plays in the process.
- 2. Ewe Lamb Selection.** Identifying the most productive ewes in the flock is the first step in selecting replacement ewe lambs. Ewes that consistently out produce other ewes, are well adapted, easy care,

long living, prolific, excellent mothers, good milkers, and wean the most quality pounds of lamb are the "elite" ewes. Replacement ewe lambs should be selected from the daughters of these superior ewes.

- 3. Culling.** A fast way to improve your flock is to cull animals that underperform, have defects, are wormy or unthrifty, lack mothering instincts or fail to wean their lambs.

In summary, identifying superior sheep that possess the traits needed to reach your flock goals is the cornerstone to a successful breeding program. Use the tools that are available to evaluate and select, then breed the best to the best and keep the daughters to make the fastest genetic improvement.



Culling Decisions

**J.L. Goelz, DVM,
Pipestone Veterinary Services, Minnesota**

*Reprinted from Pipestone Sheep Newsletter, April/
May 2009 Volume 29, Issue 2.*

Your choices of how many and which ewes to cull have a major impact on the future of your flock. Culling decisions rank second only to ram selection in the impact of moving the flock to a more highly selected genetic base. In my opinion, after weaning is the best time of year to make culling decisions for two reasons:

- 1) Ewe production is obvious. Even without great production records it is evident which ewes are not producing quality lambs. If you are selling slaughter or feeder lambs by weight, ewes that produced singles, unthrifty, or very small lambs are cull targets. In most cases we can blame poor quality lambs on the ewe, such as late lambing, poor milk production, poor mothering instinct, or poor genetics.
- 2) Feeding cull ewes is a drain on the resources of an operation. Feeding culls to put on more condition is rarely a good idea. In general, consider culls a loss and get them to market quickly. The cost of feeding these ewes to put on weight will generally not be realized in higher prices. Cull quickly after weaning regardless of price.

Which ewes to cull? First of all, I suggest that you consider how many ewes you can cull. Where will the replacements come from? Will they come from your flock or will you purchase outside replacements? What will be the cost? This may determine how many ewes you can afford to cull or replace. Next, consider what it takes for a ewe to break even or be profitable in your flock. What ewes can you make money on and which ewes will always be losses?

*"You control the
cull gate and you
determine how your
flock will look in five
years and how they
will perform."*

Start the list. The top of the list are the ewes that fail to wean a lamb, this generally means that they either did not give birth to live lambs, or had lambs that did not survive to weaning. In nearly all cases, these ewes need a one way ticket off the farm or ranch. You have fed the ewe for a year with no return on your investment; almost as bad as the stock market. The one exception is if the ewe aborted from an infectious cause, or the lambs died for a reason that was unrelated

to mothering or milking ability. These ewes had the ability to perform but did not because we failed, not them. Next on the list are the ewes that are unlikely to survive another year. Perhaps it is age catching up with them, broken mouth, chronic lameness, etc. If it is doubtful that the ewe will survive the production system for another year, she should go. Next on the list, consider the mature ewes that consistently only give birth to singles. They have no chance at weaning twins. In most production systems a set

of smaller twins is more valuable than a large single. If ewes show from records that they do not have the ability to have twins or wean twins, they are targets for culls. Lastly, I would consider ewes that perform in the flock, but make life difficult for the shepherd: fence jumpers, bad teat conformation, etc. Ewes that cause you to lose your religion in front of your family. Make your life easier and make room on that cull truck.

Many problems that shepherds face are in your control. You control the cull gate and you determine how your flock will look in five years and how they will perform. Determine how you will replace your cull ewes, what the cost is to replace a cull ewe and select replacements that will get you closer to your goals. Remember, the more culling pressure you can place on a flock, the more improvement you will make. Cull ewes contribute less than five percent to gross revenue on your operations; selling price has little impact on your bottom line.



The Madams

**Charles F. Parker, PhD,
Emeritus Director, US Sheep
Experiment Station**

Let's hear it for the "hard working" ewes---the MADAMS of your flock! Every flock has a few of these ewes mixed among the many others. Few breeders recognize just how hard these elite ewes are working or how important they are. This article is about finding the "hidden madams" and how best they can be used to improve your flock.

First let's define "hard workers." These are the ewes that yearly produce the most pounds of quality lamb for market, are genetically superior and well adapted to their environment and flock management---the true production unit profit makers! They are fertile, prolific, easy lambers, good mothers and milkers, rear a high percentage of lambs born, and yield the heaviest litter weights at weaning. Ewe productivity is unquestionably the most important economic trait for meat sheep production in the 21st century!

What do these madams look like? They come in all shapes and sizes; some are plain looking while others are stylish. In other words, they can look like any other ewe in your flock. However, the madams have one characteristic in common---excellent ewe productivity! Bottom line, the hard working meat producing ewes are commonly the "hidden ones" and cannot be recognized by their appearance but can be accurately identified from learning about their performance.

Body size, growing ability, soundness, body conformation, degree of muscling are traits of interest in producing uniform quality meat products but are not highly genetically related to ewe productivity. In

some cases when these appearance traits are selected to extremes, they can have strong negative effects on the components of ewe productivity. This detrimental relationship has also been observed for other livestock species.

If looks are deceiving, how do we identify the madams? Fortunately 20th century genetic research and technologies have provided 21st cen-



tury shepherds with the most powerful selection tools ever to identify genetically superior animals. All Katahdin breeders have access to the National Sheep Improvement Program (NSIP). This program is well designed and tested to evaluate individual performance across flocks so breeders can identify the best genetics available within their flock and breed on a common basis of comparison.

More importantly, in 2004, researchers at Virginia Tech using Katahdin data from producer flocks in NSIP developed an Estimated Breeding Value (EBV) analysis for percentage of lambs raised and total litter weight at weaning as an index for ewe productivity (US Hair Index). Katahdin breeders were the first to have the ewe productivity index available. We know from experience that approximately one out of every ten ewes in a flock is an outstanding madam. Now we have the ability to find those hidden ones. This is a major advance-

ment for the seedstock sector of the U. S. sheep industry.

Now that we can find them, how do we best use our madams? First, let's consider the aspects of flock improvement through selection. Ram selection has been credited with changing flock performance by 70-90 percent for most heritable traits. This potential is achieved by selection intensity and breeding rate where fewer rams than ewes need to be selected for breeding and can be used over years during a ram generation.

Limited recognition has been given to the genetic importance of the ewe because she provides fewer lambs in comparison to a breeding ram during her tenure in the flock. One breeding principle provided by Robert Bakewell in the 18th century that has passed the test of time is "breed the best to the best." So, can breeders create superior rams from just any ole ewe? Obviously not! Finding and using distinguished MADAMS as mates with outstanding sires is the only way to create superior young sires---thus "mating the best to the best" to create better offspring for the next generation.

Through the use of Estimated Breeding Values, ewes and rams can be found that will contribute significantly to more rapid improvement of lamb meat production. For those interested in efficient production, acquiring quality genetics is clearly a blue chip investment for the sheep enterprise in this century.

The next generation of young "best sires" in the Katahdin breed depends on mating the "best" rams with yet "even better" madams---possibly ones in your flock! Get to know your MADAMS. They are the hard working, hidden ones that will make a difference!

Selecting for Structural Correctness

Roxanne Newton, Katahdin Producer, Georgia

Taken with permission from Dr. Bert Moore's presentation at the 2014 KHSI Expo

Structural correctness is the combination of desirable physical traits which allow an animal to function properly. A properly functioning animal is healthy, fully mobile and is physically able to meet performance expectations, nourish itself and reproduce. In addition, a well put together animal looks good.

An animal's phenotype (or what they look like) is a combination of genetics and environmental effects and the interactions between the two. The animal's nutritional status greatly impacts the growth and development of an animal, as well as their ability to adapt to the climatic and stress conditions to which they are subjected. Not all structural soundness issues are genetic. Improper nutrition, environmental terrain, injury and illness can and do affect structural soundness.

The most important function livestock can perform is reproduction. In addition, their structural components should be in balance with no single element out of proportion and no single body part extreme in nature. When evaluating soundness and structural correctness, pay close attention to the following structures: a) feet and pasterns, b) legs and rump c) jaw and teeth, and d) external reproductive organs.

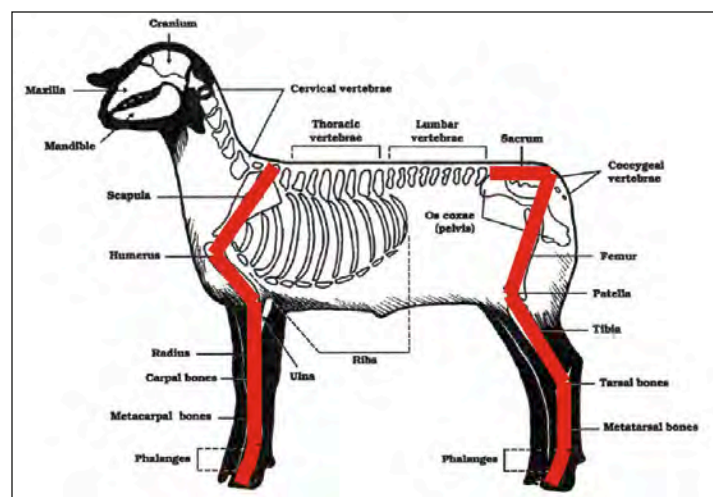


Figure 1.

SKELETAL STRUCTURE

Understanding the correct or acceptable angles of a sheep's skeletal elements is important. Structural correctness allows an animal to function efficiently, distribute weight evenly, take unrestricted strides and greatly contributes to longevity. In Figure 1, the skeleton is shown with red lines overlaid, indicating the correct angles of bones in the shoulder, pelvis, front and back legs and feet. Keep these angles in mind as you evaluate the external form of the sheep for structural correctness.

EVALUATING SOUNDNESS OF FEET AND PASTERNS

The structural components of the foot are illustrated in Figures 2a and 2b. The hoof should be large, with good depth of heel and

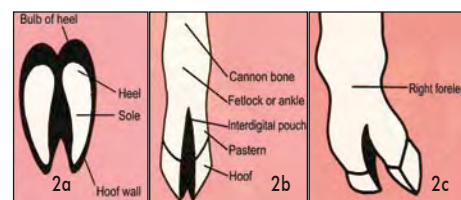


Figure 2a-c.

symmetrically shaped. Misshapen hooves or uneven toes (Fig 2c) put undue strain on the pasterns, hocks and as high up as the hips and shoulders. With the correct angle and length of the pastern and depth of hoof, the foot sits flat and even on the ground (Fig 3a, b, and c). In weak pasterns (Fig 3d) there is too much angle and length of the pastern. Pasterns can also be too straight with the sheep standing too high up on its toes affecting the shock-absorbing ability of the limbs. Improper angulations of the pastern are highly heritable, can occur in both front and back legs and can affect the breeding soundness of both rams and ewes.

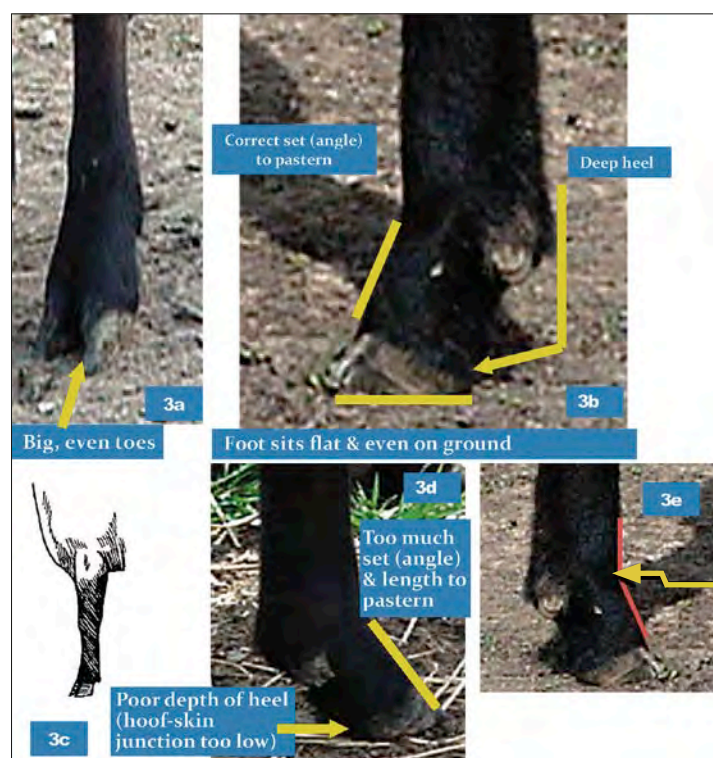


Figure 3a-e.

EVALUATING SOUNDNESS OF LEGS AND RUMP

Viewing the animal from the front, evaluate the direction in which the feet are pointing (Fig 4). Animals that are pigeon-toed (toes angle inward) or splay-footed (toes angle outward) have defects that cause uneven weight distribution and wear on the hooves. Splay-foot is more common and is often associated with the

CONTINUED ON PAGE 35

animal being knock-kneed, when the knees angle inward.

While facing the animal's side or profile, the front and rear legs and hocks should be evaluated. An animal that is sickle-hocked, having

too much of an angle (or set), forces the rear legs up under the animal preventing full stride when walking, thus affecting mobility (Fig 5). Sickle-hocks also affect balance and control of the hips and rump. How-



Figure 5.

forearm and cannon bone. This defect is referred to as buck-kneed.

Viewing the rear limbs from behind, the legs should be straight with the animal standing square. The most common abnormality of the hind legs is when the hocks angle inward and is referred to as cow-hocked (Fig 6). This defect rarely causes a loss of function.

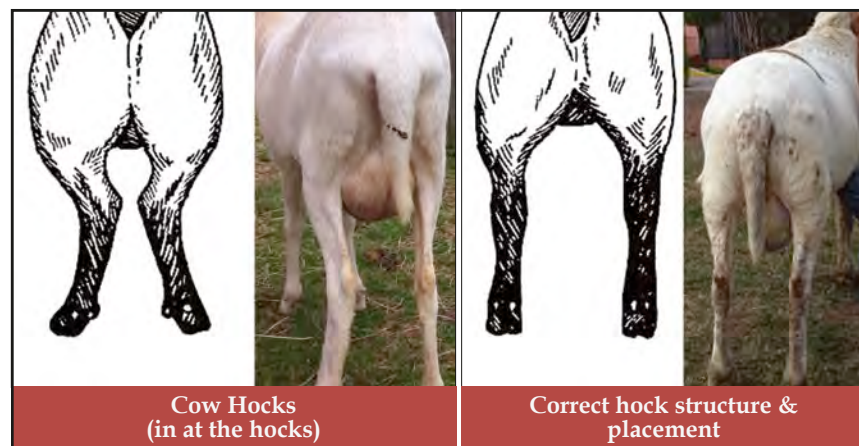


Figure 6.

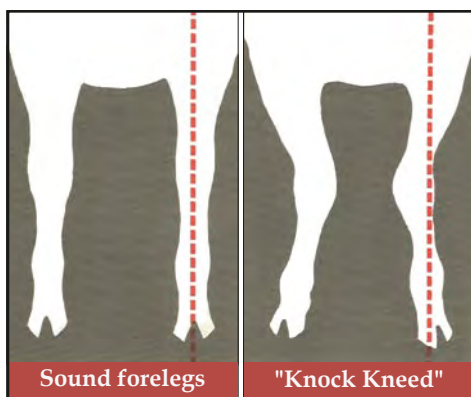


Figure 4.

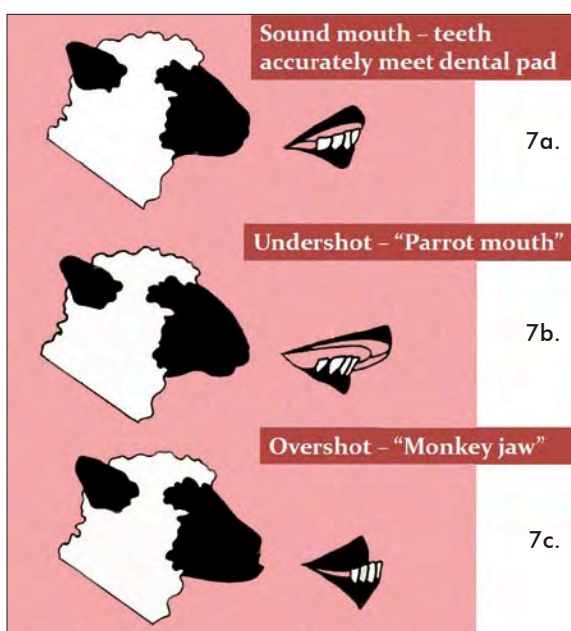


Figure 7.

EVALUATING JAWS AND TEETH

Defects of the mouth are highly genetic and can affect the sheep's ability to nourish itself. The lower incisors should properly meet the dental pad (Fig 7a). An undershot jaw or parrot-mouth is the result of the sheep's upper jaw being longer than the lower jaw (Fig 7b). Conversely, an overshot jaw or monkey-mouth is when the lower jaw is longer than the upper jaw (Fig 7c).

EVALUATING EXTERNAL REPRODUCTIVE ORGANS

The vulva should be well developed and udders should be evaluated for symmetry and the presence of abnormal teats. The scrotum of the ram should be symmetrical and of adequate size (Fig 8). Rams with partially descended (uneven) or undescended testicle (missing testicle) should be castrated and never used for breeding.

Evaluating structure requires a basic understanding of the genetics, physiology, nutrition and anatomy of the sheep. This scientific understanding needs to be combined with the practical knowledge or "savvy" of the shepherd when evaluating soundness.

Become a good observer and be truthful with yourself. Learn the differences between good and faulty structure and their impact.

Use the sale barn and locker plant as important management tools. Sound structured sheep never go out of style.



Figure 8.

The Lesson of Freckles: Adjusted Weights and the Mystery of Motherhood

Richard Gilbert, Katahdin Producer, Ohio

Excerpted from an article, "The Lesson of Freckles" from the Hairald magazine (Summer 2006).

In the excerpt below, Richard Gilbert, shepherd and author, shares his thoughts and observations as he compares two ewes in his flock.

Freckles had really begun to shine. Her mothering ability was impressive. Unlike Fancy and her ilk, Freckles never seemed to have a lost lamb crying for her in the far corner of a paddock. Freckles and her brood moved together, as if welded.

Some ewes that had triplets tried hard to raise them but failed. Those ewes did not appear able to keep track of three lambs, or they lacked other mothering skills, or they did not seem to have enough milk. Other ewes would reject a triplet, or passively allow it to fall behind and die, without my intervention.

Triplet lambs are smaller at birth than twins, and often the smallest triplet will not get enough milk; its stronger siblings shove it aside and take the teat. For these reasons, many shepherds want only twins. Triplets, overall, are a management headache in many farm situations. Often a triplet gets pulled off the ewe and raised artificially—but bottle babies are a lot of labor and need expensive milk replacer.

I was not sure I wanted a lot of triplets, but I knew I wanted more ewes like Freckles. If a ewe had triplets, I wanted her to raise them. I could not imagine Freckles rejecting a lamb. Moreover, she seemed to look out for all of her triplets equally. Freckles sailed through motherhood.

When I took 60-day lamb weights, Freckles' triplet litter weighed 99 pounds. I still had not learned how impressive that accomplishment was on pasture with no creep feed for the lambs. At the time, I admired Friendly's big twins even as I praised Freckles' amazing mothering ability. Friendly's twins, a ram and a ewe, together weighed 94 pounds.

By early August, Freckles' triplet litter weighed 138 pounds, beginning to show the income advantage that accrues to triplets even when the lambs are smaller individually (her largest lamb, a 49-pound ewe, weighed 10 pounds less than Friendly's ewe lamb). Friendly's

twins weighed 128 pounds; her ram lamb was particularly nice at 69 pounds.

One of the first breakthroughs in attempting to deal with the challenge of making fair genetic comparisons between ewes was the use of "adjusted weights." The idea was to figure out a way to compare lambs that were born on different days, whose mothers were of different ages, and whose gender was different.

This method of leveling the playing field allows a shepherd to compare the dainty ewe lamb raised by a yearling mother to the husky twin lambs, a ram and a ewe, raised by a four-year-old ewe in her prime. Without adjustment, most likely the shepherd picks

the lamb from the older mother, even though in one year the yearling's lamb will be the same size, or larger.

The yearling's lamb may become a more productive ewe. In fact, if the shepherd has been making genetic progress, the yearling should be a better ewe than the four-year-old ewe—and her lamb will be better still. But there's that size difference: even a five-pound disparity between two lambs makes a huge difference in how lambs appear at a young age.

The first step is to correct the weaning weight to a standard age, in this case 60 days. The adjusted age is used with corrections for ewe age, breed of ewe, birth and rearing type (for example, twin-born and twin-raised Katahdin) and the gender of the lambs to give the adjusted weight. Ram lambs and ewe lambs have different adjustment factors, because males grow faster. The written formula for adjusting weights is easy to use if followed step-by-step (see page 40).

I used this assessment method to compare Freckles' 2003 triplets to Friendly's twins of the same year. At the 60-day weighing point, Freckles' triplet litter weighed 99 pounds on my scale. Friendly's older twins weighed 94 pounds.

What were the adjusted litter weights? Adjusting for the age of the lambs was important here, because Friendly's lambs were eight days older. Adjusting for the type of rearing was even more significant—triplets



vs. twins—and an adjustment needed to be made as well as for the gender of the lambs.

The result was surprising, given the actual weights and the pleasing appearance of the stocky twins: Freckles' adjusted litter weight was more than 120 pounds. Friendly's comparable total was 87 pounds.

But farmers sell actual pounds, not adjusted pounds, and the actual weights were very close. Still, Freckles produced a five-pound advantage at 60 days, which means her smaller lambs would bring more at market, especially if they grew well after weaning.

Clearly, Freckles was the more productive ewe, with exceptional mothering ability. If one of the ewes were to be sold, it should be Friendly, not Freckles. Freckles' two ewe lambs should be considered for retention, especially if prolificacy is needed in the flock.

Using adjusted weights does require a person to think, to use records, and to exercise willpower—one must accept the results of the formula and act upon them, regardless of what his eyes are telling him. Top ram and ewe lambs should be picked first on paper at the kitchen table. Selection at the barn should then be made on the basis of conformation, not size, from the top group of lambs.

It goes against human nature to believe the numbers instead of the eyes. It is somewhat like a pilot learning to trust his instruments rather than his gut

feelings. Many a pilot has flown his airplane into the ground rather than believe his gauges. Many farmers steadily lose productivity in their livestock because they will not collect, use, or believe records.

Even someone who does not want triplets should retain Freckles' daughters to foster mothering ability in the flock and to keep selection pressure favoring at least a 200-percent lamb crop. Shepherds who have used adjusted weights to select breeding stock have transformed their flocks.



You Can't Tell by Looking

Ewe Production & Efficiency



Ewe A weighs 165 lbs & produced 65 lbs total lambs weaned (adj)

Ewe B weighs 140 lbs & produced 155 lbs total lambs weaned (adj)

Identifying Parasite Resistance: A Shepherd's Perspective

Kathy Bielek, Katahdin Producer, Ohio

Parasite resistance is a hallmark of the Katahdin breed, but what does that mean? Below is the answer to it and other common questions.

SO JUST WHAT DOES PARASITE RESISTANT MEAN?

Sheep that are considered parasite resistant have a genetic ability to reduce or limit the number of parasite larvae in their gut and/or reduce the number of parasite eggs produced. This helps with parasite management in two ways: the sheep are less affected by parasites and there is less pasture contamination.

ARE ALL KATAHDINS PARASITE RESISTANT?

No. While Katahdins are more resistant to parasites (gastrointestinal nematodes or GIN) than most wool sheep, there are differences between individual animals.

WHAT DOES THE TERM 'RESILIENT' MEAN?

Some sheep can tolerate a higher parasite burden without suffering a loss in production. This is often the result of good nutrition or other environmental factors (for instance, a single lamb with good milk) rather than genetics. Some resilient sheep with high fecal egg counts (FEC) can contaminate pastures with parasite eggs, thus exposing susceptible animals to potentially large numbers of parasite larvae.

DO PARASITE RESISTANT SHEEP EVER NEED TO BE DEWORMED?

Possibly. Parasite resistance is an immune response, so anything that affects the animal's immune system could temporarily affect its level of resistance, such as poor nutrition, other health conditions or multiple stressors.

I HAVEN'T DEWORMED MY KATAHDINS, SO THEY'RE PARASITE RESISTANT, RIGHT?

Maybe, but it's more likely they haven't been exposed to a significant parasite challenge. Parasite resistance in Katahdins is 40-50% heritable, which means over half of parasite issues are the result of management. Low stocking density, supplemental feed, good pasture management and feedlots with no grass or weeds can all reduce the need for deworming.

THEN HOW CAN I TELL WHICH ANIMALS ARE PARASITE RESISTANT?

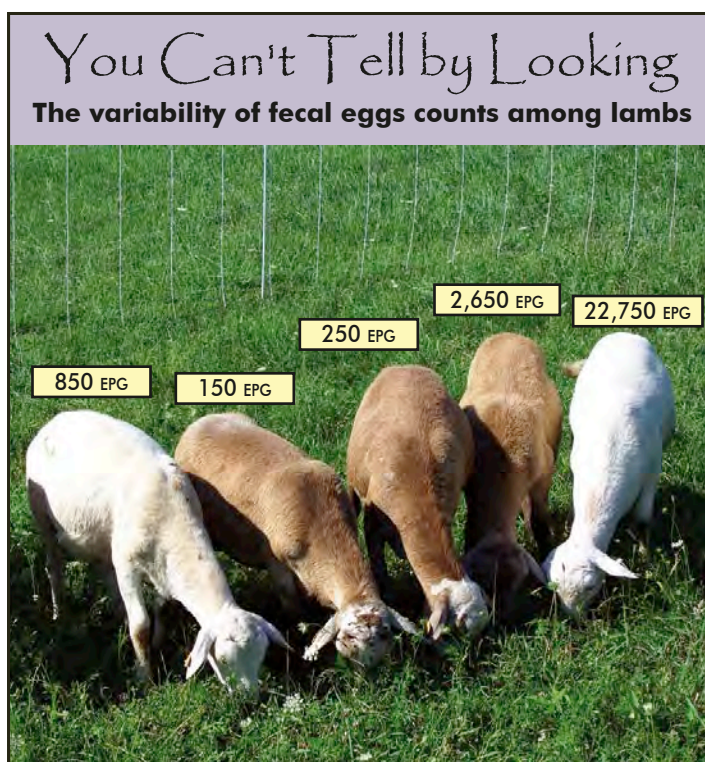
Like most traits that affect production, fecal egg count EBVs (estimated breeding values) are the most accurate way. EBVs factor in an animal's own performance as well as the performance of relatives.

ARE THERE OTHER METHODS?

Yes, but they're less effective. The following techniques improve accuracy.

- **Fecal egg counts (FEC):** Quantifiable FEC using a special McMaster technique is the most accurate way to identify potentially resistant animals, but can be labor intensive and expensive.
- **FAMACHA:** This method estimates parasite burden based on the level of anemia (a sign of infection with the barber pole worm, *Haemonchus contortus*) by evaluating the color of the mucosa of the lower eyelid. FAMACHA is easy, but labor intensive and training is highly recommended. It can select for resilient animals and does not necessarily lead to less pasture contamination.
- **Body condition scoring (BCS):** BCS is easy but does not differentiate between parasitism and other factors, especially in lambs. Without good production records, using BCS can inadvertently select against productive or hard working animals.
- **Deworming history:** This method is the least accurate. It's only effective if animals are selectively dewormed based on symptoms rather than whole-flock deworming. Culling animals that need more frequent deworming will remove the most parasite susceptible sheep, but will not differentiate the most parasite resistant sheep from the mediocre ones.

It's important to understand **the success of all these techniques requires a significant exposure to parasites (parasite challenge) to detect differences in individual animals, as well as accurate records.**



Using Records and Weights for Flock Improvement

John Stenger, Katahdin Producer, West Virginia

As a lifelong farmer, my goal has always been to improve my livestock. I'd like to share some of the lessons I've learned. To improve your flock you must identify your best sheep. The best ewe is seldom the biggest or most attractive. You have to keep records and weigh your sheep, and then use the weights and records to make selection decisions.

Ultimately, the best sheep are those that make the most profits. Profit isn't just production. Always consider input costs and selling price. You must determine your target market and then try to produce the ewes that can most efficiently produce lambs for that market. Production that fails to meet market demands will bring a lower price and reduced profits. In some markets, a smaller lamb may be more valuable than a big lamb.

Once you know your market, you can begin to identify your best and most efficient producers. You must keep records, the more the better. Keep a notebook with you at lambing. Record the ID of the ewe when she lambs and record the tag numbers you attach to each of her lambs. In the lambing notebook, record all relevant information about the birth, including mothering ability, instincts and birthing problems. The more you record, the better you can evaluate your sheep. If you don't write these things down, you will forget.

If you do FAMACHA checks for parasite load, make a chart. List every animal and record scores. Don't deworm everything automatically or at close intervals. Give innate parasite resistance a chance to show itself in the lambs. It will soon become apparent which sheep are not parasite resistant. When it comes time to choose replacements and to make culling decisions refer to these records. Katahdins are an easy care breed. Select for easy care sheep. Cull your problems.

To identify your best producers, you must weigh the lambs. The most important piece of equipment for your farm is the scale. Buy, beg, or borrow, but you must have a scale. If you only weigh the lambs once, the best time is when you wean them. When the ewe finishes her work, you need to know how much she produced. To make accurate comparisons, you need to make adjustments to the scale weights. The older lambs have more time to get bigger. The males grow faster. The lambs born to adults get more milk than those born to yearlings. Without adjustments, you cannot make fair comparisons.


To determine ewe production, calculate the adjusted pounds of lamb raised by each ewe. Your income equals production multiplied by price. The lambs must be marketable. The ewe can have lots of production, but lambs need to have meat on their bones to bring a good price. Pounds of marketable lamb raised is important, but we need another calculation before we can find our best ewes. Ewe maintenance costs are directly related to ewe weight. To discover your most profitable producers you must weigh your ewes. Divide the adjusted pounds of lamb she has produced by her body weight. This shows efficiency.



Consider ewe A, a 160 lb ewe that produced 160 pounds adjusted weight of marketable lamb. Dividing the production by the ewe weight, we see that she raised 100% of her body weight. Ewe B has 144 pounds of production. If we consider only pounds of lamb produced, Ewe A seems much better than Ewe B. But, Ewe B weighs 120 pounds. Dividing her 144 pounds of production by her weight shows that she is producing 120% of her body weight. I can keep four of the 120 pound ewes for the same input costs as three 160 pounds ewes. Four B's will produce 576 lbs of lamb, while

three A's only 480 lbs, with basically the same input costs. The wise decision would be to cull Ewe A and replace her with a daughter of Ewe B.

To identify your best and most profitable ewes, you must weigh the ewes. Weigh the lambs to determine production and weigh the ewes to determine *efficient* production. Now that you've identified your best ewes, don't sell them. Cull out the inefficient producers and the ewes with problems. Replace the culls with the daughters of your best sheep. As you replace inferior ewes with the daughters of your best, the overall quality of your flock will improve. To make improvements to your Katahdin flock you must keep records and you must weigh your sheep. The better your measurements and records, the better your decisions will be.



A flock of 50 medium framed ewes with a lambing percentage of 200% uses the same amount of forage and feed inputs and would market 20 more lambs than a flock of 40 large framed ewes. If lambs are marketed at 60 lbs for \$2/lb, the flock of medium framed ewes would increase profits by \$2400.

The Importance of Adjusting Weaning Weights

Jim Morgan, PhD, Katahdin Producer, Arkansas

Have you wondered how to accurately compare the growth rate of a single-born ram lamb raised by a yearling to a twin ram lamb raised by a 4 year old ewe? Our eyes are “magnetically” drawn to that single born and raised ram lamb that is 20 pounds heavier than the rest of his cohorts, but does he really have genetics for more growth? Probably not! The “non-genetic” effects of sex of the lamb, number born and raised and the age of the dam are significant.

The effect of the age of the dam on the volume of milk production is also not genetic and clouds the picture when the shepherd wants to identify genetics for growth. The impact of being raised as a single, twin or triplet is not genetic and also makes it more difficult to identify growth genetics. Shepherds who pick the fastest growing lamb to 60, 120 or 150 days of age are often selecting single-born ram lambs raised by mature ewes. So, how do we tell if these fast growing lambs are genetically superior for growth?

The process for adjusting the weights of your lambs to a standard is a two-step process. First you need to adjust for the age (in days) at weighing. You don't have to weigh all lambs exactly at 50 or 60 days of age. You should weigh them all on the same day and then adjust to your standard age. For example if you weigh

your lambs and they range in age from 45-75 days, you can adjust all to 50 days or 60 days. The second step is to apply the adjustment factor that corrects all lambs to the same standard, no matter if they are a triplet, twin or a single or born to a 4 year old or a 1 year old ewe. The example provided below is a 60-day weight for a twin ewe lamb raised by a 1 year old ewe. The adjustment factor is taken from the table below.

$$\text{Age adjusted wt} = \left[\frac{\text{actual wt} - \text{birth wt}}{\text{age when weighed}} \times \text{Adjustment age} \right] + \text{Birth Wt}$$

A ewe lamb weighed at age 66 days; born and raised a twin to a yearling ewe. Weighed 45 lbs. Birth weight 7.5 lbs.

$$\text{Age adjusted wt} = \left[\frac{45 - 7.5}{66} \times 60 \right] + 7.5 = 42.1 \text{ lbs}$$

Adjusting for age of ewe, number born and raised and sex of lamb. Use 1.49 for a twin Katahdin ewe lamb born to a yearling ewe. From Table 1, scan the first row (yearling ewe (1) raising a ewe lamb) and go to the column “2-2” (twin born – twin raised) and you find 1.49. The 1.49 is multiplied by the “age adjusted wt” to get the 60 day adjusted weaning weight.

60 day adj wt = 42.1 x 1.49 = 62.7 lbs

Calculating adjusted weights can be cumbersome. An easier way is to download the Excel spreadsheet, developed by Richard Stewart, from the Forms page of the KHSI website, www.katahdins.org. All that's needed is to enter the lamb data in the selected fields.

Based on thousands of records collected by Katahdin flocks in the National Sheep Improvement Program (NSIP), Dr David Notter of Virginia Tech calculated the Katahdin specific adjustment factors for 60 day weights which are given in the table below.

Multiplicative factors to adjust Katahdin weaning weights for type of birth and rearing and ewe age.

Adult (3-6 yr old) ewes rearing single ewe lambs are the base (1.00).

Type of Birth-Rearing								
Sex of Lamb	Ewe Age	1-1	1-2	2-1	2-2	3-1	3-2	3-3
Ewe Lamb	1	1.17	1.43	1.31	1.49	1.35	1.60	1.81
	2	1.03	1.23	1.13	1.27	1.17	1.30	1.45
	3-6	1.00	1.14	1.05	1.17	1.08	1.23	1.38
	7+	1.01	1.20	1.10	1.23	1.13	1.25	1.44
Ram Lamb	1	1.06	1.30	1.19	1.36	1.23	1.46	1.65
	2	0.94	1.12	1.03	1.16	1.06	1.18	1.32
	3-6	0.91	1.04	0.96	1.06	0.98	1.12	1.26
	7+	0.92	1.09	1.00	1.12	1.03	1.14	1.31
Wether Lamb	1	1.12	1.37	1.26	1.43	1.30	1.54	1.74
	2	0.99	1.18	1.08	1.22	1.12	1.25	1.39
	3-6	0.96	1.09	1.01	1.12	1.04	1.18	1.32
	7+	0.97	1.15	1.06	1.18	1.08	1.20	1.38

You Can't Tell by Looking

Genetics for growth based on 60 day adjusted weights



Lamb A: Triplet out of 2 yr old dam
ww 48, adj 63 lbs

Lamb B: Twin out of 3 yr old dam
ww 55, adj 58 lbs

Lamb C: Single out of 4 yr old dam
ww 62, adj 56 lbs

Selecting Sheep for Superior Meat Yield

Jim Morgan, PhD, Katahdin Producer, Arkansas

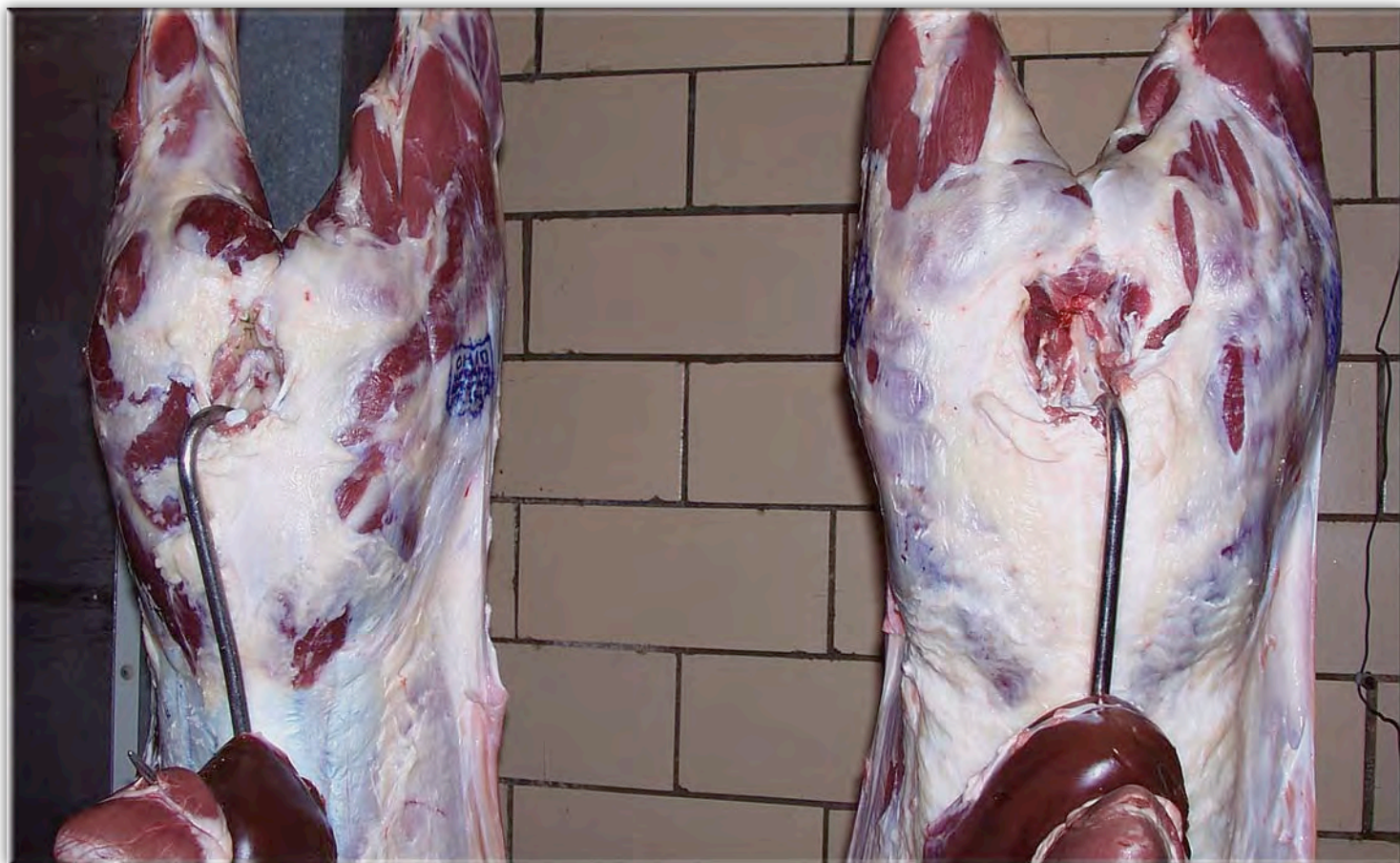
Can you look at a pen of lambs and tell which one will yield more meat and have more value to the meat packer? The premise is that a good judge can visually identify animals with superior meat yield. However, a large study (Parker, 1990) with lambs from three university flocks found that there were basically no visual measurements that could be used to accurately predict superior pounds of meat harvested from a market lamb when adjusted for weight of the lamb.

In the live lamb, physical attributes commonly used to identify superior carcass traits in animals including length of animal, length of loin, length of rump and diameter of fore shank, had no value in predicting meat yield or carcass value. However, the study did find that width of the hind leg as viewed from the back was correlated with increased meat yield. In addition, a recent study in the 2000's at the U.S. Sheep Experiment Station in Dubois, Idaho and The Ohio State University found no relationship between measurement of any trait except weight, including length in the live animal and leg measurement, with meat yield of the loin or leg in the carcass. In both the study by Parker (1990) and the one at the U.S. Sheep Experiment Station, tape measures were used to accurately evaluate over 50 different live animal measures/lamb.

USA sheep researchers (Dr. Dan Morrical, Iowa State; Dr. Kreg Leymaster, USDA Meat Animal Research Center, Nebraska; Dr. Dave Notter, Virginia Tech; Dr. Charles Parker, Emeritus Department Chair Ohio State University & U.S. Sheep Experiment Station) corroborate the lack of relationship between visual measures in the live animal and meat yield. They all agree that to determine meat yield, the most accurate measurement in the live animal is ultrasound to determine the area of the loin/rib eye muscle and back fat on lambs at market ages and weights, for example between 4-8 months of age.

Both Dr. Charles Parker and Dr. Dan Morrical pointed out in 2005 that over the last 20 years, the rib eye area of the champion meat lambs at the Ohio State Fair and Iowa State Fair have not increased in size, even though lamb weights have increased by 20 lbs. On a per pound basis it can be said that market lambs selected by visual evaluation alone have resulted in a decrease in loin eye muscle on a per pound basis.

In summary, if you are selecting for increased meat yield in your breeding rams, ultrasound of loin/rib eye is the best measure. It needs to be coupled with improved reproductive efficiency since weaning percentage is the money trait for meat production. No matter how meaty the genetics are, lambs that are not alive at marketing cannot be sold.



EBVs: Breeding Control Knobs for the Future

**Michelle Canfield,
Katahdin Producer, Washington**

For the last hundred years or so livestock breeders have employed the same basic tools for genetic improvement: visual appraisal and simple recordkeeping. Folks would get together at county fairs, comparing the best animals that each person had based on outward appearance. Was the animal structurally sound and built correctly to do the job for which he was bred? Was he healthy and vigorous? Did his temperament appear manageable? Did he represent the breed standard? Some performance history may have been considered, but it was limited to what the breeder could remember or write down. Were this animal's parents also good performers? What about his siblings? This method worked to an extent, but progress towards breeding goals was slow, often taking years or generations.

We know intuitively that animals from a family of strong genetics have better odds of passing on desirable genes than animals from a family of weak genetics, despite the traits of the individual animal. A mediocre ewe from a strong family is usually more desirable to use for breeding than a strong ewe from a mediocre family. We know that she's going to pass on some of her observed traits, but also many other traits that we can't see, so we want her to come from as strong of a family as possible.

Now we have Computer Power. What if there were a way to average the performance of a whole family's worth of data - hundreds or thousands of records - on a particular trait of interest, so we could compare Ram A and Ram B, and know "whose family is stronger overall?"

If I assume a ram is the average of his parents, his own performance, and all of his progeny, I can get a pretty good measure of his genetic potential, right? Likewise, if I have the same averaging data on his parents, now I've incorporated data about his nieces, nephews and cousins, all which "roll up" into his parents' averages through the pedigree. This becomes some pretty powerful data! And this is what Estimated Breeding Values (EBVs) have to offer us: hundreds, thousands, or even millions of calculations across correlated pedigrees to give us more accurate predictions about inherited traits than we could ever figure out by hand.

EBVs help us see that everything and everyone has a bell curve. Even gifted breeders will have a lot of

middle-performing animals in their flock, flanked by a handful of animals which excel and a handful of them which are sub-par when compared to their peers. We need objective data to differentiate how an animal performs against his peers, when they are all in the same environment and situation; and how *much* better he performs: is it by a little, or a lot? We want to be able to identify those extremes in the bell curve, so we can select those that excel on desired traits and cull those that underperform, which helps improve our averages over time.

The neat thing about EBVs is they not only help you rapidly improve in areas where you want increases, they can also help you hold some traits steady, or even *decrease* them if it's right for your system. I liken



them to "control knobs". Want more triplets? Select for higher "Number Lambs Born (NLB)" EBVs. On the other hand, do you prefer fewer triplets? Turn that trait down by selecting against high EBVs for that trait. Happy where you are? Keep an eye on that EBV to hold it steady as you select to change other traits which might otherwise influence it up or down. Need more milk to grow your grass-fed lambs? Turn up the volume on the milk EBV (Maternal Weaning Weight).

EBVs are an incredible tool for managing economically important traits to achieve your breeding goals, offering much faster progress than you could ever achieve by manual data analysis or visual appraisal alone.

Rate of Genetic Improvement

Jim Morgan, PhD, Katahdin Producer, Arkansas

Rate of flock improvement is based on several factors. These include accuracy of identifying superior animals, generation interval, number of traits selected for and consistency of selection from year to year. To make progress, traits need to be both heritable and variable within your flock or breed.

My father raised registered Shorthorn cattle for 30 years before transitioning to a commercial herd. After WWII, Dad returned to farming with an interest in beef genetics. Advice my dad got from an old college textbook he borrowed was, "Select three traits that you want your cattle herd to improve on and never use a bull or a replacement heifer that takes you backwards on any of those three traits. At the end of 30 years, you can add a fourth trait". Dad told the story more as a lesson for life and not as much for the genetics. His goal was that my siblings and I would understand the importance of selecting a few key goals and being consistent and patient in achieving them. Little did Dad know that this piece of wisdom would become important in my second career as a shepherd.

How does the advice from the 1940's beef genetic textbook apply to genetic selection for sheep performance now? The basic principles still apply but two important differences should be mentioned. In terms of biology, sheep have a shorter generation interval than cattle and most breeds have twins, meaning genetic progress has the potential for being much faster with sheep than cattle. Secondly, with the development of EBVs (estimated breeding values), livestock producers now have access to increased accuracy of selection and can make significantly faster progress than my dad could with his cattle.

But wait, meat production requires many traits. Inferior quality in any of the following can cause production train wrecks: structural soundness, growth, reproductive soundness, milking ability, prolificacy, lamb survival, parasite resistance and the list goes on. They are all important, but if a shepherd only selects for three to four traits, what happens to the rest? Eventually, the traits not selected for could become unacceptable, so they cannot be ignored.

One approach is to select a few key traits that have the most impact on financial return and production and then set minimum standards/cull levels for secondary traits the shepherd also deems important. This will keep the second tier traits acceptable but still allow the flock to greatly improve production. Note that the more rigorous

the cull levels are for the second tier, the slower the progress will be on the primary traits.

A second approach is to use an EBV (estimated breeding value) index that moves several traits simultaneously. The U.S. Hair index ranks several production traits according to their importance for marketed pounds of lamb. This EBV index combines reproductive efficiency (number weaned) with good growth and milk production. At the sale barn, shepherds are paid for pounds of live lamb. This is the "money trait" for production and rewards genetics for growth, prolificacy, milk and survival.

My preference is to select using the US Hair index for improved meat production (pounds lamb weaned/ewe lambing) and Wfec EBV for im-

proved parasite resistance, cull animals that are not structurally or reproductively sound, and set acceptable minimum standards for conformation and muscling. Note that the primary selection index is rewarded at the market and improvement in the traits that are culled is poorly rewarded.

The main point to make is that the US Hair index EBV allows shepherds to select multiple traits based on their importance for production and/or financial return as though it was a single trait, resulting in faster genetic progress and better accuracy.

In summary, keep your important selection traits to a minimum, be consistent from year to year and use the best tools available. For the important traits that do not make the primary list, set minimum levels for culling breeding stock that do not meet acceptable production standards.

"With the development of EBVs, livestock producers now have access to increased accuracy of selection and can make significantly faster progress"





Where Can I Find the Best Sheep?

Jim Morgan, PhD, Katahdin Producer, Arkansas

It depends! Like automobiles, there is not a perfect Katahdin “model” that will work for all producers and in all markets. While Katahdin producers don’t need the variety of models that the automobile industry provides, there are important differences in production systems that shepherds need to consider before purchasing the “best” sheep.

Each new shepherd needs to do their homework first. Before buying or looking at sheep, consider the following questions to help determine *where to find the best Katahdins for each operation and goals*.

- What is my market? Where will I sell my sheep? What size and/or conformation of sheep are rewarded in my market?
- What resources do I have access to? Have I considered the availability/cost of land, forage, hay, supplements, barns, fencing, and labor?
- How do I plan to manage my flock? Will my management include lambing indoors in winter, pasture lambing in spring, fall lambing, rotational grazing, creep feeding, forage only or organic?
- What are my breeding goals and objectives? In an economical management system, breeding goals and objectives will be developed based on the answers to the questions above.

The answers to these questions should, and do vary from flock to flock and across the country. The best sheep for any particular system will depend on the goals, resources and management of the individual shepherd.



Resources

KHSI LINKS

Katahdin Hair Sheep International (KHSI) - www.katahdins.org
 KHSI Classified Ads - www.katahdins.org/classified-ads/
 KHSI Membership Listing - www.katahdins.org/membership-directory/
 KHSI Registry Services - www.katahdins.org/register-sheep/
 Katahdin Weaning Weight Adjustments - www.katahdins.org/khsi-forms/

Books

From the Feed Trough: Essays and Insights on Livestock Nutrition in a Complex World, 2014, Woody Lane, PhD.
SID Sheep Production Handbook, American Sheep Industry, 2015, Volume 8
Storey's Guide to Raising Sheep, 4th Edition, Ekarius & Simmons, Storey Books

PERIODICALS

Sheep Industry News, American Sheep Industry (monthly magazine)
<https://sheepusa.org/magazines>
sheep!, Countryside Publications, (bimonthly magazine)
<https://iamcountryside.com/sheep/>
Stockman Grass Farmer, Grazing publication (monthly) www.stockmangrassfarmer.com/
The Banner, Banner Publications, (9 issues/yr magazine) www.bannersheepmagazine.com/
The Shepherd, Long Draw Publishing, (monthly magazine)
www.theshepherdmagazine.com/
Sheep Canada magazine, www.sheepcanada.com (quarterly)

INTERNET

American Consortium for Small Ruminant Parasite Control - www.wormx.info/
 American Lamb Board Resource Center: Links to genetics, marketing reports, quality assurance, production and more - <http://lambresourcecenter.com/>
 American Sheep Industry Association - www.sheepusa.org/
 Facebook: Hair Sheep for Sale - www.facebook.com/groups/hairsheepforsale/
 Facebook: Katahdin Hair Sheep International - www.facebook.com/KatahdinsIntl/
 Facebook: Katahdin Sheep Breeders - www.facebook.com/groups/katahdinsheep/
 Facebook: NSIP Sheep for Sale - www.facebook.com/NSIPmarketplace/
 Katahdin NSIP Resources & Publications -
www.katahdins.org/national-sheep-improvement-program-nsip/
 Maryland Small Ruminant Page - www.sheepandgoat.com/
 NRC: Nutrient Requirements of Sheep - www.nap.edu/read/614/chapter/1
 National Resources Conservation Service - www.nrcs.usda.gov/
 National Scrapie Eradication Program - www.aphis.usda.gov/
 National Sustainable Agriculture Information Services - www.attra.ncat.org/
 National Sheep Improvement Program - www.nsip.org/
 USDA Market Reports/lamb - www.ams.usda.gov/mnreports/lswlamb.pdf
 USDA New Farmer Information - <http://newfarmers.usda.gov/>

This list of common resources is by no means comprehensive. Many excellent books, magazines, research studies, articles and web links are available, but were not included, due to limited space.



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