Journeyman Farmer Certificate Program

Small Ruminant Production Participant Notebook

Supported by: USDA NIFA

Beginning Farmer and Rancher Development Program

Developing the Next Generation of Sustainable Farmers in Georgia
In partnership with:

UGA extension
FVSU extension Knowledge for Inspiring Lives
University of Georgia SBDC
Farm Credit Associations of Georgia
Georgia Organics

JOURNEYMAN FARMER
CERTIFICATE PROGRAM

Beginning Farmer and Rancher Development Program:

Developing the Next Generation of Sustainable Farmers in Georgia Grant

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

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Participant Notebook

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Small Ruminant Production
General Agenda & Learning Objectives

Note: Times do not include breaks, optional activities, or prep time

Session One (115 minutes)

- Breeds and Breeding Stock Selection
- Nutrition

Learning Objectives:

- Choose breed/animals that will fit best on your farm
- Identify basic nutrient (protein, energy and fiber) sources for goats and sheep
- Understand different animal requirements based on production stage/level

Session Two (105 minutes)

- Pasture Management
- Predator Control

Learning Objectives:

- Identify forage types and basic nutrient content (i.e. grasses, legumes, forbs, and browse)
- Recognize the link between forage height/maturity and nutrient content/quality as well as parasite management
- Describe the risks that determine the need for predator control, the types of predator control, and the resources needed for each

Session Three (104 minutes)

- Health and Diseases
- Breeding
- Lambing and Kidding

Learning Objectives:

- List some of the most common diseases of goats and sheep and understand how to prevent or treat them
- Understand best management practices for breeding and for lambing or kidding

Session Four (110 minutes)

- Integrated Parasite Management I
- Integrated Parasite Management II

Learning Objectives:

- Understand dewormer resistance (immunity) issues
- Identify small ruminant anthelmintics (dewormers) and common parasites of small ruminants
- List best management practices to avoid parasite infection and keep dewormers working longer

Session Five (108 minutes)

- Meat Production
- Marketing

Learning Objectives:

- Understand the difference between live weight, hanging weight (hot carcass weight), and retail yield
- Describe how animal age, sex, and management practices affect meat quality
- Identify different markets for live animals
- Understand the requirements for marketing meat products in Georgia

Session Six: Hands-on Demonstration (200 minutes)

- Body Condition Scoring
- FAMACHA/Five Point Check/Deworming
- Foot Trimming, Castrating and Giving Shots

Learning Objectives:

- Be able to body condition score goats and/or sheep
- Demonstrate use of FAMACHA© and The Five Point Check© to select animals for deworming
- Learn foot trimming, castrating, and how to give shots

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Small Ruminant Production Training

Breeds and Breeding Stock Selection

Nutrition

Session One

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Knowledge for Inspiring Lives!

Session 1: Breeds and Selection; Nutrition and Feeding

Introductions (10 min)

Handouts (10 min):

Basic Sheep and Goat information
Sheep and Goat Anatomy
Basics of Feeding

Breeds and Selection (45 min, Dr. Niki Whitley, Fort Valley State University)

- Choosing a breed, breed type or breeding system to match farm resources and markets
- Goat and sheep breeds, including their role in the industry (terminal/maternal types)
- Selection of animals within a breed or breed type

Learning Objectives*:*

- Select a breed and breeding stock matching goals/resources
- Identify records needed for future stock selection/marketing

Activity (20 min) – Selection

Ideas for how you can use this at home – Identify a breed to meet farm goals/resources and develop a list of questions to ask potential sources of breeding stock; if selecting from your own farm instead of buying new animals, develop a list of criteria to use for selection (in the order of importance).

BREAK

Nutrition (30 min, Dr. Lawton Stewart, University of Georgia)

- Nutritional/nutrient requirements for goats and sheep based on stage of production
- Sources of different nutrients (feeds/feedstuffs)
- Vitamins and minerals – importance of ratios/balance

Learning Objectives*:*

- Understand different animal requirements based on production stage /level
- Identify basic nutrient (protein, energy and fiber) sources for goats and sheep

Ideas for how you can use this at home: Evaluate the farm feeding plan and determine if it would change based on information learned in this Session.

Session 1: Basic Sheep and Goat Information Terminology

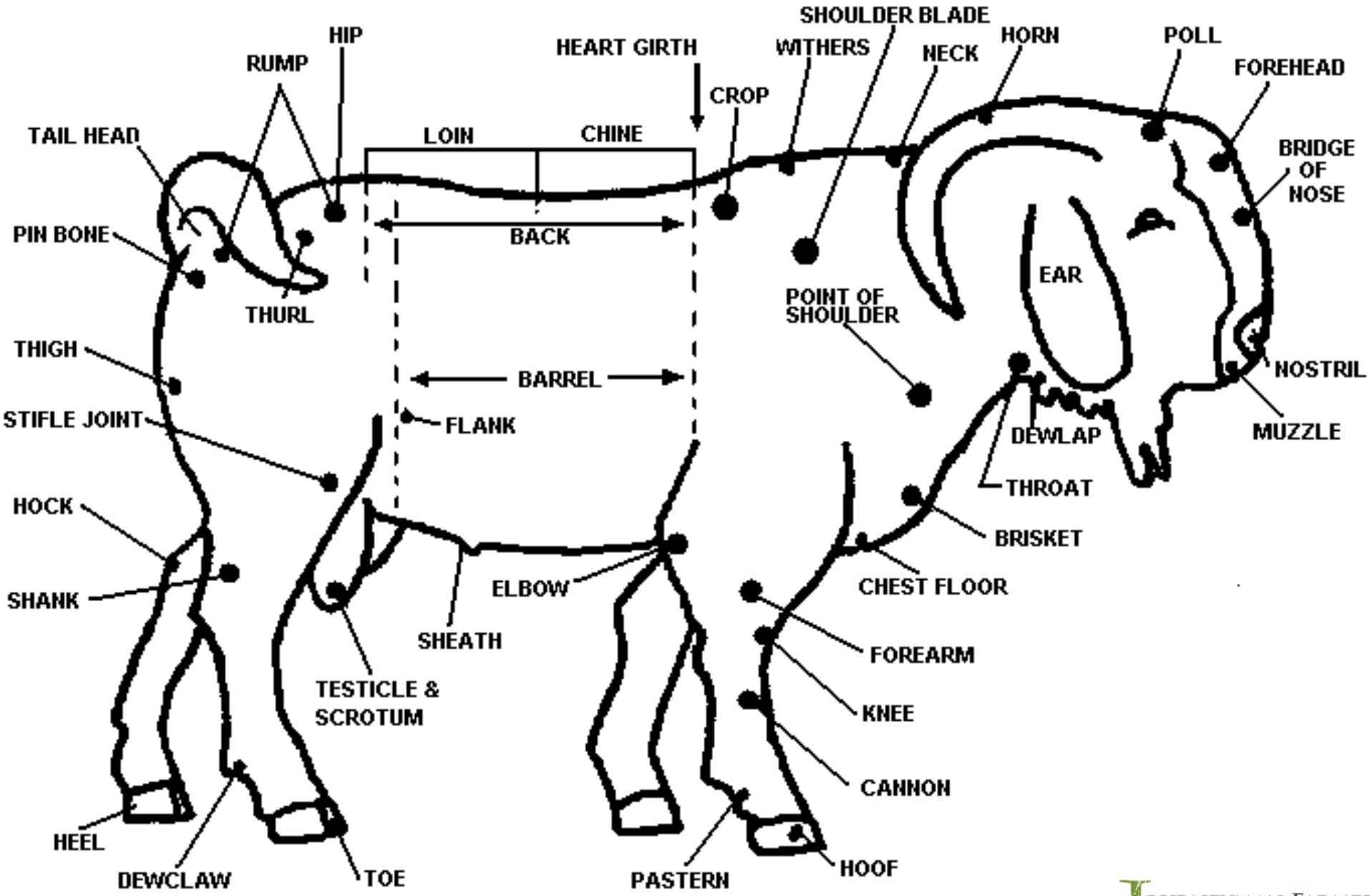
Species	Intact Male	Castrated (Neutered) Male	Adult Female	Offspring up to a year
Sheep	Ram	Wether	Ewe	Lamb (Ewe lamb, ram lamb)
Goat	Buck	Wether	Doe	Kid (doe kid, buck kid)

You may also hear doeling or buckling for young goat offspring and some use the word buck for a ram too. For both species, if they are around a year old, we use the term yearling (i.e. she is a yearling doe). The process of giving birth is lambing or kidding. For all livestock, the mother is called the dam, the father is called the sire.

Basic notes:

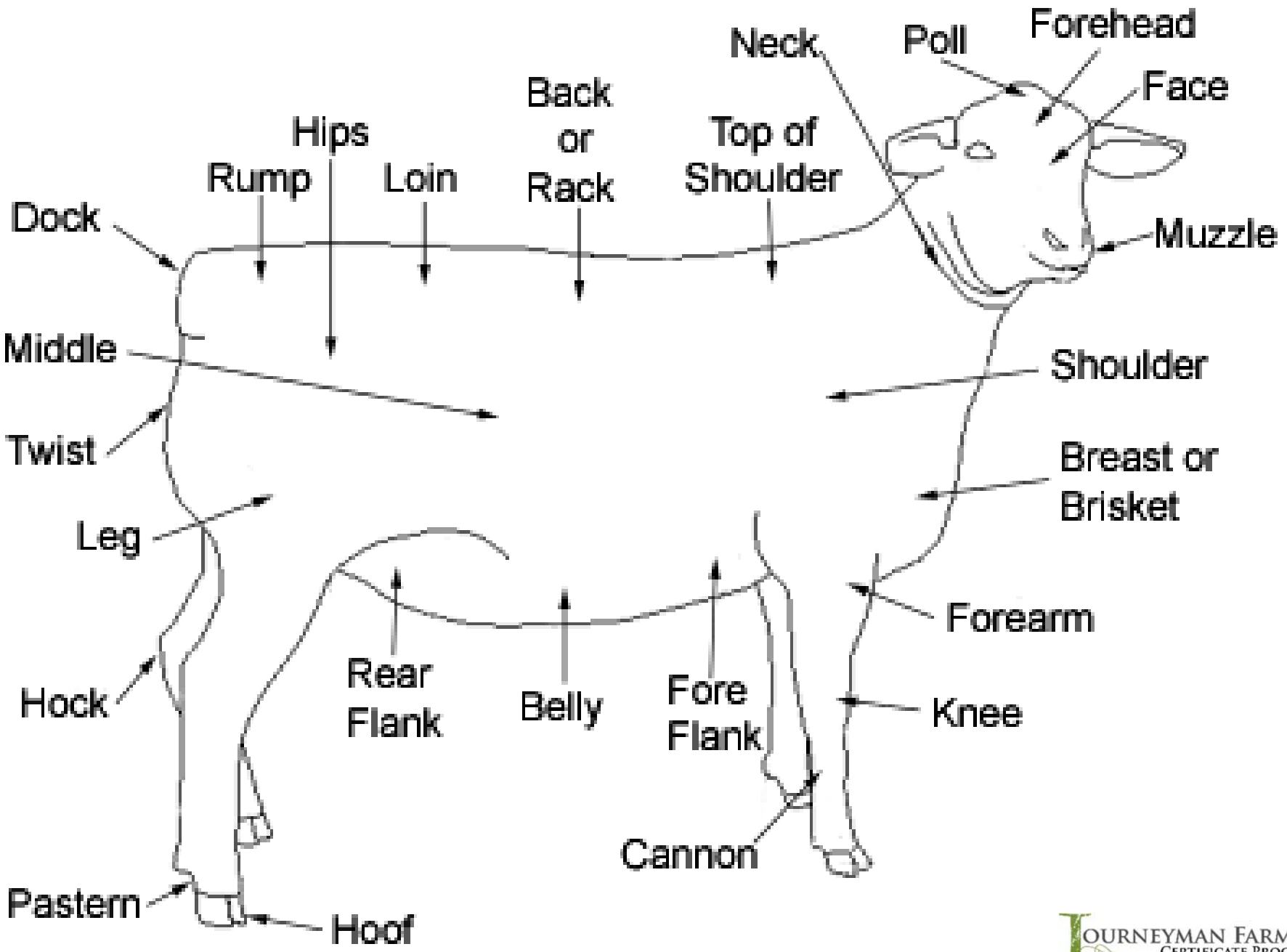
- All goats of both sexes are horned but can be dis-budded by burning the horn buds at 4-10 days of age before horn growth starts; it is extremely rare for kids to be born without horns
- Disbudding is a typical management practice in dairy goats
- Most (not all) sheep breeds are polled (born with no horns)
- Sheep and goats breed best in the fall/winter (short days); some are less seasonal than others and will breed outside of that time period
- Sheep and goats have 1 to 4 offspring (twins optimal)
- Offspring are weaned from nursing the mother (dam) at 60-90 days
- Some hothouse lambs are sold at 30 lbs (2 months of age)
- Most lambs go from weaning into a feedlot to until 135 lb average (so taller/larger animals desired); they are 12-14 months old when ready for harvest
- Lamb is pasture finished (raised to harvest size) for specialty markets and smaller sized/framed animals are used; most goats are sold into specialty/ethnic markets
- Dairy and wool/fiber animals eventually end up as meat as well (male dairy offspring and dairy/wool animals with poor fiber or poor milk production)

Meat goat – Boer type but parts the same for all breeds



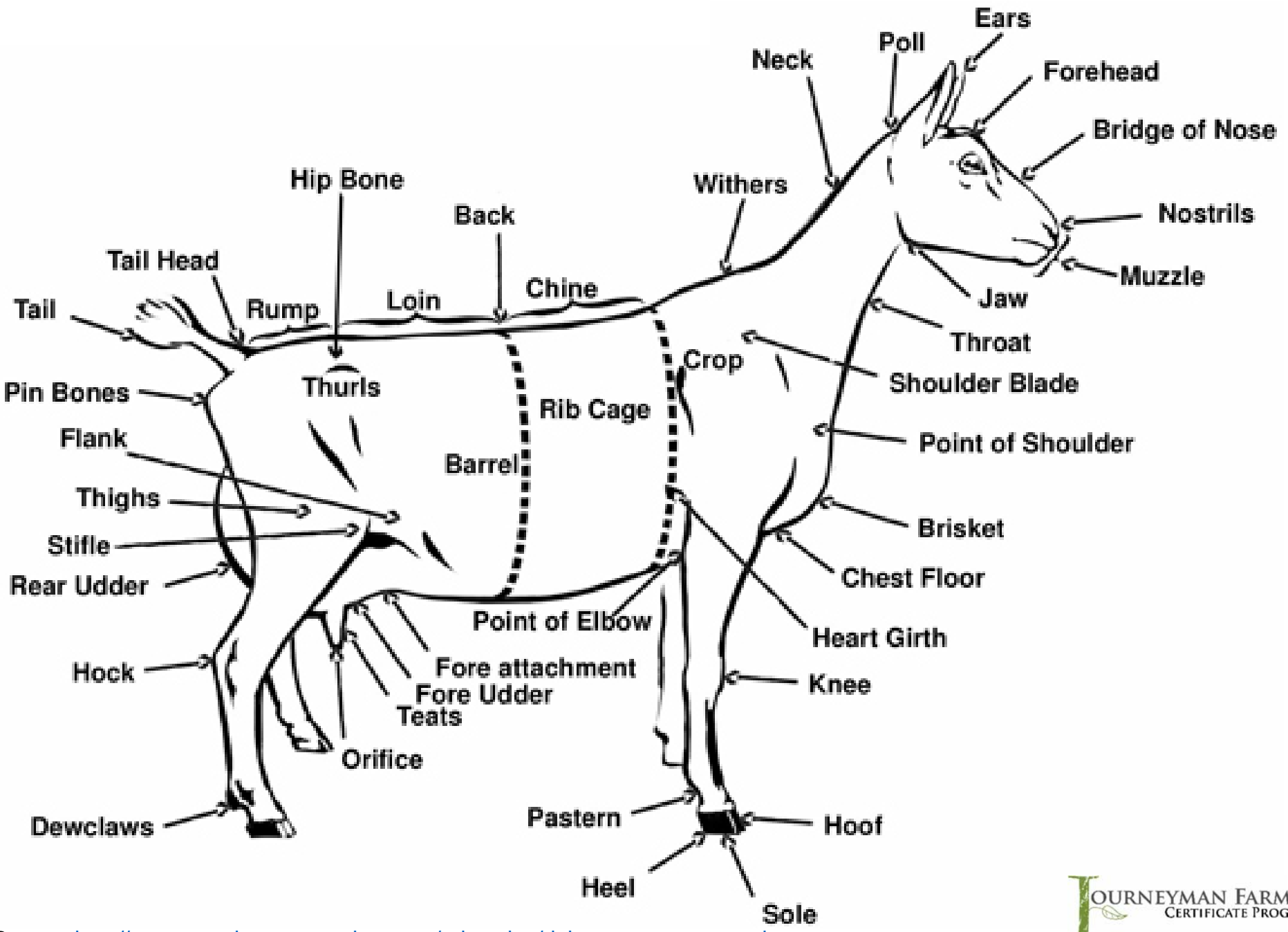
Source: www.boergoats.com

Sheep – hair type but parts the same for all breeds



Source: http://www.geauga4h.org/ (originally from Oklahoma State University)

Dairy goat



Source: http://www.americangoatsociety.com/education/dairy_goat_anatomy.php

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Small Ruminant Production

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Session 1
Breed and Breeding Stock Selection

Dr. Niki Whitley
Animal Science Extension Specialist
Fort Valley State University

Susan Schoenian
Sheep & Goat Specialist
University of Maryland Extension

Learning Objective

- Understand how to select animals using records and visual appraisal

Selection

- Species/breed depends on:
  - Production system/market
    - Meat animals
    - Breeding stock/meat
    - Show/meat
    - Fiber/meat
    - Dairy/meat
  - Resources

Photos: Susan Schoenian, Baalands Farm

Production System/Market

- Meat animals
  - Local sale barn
  - Livestock buyers
  - Direct to consumer/farm
  - Meat-processing; permits
- Breeding stock
  - Direct sales
  - Special breeding stock sales

Photos: Susan Schoenian, Baalands Farm

Production System/Market

Saanen dairy goat

- Show animals
  - Direct sales
  - Show sales
  - Market for culls
- Fiber/dairy
  - Direct sales
  - Products - processing
  - Regulations for dairy
  - Market for culls

Photos: Susan Schoenian, Baalands Farm

Resources

- Farm size
  - Stocking rates
- Structures
  - Barns/shelters
  - Storage
  - Other
- Labor
- Funds
  - For animals
    - Hard to find?
  - Feeding
  - Vet/Health Care
  - Marketing

Photos: Susan Schoenian, Baalands Farm

Potential profitability

- Look at market to determine possible output (sales) from animals
- Resources you have or have to purchase for inputs/costs
- Profit = outputs – inputs
- Enterprise budgets can help
  - Internet search “goat and sheep budgets”
  - Local County Extension Office

Commercial Meat Production

Important

- Performance (output)
  - Pounds of quality offspring to sell
  - Meet market needs
- Fitness (input)
  - Disease-resistant
  - Longevity
  - Easy-care

Photo: Susan Schoenian, Baalands Farm

Less important

- Body conformation
- Fiber/Wool

Sire selection is very important, three generations = 88% genetics

Breeding Stock

Important

- **What the market is looking for- pedigree/bloodlines, breed character, fitness, growth**
- Reproductive efficiency
  - Pounds quality offspring to sell
- Body conformation
  - Structural correctness - related to performance/longevity
- Current fad?

Show animals

Important

- **Looks/conformation (what market is looking for)**
- **Winning records**
- Current fad?
- Reproductive efficiency?
  - Number quality offspring to sell

Fiber/Dairy Animals

Important

- **Quality/quantity of product**
- **Winning/best records**
  - **Fiber shows**
  - **DHIA results**
- Reproductive efficiency?
  - Number quality offspring to sell
- Conformation (udder)

Meat	Wool	Multi-purpose	Other
Hair (or shedding)	**Fine**	**Wool**	Babydoll Southdown Black Welsh Mountain Blueface Leicester Calif. Variegated Mutant Clun Forest Florida Cracker Florida or Gulf Coast Native Hog Island Icelandic Jacob Karakul Navajo-Churro Scottish Blackface Shetland Soay
American Blackbelly Barbado California Red **Dorper** **Katahdin** Romanov Royal White St. Croix Wiltshire Horn	Booroola Merino Cormos Debouillet Merino Panama **Rambouillet**	Columbia Corriedale Finnsheep **Polypay** S. African Meat Merino Targhee	
Wooled	**Long**	**Dairy**	
Border Cheviot **Dorset** **Hampshire** Ile de France North Country Cheviot Oxford Shropshire Southdown **Suffolk** **Texel**	Border Leicester Coopworth Cotswold Leicester Longwool Lincoln Perendale Romney Wensleydale	Awassi East Friesian Lacaune	

US Sheep Breeds by Primary Purpose

SHEEP TERMINAL (SIRE BREEDS)

Suffolk, Hampshire – Frame/growth (feedlot)

Texel– Muscling/carcass (pasture)

Dorper/White Dorper – Muscling, hair (pasture)

Photos: Susan Schoenian

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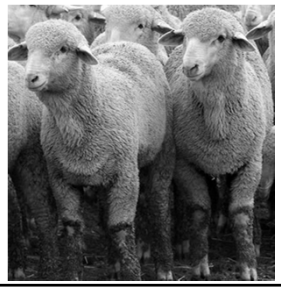
SHEEP MATERNAL (EWE BREEDS)

Dorset – Both: reproduction, good growth

Katahdin – Fitness, reproduction

Polypay – prolificacy, mothering

Rambouillet – Maternal wool



Photos: Susan Schoenian, Baalands Farm

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US Goats Breed by Primary Purpose

Meat	Dairy	Fiber	Other
Boer **Kiko** Myotonic (Tennessee Fainting) Pygmy Savanna **Spanish***	Alpine La Mancha Nigerian Dwarf **Nubian** Oberhasli **Saanen** Toggenburg	**Angora** Cashgora Cashmere* Pygora	Arapawa Golden Guernsey Kinder Other mini-goats Sable (Saanen) San Clemente Scrub/Brush/Wood*

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GOAT TERMINAL (SIRE BREEDS)


Boer, Savanna – muscling, growth


Kiko – growth, fitness (both?)

Photos above: Susan Schoenian, Baalands Farm

GOAT MATERNAL (DOE BREEDS)

Spanish – Fitness, mothering

Kiko – both?; fitness, mothering, growth

Selection and Marketing

Performance (objective)

- **Birth records**
- **Growth records**
- **Deworming/fecal egg counts**
- **Ultrasound**
- **Actual carcass measurements**
- **Fleece weights/Micron testing**
- **Milk yields**
- **EPDs/EBVs**
- **Genetic testing**

Visual appraisal (subjective)

- **Body conformation**
- **Udder conformation**
- **Live evaluation/handling**
- **Visual evaluation of wool**
- **Show winnings**

Photo: Susan Schoenian

Selection and Marketing

- Performance and looks are impacted by environment and genetics
- Environmental factors: Nutrition, health, weather/season, management, housing, age
- Purchase from people with similar management/farm environment


Selection and Marketing

- Performance selection – genetics
  - On farm records comparisons – reproduction, adjusted weights, fecals or dewormings, flock/herd EBVs/EPDs
  - Performance tests (compares animal data); across-flock EBVs/EPDs
  - Genetic testing – scrapie, myostatin, fecundity genes

nsip.org – EPDs/EBVs for sheep and goats

Selection Tips

- Decide traits you want
- Balanced selection - can select for multiple traits
- Set minimum standards

Example:

- Twin or better
- Dewormed once as lamb/kid
- Weaning wt ratio above 100% (pre-weaning for females, also post-weaning for males)

Within herd/flock selection

Look at:

1. Data/records – within the breed or breed type
2. Check pedigree to avoid inbreeding
3. Problems/issues – health, behavioral
4. LAST: Visual appraisal – reduces temptation to keep probable bad genetics in a pretty animal

Purchase from another farm

Consider/ask about:

1. Farm Health Status - problems/issues, vaccinations, routine treatments
2. Management - feeding, housing, lambing assistance, records/information kept
3. Records specifically for all animals for sale
4. LAST: If no problems related to health and management, visually appraise animals chosen based on records

Photo: Susan Schoenian, Baalands Farm

Visual appraisal

- Health/Soundness
  - Bright, alert, front of flock/herd?
  - Good body condition
- Problems (do not buy)
  - Limp
  - Abscesses or pink eye
  - Sore mouth lesions
  - Respiratory symptoms- snotty nose, labored breathing
  - Extremely poor condition

Photo above: Susan Schoenian

More info: http://www.sheep101.info/201/acquiringstock.html

GENERAL VISUAL APPRAISAL

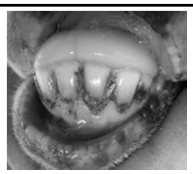
- Males look masculine, females look feminine
- Udder connection good, no lumps/bumps, no teat defects/extra teats (males too), seem functional
- Testicles firm, no lumps/bumps, normal size

Fish teat, not good

Photos: Susan Schoenian, Baalands Farm

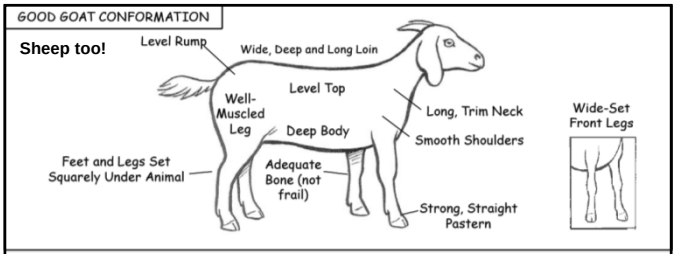
GENERAL VISUAL APPRAISAL

- Mouth:
  - Top palate and bottom teeth should meet
  - No undershot bottom jaw (monkey mouth) or overshot top (parrot mouth)
- Good conformation



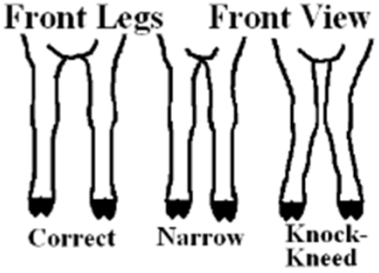
Undershot jaw/underbite – not good

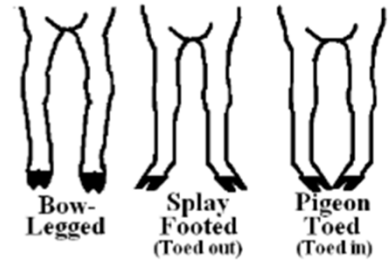
Photos: Susan Schoenian, Baalands Farm



Picture and following text from ATTRA (attra.ncat.org)- Animals with good conformation are strong in structure, deep bodied, wide chested and able to walk squarely on feet and legs.

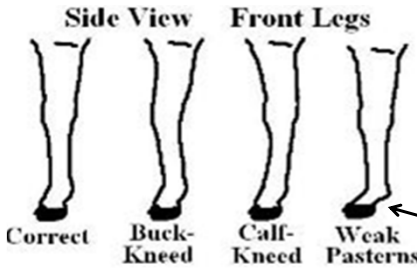
More: www.danekeclublambs.com/SheepFeetandLegStructureTest.html

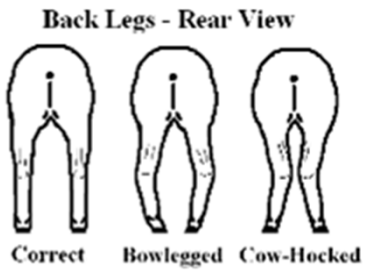


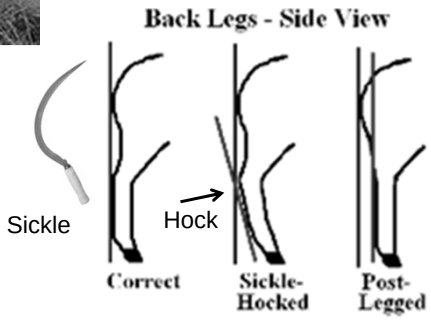


Sires in ANY production system should have good conformation!!!

A nice ewe lamb
Photo above: Susan Schoenian







Pastern-area between ankle and hoof

www.lazyjvranch.com/sitebuilder/images

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SUMMARY TIPS

- Select a breed (or breeds to crossbreed) based on your farm goals, market and resources
- For stock selection, get performance records first, then do visual appraisal and choose healthy, sound animals
- Buy from reputable breeder (with management similar to your own)
- Be aware - sale barns/grouped animals from different places – isolate new animals for 30 days

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References and Additional Resources

Small Ruminant Webinars:
- www.sheepandgoat.com/#!webinars/cu81

Goats:
- www.famu.edu/cesta/main/assets/File/coop_extension/small ruminant/goat pubs/Selecting_Goats.pdf
- www.aces.edu/pubs/docs/U/UNP-0110/UNP-0110.pdf
- extension.psu.edu/courses/meat-goat/basic-production/selecting-meat-goats
- www.youtube.com/watch?v=A4LFKjInVmE

Sheep:
- www.aces.edu/pubs/docs/A/ANR-0821/index2.tmpl
- www.sheep101.info/201/acquiringstock.html
- www.onlinesheepshow.com/placed.htm (show sheep)

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References and Additional Resources

General:
- attra.ncat.org/attra-pub/download.php?id=218
- attra.ncat.org/attra-pub/livestock/
- http://www.sheepusa.org/ResearchEducation_OtherResearch_UsBaselineLambCostOfProductionModel

Budgets:
- economics.ag.utk.edu/budgets/2010/PB1793-MeatGoat.pdf
- www.sheep101.info/201/budget.html
- agecoext.tamu.edu/resources/crop-livestock-budgets/by-commodity/sheep-and-goats/2015-sheep-and-goats/
- agebb.missouri.edu/mgt/budget/

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NOTES:

Goat and Sheep Production – Basics of Feeding
Fact Sheet

Developed by Dr. Niki Whitley, Fort Valley State University

Goats and sheep are ruminant animals with a four chambered stomach made for digesting forages like pasture, forbs/weeds, browse and hay. However, forages may not always provide them what they need. The following information provides some basic tips for feeding goats and sheep.

- Excellent pasture and animal management is required for pasture-based systems, but supplemental feeding will probably still be needed at some point.
- Management tips include:
    - Manage animals in groups by age or production status for nutrition and health reasons.
    - Use integrated parasite management for multiple methods of worm control.
    - Do not over-graze - three to five adults per acre of good forage is the recommendation.
    - Rotationally graze for the best forage quality; as forage matures, quality goes down.
    - Mow pastures to maintain forage quality as needed.
    - Graze at no less than four inches of forage height for parasite control.
    - Use browse (brush/woody forage) when available for goats; sheep will eat some weeds but generally like to graze.
    - Soil sample and fertilize pastures based on forage needs.

- Some animals need extra protein and/or energy, usually given as a grain-based feed:
    - Young animals (less than a year of age) need more protein and energy.
    - Feeding extra energy to females two to four weeks prior to breeding and two weeks after may help increase number of offspring born.
    - Four to six weeks prior to giving birth, pregnant animals need extra energy because the babies are growing very fast then.
    - Females nursing offspring need more energy; the more offspring nursing, the more energy needed.

- Loose, not block, minerals made for your species should be available at all times; give sheep only minerals (and feed) made for them due to issues with copper toxicity.
- Fresh, clean water should be available at all times.
- Do not feed directly on the ground; keep feeders clean.
- Provide plenty of feeder space when feeding hay or grain.
- Learn about and use body condition scoring (scores of 1 to 5 with 1=too thin and 5=obese):
    - It is best to feed for scores between 2 and 4.
    - Animals with poor body condition should be fed more.
    - Pregnant animals should be no higher than a 4 to avoid possible pregnancy toxemia.

For more information, contact your local County Extension Center or Fort Valley State University Cooperative Extension Program (478-825-6296).

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Small Ruminant Production

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Session 1
Small Ruminant Nutrition

Dr. Lawton Stewart
Extension Animal Scientist
University of Georgia

Susan Schoenian
Sheep and Goat Specialist
Western Maryland REC

Learning Objectives

- Identify basic nutrient (protein, energy and fiber) sources for goats and sheep
- Understand different animal requirements based on production stage /level

Basic Nutrition

- Six Key Nutrients
  - Protein
  - Carbohydrates
  - Fats
  - Minerals
  - Vitamins
  - Water

Six Essential Nutrients

- Many (most) feedstuffs contain more than one of the essential six nutrients.
- Feedstuffs vary considerably in their content of the six essential nutrients.
- No single feedstuff can supply all six essential nutrients that an animal needs to survive and thrive.

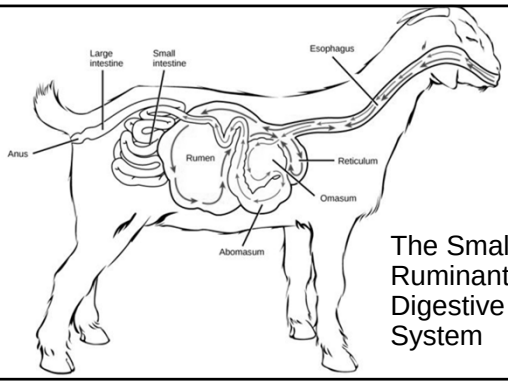
Water

- The most critical "nutrient".
- Has many important functions in the body.
- Needs vary by species, stage and level of production, and climate.

Water Content of Feeds

Feedstuff	Water	DM
Orchardgrass pasture	76%	24%
Wet distiller's grains	75%	25%
Corn silage	66%	34%
Molasses, cane	24%	76%
Grass hay	12%	88%
Whole corn	12%	88%
Ground limestone	2%	98%
Urea	1%	99%

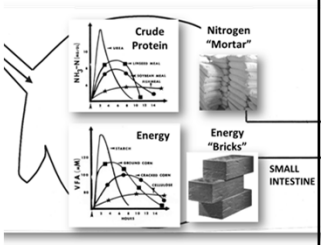
- All feedstuffs contain water. This must be considered when balancing rations. Rations are balanced on a dry matter (DM) basis.



The Small Ruminant Digestive System

Crude Protein

- Protein is often the most expensive feedstuff, but as the building block for animals, is an important one
- Ruminant animals can convert nitrogen to protein due to the microbes in their rumen
- Energy is needed to create and to digest protein



Energy

- Energy is needed in the greatest quantity; it is the building block for other nutrients.
- Requirements change based on age, sex, stage of production, and work.
- Sources of energy are starch, fat/oils, protein and cellulose (in forages).
- Fat/oils (i.e. corn oil) provide the most energy.
- Dietary excess is stored as fat.
- Expressed as total digestible nutrients (TDN), net energy (NE) or metabolizable energy (ME)

Feedstuff	% TDN
Urea	0%
Oat straw	48%
Orchardgrass hay	59%
Grass silage	61%
Fescue pasture	64%
Dry beet pulp	75%
Barley	84%
Corn	88%
Bread by-product	91%
Distiller's grains	92%
Fat	195%

Energy content of feeds

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What about fiber?

- Not a nutrient
- Essential dietary component for ruminants
- Does not have to be long stem roughage for young lambs/kids
- Adults seem to do better with some long stem roughage

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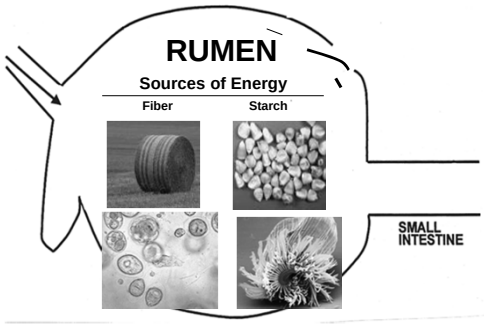


Energy – Fats/lipids

- Cheapest energy source.
- 2.25x as much energy as carbohydrates.
- Used to raise energy level of feed, improve flavor, texture, and palatability (how tasty it is).
- Source of heat, insulation and body protection.

Fat content of feeds

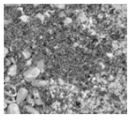
Fat can be used to help increase body condition score/provide energy to high producing animals, but for ruminants, usually want to feed it at no more than 7% of the total diet (counting everything they eat on a dry matter basis).

Feedstuff	% EE
Urea	0%
Dry beet pulp	0.7%
Barley	2.1%
Alfalfa hay, mid-bloom	2.3%
Orchardgrass hay	3.3%
Corn	4.3%
Fescue pasture	5.5%
Corn distiller's grains	10.5%
Whole cottonseed	17.8%
Whole soybeans	18.8%
Fat	99%

Minerals

1) Macro
   Needed in gram amounts
   Ca, P, Na, Cl, Mg, K, S

2) Micro
   Needed in milligram amounts
   Co, Cu, F, I, Mn, Mo, Se, Zn



- Multiple functions in body

Ca and P content of feeds (ratio important)

Dry matter basis	Ca	P	Ca: P
Corn	0.02%	0.30%	0.07
Barley	0.06%	0.38%	0.16
Soybean meal	0.28%	0.71%	0.39
Orchardgrass hay	0.32%	0.30%	1.07
Fescue pasture	0.48%	0.37%	1.30
Soybean hulls	0.55%	0.17%	3.24
Alfalfa hay, mid-bloom	1.4%	0.24%	5.83
Dried kelp	2.72%	0.31%	8.77
Dicalcium phosphate	22%	18.65%	1.18
Bone meal	27%	12.74%	2.12
Ground limestone	34%	0.02%	1700

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Minerals

- Georgia soils are low in selenium (important for fertility) and copper (important for immune fxn)
- Goats have a much higher copper requirement than sheep
- Sheep are more likely to experience copper toxicity.
- Use a mineral designed for your species and state/region/area.
- Loose minerals are better to use than a mineral block.

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Vitamins

1) Water soluble
   B & C

2) Fat soluble
   A, D, E , & K

- Multiple functions in body.
- Requirements increase with age.

☛No dietary requirement for vitamin K or B complex.

Vitamin sources

Vitamin	Feedstuff
β-caroteen (vitamin A)	Green, pasture forage; dehydrated hay; cured hay, vitamin supplements
D	Ultraviolet irradiation, sun-cured hays, vitamin supplements
E	High quality legume hay, dehydrated alfalfa, wheat germ, vitamin supplements
K	Green, leafy feedstuffs (K1). K2 synthesized in rumen
B	Not required in diets of ruminants

Nutrient requirements depend on …

- Species
- Size (weight)
- Sex
- Age
- Genetics
- Stage and level of production
- Climate, environment, and activity
- Body condition

Nutrient needs – general

- Sheep have lower maintenance requirements than goats.
- Dairy goats have higher maintenance requirements than meat and fiber goats.
- Females with a higher genetic potential for milk production (meat or dairy animals) have higher nutritional requirements.

Nutrient needs – adult size/age:

- Bigger (mature weight/frame size) animals need to eat more and consume larger quantities of nutrients.
- However, smaller animals need to consume a more nutrient-dense diet.
- Mature females are usually bigger and need to eat more to get the greater pounds of nutrients needed.
- However, young females need a more nutrient-dense diet.

Nutrient requirements – stage of production, females:

- Energy requirements during late gestation are more than 50% higher than for maintenance.
- Females require a more nutrient-dense diet during late gestation and lactation.
- Protein requirements increase in late gestation or when the female begins to lactate.

Nutrient needs – number of offspring

- Females carrying or nursing twins and triplets need to eat more of a more nutrient-dense diet.
- Those carrying triplets needs 43% more energy than those carrying a single fetus.

Nutrient needs - milking:

- The more milk a female produces the more nutrients she needs to consume.
  - Energy
  - Protein
  - Minerals
- In some cases, animals can simply be fed more, but in the case of higher-producing animals, a more nutrient dense diet must be fed.
- Nutrient requirements are significantly higher for dairy does and ewes.

What about growing lambs and kids?

- Their nutritional requirements are affected by many of the same factors.
  - Age
  - Species
  - Size
  - Genetic type and potential
  - Level of performance
  - Environment, activity

Nutrient needs - lambs:

- Assuming the same size and rate-of-gain:
  - Young lambs convert feed more efficiently, but need a higher percentage of protein in their diet.
  - Older lambs need to eat more and require a more digestible diet to achieve the same rate-of-gain.
  - Later maturing (larger breed) lambs need to eat more, but have lower protein requirements.

Nutrient needs – kids, size:

- Assuming the same rate of gain:
  - Smaller kids (weight) need to consume a more nutrient-dense diet, both energy and protein.
  - Bigger kids need to consume more quantity of nutrients, but the diet does not need to be as high quality (% TDN, CP).

Nutrient needs – kids, type/sex:

- Assuming the same rate of gain:
  - Dairy goat kids have the highest energy needs.
  - Boer buck kids need to eat the most, and have the highest requirements for protein.
  - Indigenous (local/native) breed goat kids have lower requirements for protein than improved breeds (like Boer).
  - Buck kids need to eat more than does.
  - Buck and doe kids require the same amount of protein, but since does eat less, they require a higher percentage of protein in their diet.

Nutrient needs – kids and lambs:

- Assuming the same genetic potential for growth:
  - The more you feed a kid or lamb the more it will gain.
  - Better performance requires both more feed and better quality feed.
    - Higher% TDN
    - Higher% CP
  - The bigger question is: is better performance economical?

ADG	% TDN	% CP
0 lbs/day	49.7%	7.8%
0.22 lbs/day	67.1%	13.8%
0.33/lbs/day	87.9%	19.9%
0.44 lbs/day	89.2%	21.7%
0.55 lbs/day	88.6%	23.1%

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Summary

- Different feedstuffs offer different levels of nutrients; for example, grains, quality forages/hay, and fat sources provide more energy; soybean products and legumes provide more protein.
- Minerals are important and should be fed based on species and location and in loose form.
- Animals with higher nutrient requirements may need supplementation: young, growing animals and females in late gestation and lactation (especially with twins or more)

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Additional Resources

Goats:

- http://extension.psu.edu/courses/meat-goat/nutrition
- http://www2.luresext.edu/goats/training/nutrition.html

Sheep

- https://pubs.ext.vt.edu/410/410-853/410-853.html
- http://www.sheep101.info/201/

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

USDA NIFA

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Developing the Next Generation of Sustainable Farmers in Georgia Grant

UGA extension

FVSU extension Knowledge for Inspiring Lives!

Georgia Organics

NOTES:

Additional Resources Page

Session 1: Breed and Breeding Stock Selection

Sheep judging (online show info with placings/reasons):
http://www.onlinesheepshow.com/placed.htm

How to judge:
http://learnhowtojudge.blogspot.com/p/how-to-judge.html

Goat Anatomy:
http://abga.org/abga-education/goat-anatomy/

Sheep Anatomy:
www.danekeclublambs.com/SheepAn.html

Goat selection:
www.luresext.edu/?q=content/selection-methods-and-tools

Dairy goat information:
http://adga.org/category/dairy-goat-information/

Dairy goat judging:
www.thejudgingconnection.com/pdfs/Dairy_Goat_Judging.pdf

Wool judging:
www.slideshare.net/schoenian/wool-judging

Improving wool quality:
http://extension.psu.edu/courses/sheep/basic-production/wool-production-basics/improving-wool-quality

Session 1: Nutrition

Testing nutrient values for pasture, hay or grain/feed:
http://aesl.ces.uga.edu/
www.noble.org/ag/testing-services/forage-sampling/
www.aces.edu/pubs/docs/A/ANR-2224/ANR-2224.pdf

Feeding sheep:
www.sheep101.info/201/balanceration.html
www.sheep101.info/201/feedingewes.html
www.sheep101.info/201/feedinglambs.html
www.sksheep.com/documents/Ex_Nutrition_FS.pdf
www.merckvetmanual.com/mvm/management_and_nutrition/nutrition_sheep/feeding_practices_in_sheep.html

Feeding goats:
http://articles.extension.org/pages/19336/goat-feeding-the-lactating-doe
https://content.ces.ncsu.edu/nutritional-feeding-management-of-meat-goats

Ration balancing:
http://extension.psu.edu/courses/meat-goat/nutrition/basic-ration-balancing
www2.luresext.edu/goats/research/nutreggoats.html

Dairy or fiber goats:
http://extension.missouri.edu/p/G3990
http://articles.extension.org/pages/31742/dairy-goat-management
http://articles.extension.org/pages/28312/goat-management-establishing-a-fiber-goat-operation

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Small Ruminant Production

Pasture Management

Predator Control

Session Two

Participant Notebook

UGA extension

FVSU extension
Knowledge for Inspiring Lives!

Session 2: Pasture Management; Predator Control

Pasture Management (40 min – Dr. Dennis Hancock, University of Georgia)

- Soil testing
- Dependence of forage species on location (U.S. and within GA)
- Types of forages for goats vs sheep based on eating habits
- Nutritional value of forages
- Fencing

Learning Objectives*:*

- Identify forage types and basic nutrient content (i.e. grasses, legumes, forbs and browse)
- Recognize the link between forage height/maturity and nutrient content/quality

Activity (35 min) – Nutrition and Forages Activity (PowerPoint)
Ideas for how you can use this at home – Identify forages for the farm based on livestock species and nutrient content; conduct a pasture soil test and discuss results with your local county extension agent.

BREAK

Predator Control (30 min, Dr. Jay Daniel, Berry College)

- Predator types
- Risks for attracting predators
- Methods to control predators

Learning Objectives*:*

- Describe the risks that determine the need for predator control, the types of predator control and the resources needed for each.

Ideas for how you can use this at home – If not conducted in class, develop a predator control plan based on farm risks and resources and discuss it with your local county extension agent.

Alabama Planting Guide for Forage Grasses

Crop	Growth Habit	Area	Soils	Seeding Rate (lb/A) Pure Live Seed	Seeding Depth (Inches)	Planting Dates	Seed Quality			Seed /Pound
							Germ. % (Min.)	Purity % (Min.)	Weed Seed % (Max)	
Bahiagrass	Warm-season perennial	N,C, S	Moist sandy soils to droughty uplands; pH 5.6–6.5	B: 15–20	¼–½	C: Mar. 1–July 1 S: Feb. 1–Nov. 1	85	95	0.40	210,000
Special Notes: Best if planted in early spring after frost, before summer rains. Seed dormancy is high in some varieties. A few varieties are now options for growth in northern Alabama; check with local Extension before planting to make sure.										
Barley (grazing)	Cool-season annual	N,C	Well drained, productive; pH 5.8–6.5	Alone: B: 100–120 Mix: B: 60–75	1–2	N: Aug 25–Oct. 1 C: Sept. 1–Oct. 25 S: Sept. 15–Nov. 1 Overseeded: 3–5 wks later	85	98	0.07	14,000
Special Notes: Recommendation made for forage only. For dual purpose use (grazing and grain) plantings: N,C: Sept. 15–Nov. 1.										
Bermudagrass Common (seed hulled)	Warm-season perennial	N,C,S	Well drained, light sand to clay loam; pH 5.6–7.0	Hulled: B: 5–10 Unhulled: B: 10–15	¼–½	N: Apr. 1–July 15 C: Mar. 15–July 15 S: Mar. 1–July 15	85	95	0.50	2,071,000
Special Notes: Well suited for conservation.										
Bermudagrass Hybrid (vegetatively propagated)	Warm-season perennial	N,C,S	Well drained, light sand to clay loam; pH 5.6–7.0	R: 15 bu. sprigs B: 30–40 bu. Sprigs	sprigs not seed	Late Feb.–Aug. 15	Use fresh, live, certified sprigs			1,000 sprigs/bu
Special Notes: Plant when soil moisture is adequate for sprig survival. Should be planted promptly after having been dug.										
Big Bluestem	Native warm-season perennial	N,C,S	Well drained, low fertility, moist; pH 5.0–6.0	B: 9–12 PLS D: 7–9 PLS	¼–½	N: Mar. 25–May 10 C: Mar. 15–Apr. 30 S: Mar. 1–Apr. 20	70	90	0.50	150,000
Special Notes: Special planting methods need to be used. Requires agitator in drill's seed box.										
Corn (field)	Warm-season annual	N,C,S	Well drained, fertile; pH 5.8–6.5	R: 7–10	1–2	N: Mar. 25–May 10 C: Mar. 15–Apr. 30 S: Mar. 1–Apr. 20	90	99	None	Variable
Special Notes: Great for silage production, Narrow rows improve yield.										
Crabgrass	Warm-season annual	N,C,S	Well drained; pH 5.6–7.5	B/D: 3–5 PLS	¼–½	Late Feb.–Apr.	N.D.	N.D.	0.50	460,000
Special Notes: Often considered a weed, in some situations. Can be useful as a high-quality short-term hay and pasture forage. Seed does not flow well. Mix with a carrier for better distribution.										
Dallisgrass	Warm-season perennial	N,C,S	Well drained, fertile, moist; pH 5.6–8.0	B: 10–15 PLS	¼–½	N: Mar. 15–July 1 C: Mar. 1–July 1 S: Feb. 1–July 1	60	70	0.25	300,000
Special Notes: Germination is typically low; adjust rate accordingly.										
Eastern Gamagrass	Native warm-season perennial	N,C,S	Heavy soils and moist bottoms; pH 5.6–7.5	D: 8–14 PLS	½–1	N: April 1–July 1 C: Mar. 15–July 15 S: Mar. 1–July 15	N.D.	N.D.	0.50	724,000
Special Notes: Special planting methods need to be used. Requires agitator in drill's seed box.										
Indiangrass	Native warm-season perennial	N,C,S	Well drained, sandy to clay loam; pH 5.0–6.0	B: 10–12 PLS D:7–9 PLS	¼–½	N, C, S: April 1–June 15	45	25	0.50	200,000
Special Notes: Special planting methods need be applied. Requires agitator in drill's seed box.										
Johnsongrass	Warm-season perennial	N,C	Medium–heavy soils; pH 5.6–7.5	B: 20–30 D: 10–15	½–1	Apr.–July	60	90	0.25	119,000
Special Notes: Can be a weed in row crop plantings. Most commonly used as forage in the Black Belt region.										
Kentucky Bluegrass	Cool-season perennial	N	Well drained, productive; pH 5.6–7.0	B: 8–15	0–¼	N: Sept.–Oct.	80	90	0.50	2,177,000
Special Notes: High nutritive value pasture; not highly productive unless well fertilized or grown with legume.										
Browntop Millet	Warm-season annual	N,C,S	Well drained, productive; pH 5.6–6.5	B: 25–30 D: 15–20	½–¾	N: May 1–Aug. 1 C: Apr. 1–Aug. 15 S: Apr. 1–Aug. 15	80	98	0.05	140,000
Special Notes: Avoid lime in Black Belt soils.										
Foxtail Millet	Warm-season annual	N,C,S	Well drained, productive; pH 5.6–6.5	B: 25–30 D: 15–20	¼–½	N: May 1–Aug. 1 C: Apr. 1–Aug. 15 S: Apr. 1–Aug. 15	80	98	0.05	213,000
Special Notes: Seed supplies are limited. If used for hay, usually a one-cut crop.										
Pearl Millet	Warm-season annual	N,C,S	Well drained, fertile; pH 5.6–6.5	B: 25–30 D: 12–15	½–1 ½	N: Apr. 20 –July 1 C: Apr. 15–July 1 S: Apr. 1–July 15	80	98	0.05	82,000
Special Notes: Avoid lime in Black Belt soils.										
Oats (grazing)	Cool-season annual	N,C,S	Clay loam to sandy loam; pH 5.8–6.5	Alone: B: 90–120 Mix: B: 60–90	1–2	N: Aug. 25–Oct. 1 C: Sept. 1–Oct. 25 S: Sept. 15–Nov. 1	85	98	0.07	15,000
Special Notes: Recommendation made for forage only. For dual purpose use (grazing and grain) plantings: N: Sept. 1–Sept. 20 | C: Sept. 1–Oct. 1 | S: Sept. 20–Oct. 30										
Orchardgrass	Cool-season perennial	N	Well drained, fertile, medium to heavy; pH 5.6–6.0	B: 15–20	¼–½	N: Sept.–Oct.	80	90	0.50	416,000
Special Notes: Cool-season perennial best suited to northern Alabama; less tolerant of drought and poor drainage than tall fescue.										
Rye (grazing)	Cool-season annual	N,C,S	Well drained, sandy to clay loams; pH 5.8–6.5	Alone: B: 90–120 Mix: B: 60–90	1–2	N: Aug. 25–Oct. 1 C: Sept. 1–Oct. 25 S: Sept. 15–Nov. 1	75	98	0.07	18,000
Special Notes: Recommendation made for forage only. For dual purpose use (grazing and grain) plantings: N: Aug. 15–Oct. 1 | C: Sept. 1–Oct. 15 | S: Sept. 15–Nov. 1										
Ryegrass	Cool-season perennial or annual	N,C,S	Clay loam; pH 5.8–6.5	Alone: B: 20–30 Mix: B:15–20	0–½	N: Aug. 25–Oct. 1 C: Sept. 1–Oct. 25 S: Sept. 15–Nov. 1	85	95	0.50	224,000
Special Notes: Overseeded on warm season grass sods: 3–5 wks later										
Sorghum (forage)	Warm-season annual	N,C,S	Well drained; pH 5.6–6.5	B: 15–20 Silage: D: 4–10	1–2	Late Apr.–May 15 S (only): late as July 1	80	98	0.01	24,000
Special Notes: Not tolerant of highly acidic soils. Used for high-energy silage.										
Sorgum-Sudan Hybrid	Warm-season annual	N,C,S	Well drained, productive; pH 5.6–6.5	B: 30–35 D: 20–25 Wide R: D: 8–12	½–1	N: May 1–Aug. 1 C: Apr. 15–Aug. 1 S: Apr. 1–Aug. 15	80	98	0.01	Variable
Special Notes: Hybrid crop used for hay, pasture, silage; not tolerant of highly acid soils.										
Sudangrass	Warm-season annual	N,C	Light sandy to heavy clay; pH 5.6–6.5	B: 30–40 D: 20–25	½–1	May 1–Aug. 1	80	98	0.01	43,000
Special Notes: Finer stems than sorghum-sudan hybrids. Used for hay, pasture, and silage. Not tolerant of highly acidic soils.										
Switchgrass	Native warm-season perennial	N,C,S	Poorly to moderately drained, deep soils; pH 5.0–6.0	B: 5–6 (PLS) D: 405 PLS	¼–½	N: April 1–July 15 C: March 15–July 15 S: Mar. 1–July 1	50	80	0.50	280,000
Special Notes: Develops stems earlier than other NWSG; graze or hay early or material may become unpalatable.										
Tall Fescue	Cool-season perennial	N,C	Moist, fertile bottoms, productive upland; pH 5.6–6.5	B: 15–20 D: 10–15	¼–½	N,C: Sept–Oct. S: Sept. 15–Nov. 15	80	98	0.30	227,000
Special Notes: Fescue toxicosis can occur when grazing toxic/endophyte-infected pastures. Be cautious in pure pastures, or use novel endophyte tall fescue varieties.										
Timothy	Cool-season perennial	N	Well drained, productive; pH 5.8–6.5	B: 6–8	¼–½	N: Aug. 15–Sept. 15	80	97	0.50	1,152,000
Special Notes: While Timothy is a perennial, it often acts as an annual in Alabama.										
Wheat (grazing)	Cool-season annual	N,C,S	Medium–heavy soils; pH 5.8–6.5	Alone: B: 90–120 Mix: B: 60–90	1–2	N: Aug. 25–Oct. 1 C: Sept. 1–Oct. 25 S: Sept. 15–Nov. 1	85	98	0.07	11,000
Special Notes: Recommendation made for forage only. For dual purpose use (grazing and grain) plantings: N,C: Sept. 15–Nov. 1 | S: Oct. 1– Nov. 15 | Early plantings of wheat can result in increased Hessian fly populations.										

PLS—Pure Live Seed N.D.—No Data to Support a Recommendation B—Broadcast D—Drill R—Rows

Note: Presented pH values are a range and may not represent the ideal pH of planting.

The above information is for recommendation purposes only, planting dates, rates, etc., may be adjusted according to specific situation.
All species recommendations may not be suitable to your specific area and are for information purposes only.

ALABAMA COOPERATIVE Extension SYSTEM
Alabama A&M and Auburn Universities

Alabama Planting Guide for Forage Grasses

Many factors influence successful forage production, but establishment of the crop is a key to profitability. It is essential to choose the appropriate crop species for the needed yield, quality, and persistence. Then, it is critical to choose a variety that is recommended for one's area. (Find more information on which forage species is appropriate for the need and a list of recommended varieties for the selected species at www.alabamaforages.com.)

Attention to other factors that affect successful stand establishment and yield is important as well. Select a high-quality seed that meets or exceeds recommended levels of germination, purity, and weed seed contamination. Ensure that the seed is planted at the right rate, depth, and time of year. Also be sure that the seeding method and planting environment are appropriate to the species.

The planting operation is when producers most often make yield-reducing mistakes, so take time to minimize these errors. This planting guide has been developed to help producers establish most forage grasses commonly grown in Alabama. Information provided about a given forage species is not necessarily a recommendation to grow that species. Some commonly grown forage grasses are not recommended by Auburn University. Also, some varieties of a given species may produce well in certain areas while others may not. This guide simply offers the information needed to have the best chance of establishing a forage grass species.

Jennifer Johnson, *Extension Specialist,* Assistant Professor, Agronomy and Soils, Auburn University. Originally prepared by **Donald M. Ball**, former *Extension Agronomist*.

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

Published by the Alabama Cooperative Extension System (Alabama A&M University and Auburn University), an equal opportunity educator and employer.

ANR-0149

Revised July 2013, ANR-0149

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5 Steps to Higher Yields and More Profit

1. Test the soil to determine nutrient needs. (Send soil samples to be analyzed at a certain diagnostic lab, such as AU Soil Testing Laboratory.

Apply lime and fertilizer at levels appropriate to soil test result recommendations.

2. Seed with good, high quality seed and good seeding techniques.

Seed with certified seed or added assurance of high quality seed quality.

Seed with treated seed, when possible, to protect against insect pest and disease.

3. Plant with a goal of perfect stands

Plant at the proper depth in a properly prepared seedbed or no-till environment.

Plant at the proper time, when soil temperature is adequate and moisture is appropriate.

Plant at the correct seeding rate per acre.

4. Manage for high yields!

Manage pests (weeds, insects, and diseases) to ensure that the plant is competitive in establishing and maintaining a good stand.

Manage to maintain proper soil fertility throughout the life of the stand.

Manage grazing to best utilize forage potential.

5. Harvest for high quality yields!

Harvest at the right time.

Harvest with appropriate equipment that has been properly adjusted.

Exercise good handling and storage techniques to protect forage quality.

Alabama Planting Guide for Forage Legumes

Crop	Growth Habit	Area	Soils	Seeding Rate (lb/A) Pure Live Seed	Seeding Depth (inches)	Planting Dates	Seed Quality			Seed /Pound	Inoculant Group
							Germ. % (Min.)	Purity % (Min.)	Weed Seed % (Max)		
Alfalfa	Warm-season perennial	N,C,S	Well drained, fertile, deep; pH 6.5–7.0	D: 18–25 B: 20–25	0–¼	N: Aug. 15–Oct. 1 C: Sept. 1–Oct. 1 S: Oct. 1–Nov. 1	80	99	0.50	227,000	Alfalfa
Special Notes: Avoid soils where subsoil pH is greater than 5.5, for greater chance of stand success and longevity.											
Alyceclover	Warm-season annual	S	Well drained, fertile; pH 6.5–7.0	B: 15–20	¼–½	S: May 15–July 15	85	98	0.25	300,000	Cowpea
Special Notes: Grows best in the Gulf Coast area with high summer rains											
Birdsfoot Trefoil	Warm-season perennial	N,C	Well drained, productive; pH 6.5–7.0	Alone: B: 8–10 Mix: B: 4–5	0–¼	Sept.–Oct.	80	99	0.50	370,000	Trefoil
Special Notes: Will not compete with bahiagrass or bermudagrass. Reseeds under proper management.											
Black Medic	Cool-season annual	Black Belt	Lime soils; pH of 6.5–7.5	B: 10–12	0–¼	Sept.–Oct.	80	95	0.30	266,000	Alfalfa
Special Notes: Can be grazed in pastures in the Black Belt Region. Not recommended for hay production.											
Brassicas (rape, kale, turnip, canola)	Cool-season annual Brassica	N,C,S	Well drained, productive; pH 5.8–7.0	B: 8–10 D: 5–8	0–½	Feb.–Mar. Sept.–Oct.	85	99	0.20	156,000	----------
Special Notes: Not a legume. Primarily used for soil improvement and spring hog grazing.											
Caley Peas	Cool-season annual	Black Belt	All Black Belt soil; pH 5.8–7.0	B: 50–55	½–1	Sept. 1–Oct. 15	80	95	0.20	18,000	Pea and Vetch
Special Notes: Good at reseeding. Grows on soils too wet for most clovers on both acid and calcerous soils.											
Chicory, Forage	Perennial Forb	N,C	Moderately well drained: pH 5.8–8.0	Alone: D:4–5 Mix: D: 2–3	¼–½	Aug.–Oct. 15	65	N.D.	0.50	426,000	----------
Special Notes: Not a legume. High nutritive quality and very palatable.											
Clover:											
Arrowleaf	Cool-season annual	N,C,S	Well drained, medium to high fertility; pH 5.8–7.0	B: 5–10	0 –½	N: Aug. 25–Oct. 1 C: Sept. 1–Oct. 15 S: Sept. 15–Nov. 1	85	99	0.50	400,000	Clover
Special Notes: Overseeded 3–5 weeks later.											
Ball	Cool-season annual	N,C,S	Sandy loam to clay pH 5.8–7.0	B: 3–5	0–¼	Sept.–Oct.	85	95	0.30	1,000,000	Clover
Special Notes: Tolerates wet soils. Will germinate at lower temperatures than most annual clovers											
Berseem	Cool-season annual	S	Poorly drained, loam to clay loam; pH 5.8–8.0	B: 20–25 D: 15–18	¼–½	S: Oct. 1–Nov. 15	85	98	0.50	207,000	Clover
Special Notes: Well suited for non-acid Black Belt soils and in high rainfall areas near the Gulf Coast.											
Crimson	Cool-season annual	N, C, S	Well drained; pH 5.8–7.0	B: 20–30	¼–½	N: Aug. 25–Oct. 1 C: Sept. 1–Oct. 15 S: Sept. 15–Nov. 1	85	99	0.50	150,000	Clover
Special Notes: Overseeded: 3–5 weeks later. Avoid lime soils.											
Red	Cool-season biennial	N, C, S	Well drained, fertile; pH 6.0–8.0	B: 12–15 D: 8–10	¼–½	N,C: Sept. 15–Nov. 15 --OR-- Feb. 1–Apr. 1 S: Sept. 15–Nov. 15	85	98	0.50	272,000	Clover
Special Notes: Persistence is typically 2–3 years, excellent for use in mixed pastures for grazing											
Subterranean	Cool-season annual	C, S	Well drained, productive; pH 5.8–7.3	B: 8–10	¼–½	C,S: Sept.–Oct.	85	99	0.05	54,000	Clover
Special Notes: Good reseeding potential. Lower yielding than crimson or arrowleaf clover.											
White/Ladino	Cool-season perennial	N,C,S	Moist bottoms and productive uplands; pH 6.0–7.5	B: 2–3	0–¼	N, C: Sept.–Oct. --OR-- Feb. 1–Apr. 1 S: Sept. 15–Nov. 15	85	99	0.50	768,000	Clover
Special Notes: Commonly used seeded into established cool season grass pastures											
Cowpeas	Warm-season annual	N,C,S	Well drained, fertile; pH 5.8–6.5	R: 30–40 B: 100–120	1–3	May 1–Jun. 15	80	98	0.25	4,000	Cowpea
Special Notes: Most commonly used for soil improvement and wildlife plantings.											
Crownvetch	Cool-season perennial	N	Well drained; pH 5.8–6.5	B: 8–10	¼–½	N: Sept.–Oct.	65	95	0.50	242,500	Crownvetch
Special Notes: Conservation is the primary usage. Slow to establish, but provides good cover.											
Lespedeza:											
Annual (Striate and Korean)	Warm-season annual	N, C	Avoid lime soils of the Black Belt; pH 5.8–6.5	B: 25–35	¼–½	Feb. 15–Apr. 11	85	99	0.50	230,000 to 240,000	Cowpea
Special Notes: High nutritive quality, low yield.											
Sericea	Warm-season perennial	N,C,S	Well drained, moist (avoid lime soils); pH 5.8–6.5	B: 15–20 B: 20–30 (if no herbicide)	¼–½	N: Mar. 15–May 15 --OR-- Jun. 15–July 15 C: Mar. 1–May 1 S: Feb. 1–May 1	85	99	0.50	372,000	Cowpea
Special Notes: Use certified, hulled seed.											
Blue Lupine	Cool-season annual	S	Well drained; pH 5.8–67.5	B: 100–120 D: 50–75	1 ½	S: Sept. 15–Nov. 1	80	98	0.30	3,000	Lupine
Special Notes: If fertilized, does well on sandy soils. Sweet varieties utilized for grazing.											
Perennial Peanut	Warm-season perennial	S	Well drained, sandy; pH 5.8–7.5	Rhizomes: 80 to 120 bu/A	1–2	S: Dec. 1 - Mar. 1	Use fresh, live, certified sprigs.			Rhizomes	----------
Special Notes: Will not tolerate poor drainage. Best adapted to the southern one third of Alabama.											
Soybeans	Warm-season annual	N,C,S	Deep loam, bottoms; pH 5.8–6.5	D: 60–100	1–3	N: May 1–May 30 C: May 1–May 30 S: Before June 15	80	98	0.10	Variable	Soybean
Special Notes: Tolerates drought when grown for forage. Short grazing season with no substantial regrowth.											
Sweetclover	Cool-season annual or biennial	Black Belt	Lime soils of the Black Belt; pH 6.5–7.0	B: 12–15	¼–½	Sept.–Oct.	80	99	0.50	259,000	Alfalfa
Special Notes: Drought tolerant, winter-hardy. Will not tolerate soil acidity.											
Vetch:											
Common	Cool-season annual	N,C,S	Well drained, sand, loam, clay; pH 5.8–8.0	B: 30–40	1–2	N: Sept. 1–Oct. 15 C: Sept. 1–Oct. 15 S: Sept. 15–Nov. 15	80	98	0.10	8,000	Pea and vetch
Special Notes: Vetch/small grain mix: B: 20–30 lb of vetch, with 60–90 lbs of small grain per acre.											
Hairy	Cool-season annual	N, C, S	Well drained, sand, loam, clay; pH 5.8–8.0	B: 20–25	1–2	N, C: Sept. 1–Oct. 15 S: Sept. 15–Nov. 1	80	98	0.10	16,000	Pea and vetch
Special Notes: Vetch/small grain mix: B: 18–20 lb of vetch, with 60–90 lbs of small grain per acre.											

PLS–Pure Live Seed N.D.–No Data to Support a Recommendation B–Broadcast D–Drill R–Rows

When buying inoculants, be sure that the legume species you want to plant is listed on the package. All inoculants are not created equal and are species specific. Apply fungicide/fertilizer or other seed treatments at least 48 hours before planting; inoculate at planting. ***Remember*** (1) ***not to inoculate*** and ***treat*** legumes with fungicides at the same time, and (2) ***not to inoculate*** legume seed with fertilizer.

Note: Presented pH values are a range and may not represent the ideal pH of planting.

Alabama Planting Guide for **Forage Legumes**

Many factors influence successful forage production, but establishment of the crop is a key to profitability. It is essential to choose the appropriate crop species for the needed yield, quality, and persistence. Then, it is critical to choose a variety that is recommended for one's area. (Find more information on which forage species is appropriate for the need and a list of recommended varieties for the selected species at www.alabamaforages.com.)

Attention to other factors that affect successful stand establishment and yield is also important. Select a high-quality seed that meets or exceeds recommended levels of germination, purity, and weed seed contamination. Ensure that the seed is planted at the right rate, depth, and time of the year. Additionally, ensure that seeding method and planting environment are appropriate to the species too. Also ensure that the seed is either pre-inoculated or that it is inoculated with the correct inoculant group.

The planting operation is when producers most often make yield-reducing mistakes, so take time to minimize these errors. This planting guide has been developed to help producers in establishing most forage legumes commonly grown

www.aces.edu

ALABAMA COOPERATIVE Extension SYSTEM

ANR-0150

Jennifer Johnson, *Extension Specialist,* Assistant Professor, Agronomy and Soils, Auburn University. Originally prepared by **Donald M. Ball**, former *Extension Agronomist*.

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

Published by the Alabama Cooperative Extension System (Alabama A&M University and Auburn University), an equal opportunity educator and employer.

Revised July 2013, ANR-0150

www.aces.edu

in Alabama. Information provided about a given forage species is not necessarily a recommendation to grow that species but rather is for information only. Some commonly grown forage legumes are not recommended by Auburn University. Some varieties of a given species may also produce well in certain areas while others may not. This guide simply offers the information needed to have the best chance of establishing a forage legume species, if a producer so chooses.

5 Steps to Higher Yields and More Profits

1. Test the soil to determine nutrient needs. (Send soil samples to be analyzed at a certain diagnostic lab, such as AU Soil Testing Laboratory.

Apply lime and fertilizer at levels appropriate to soil test result recommendations.

2. Seed with good, high quality seed and good seeding techniques.

Seed with certified seed or added assurance of high quality seed quality.

Seed with treated seed, when possible, to protect against insect pest and disease.

3. Plant with a goal of perfect stands

Plant at the proper depth in a properly prepared seedbed or no-till environment.

Plant at the proper time, when soil temperature is adequate and moisture is appropriate.

Plant at the correct seeding rate per acre.

4. Manage for high yields!

Manage pests (weeds, insects, and diseases) to ensure that the plant is competitive in establishing and maintaining a good stand.

Manage to maintain proper soil fertility throughout the life of the stand.

Manage grazing to best utilize forage potential.

5. Harvest for high quality yields!

Harvest at the right time.

Harvest with appropriate equipment that has been properly adjusted.

Exercise good handling and storage techniques to protect forage quality.

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CERTIFICATE PROGRAM

Small Ruminant Production

USDA NIFA | FVSU extension Knowledge for Inspiring Lives! | UGA extension

Session 2
Pasture Management

Dr. Dennis Hancock
Extension Forage Specialist
Crop & Soil Sciences Dept
University of Georgia

Learning Objectives

- Identify forage types and basic nutrient content (i.e. grasses, legumes, forbs and browse)
- Recognize the link between forage height/maturity and nutrient content/quality as well as parasite management.

Over the next few minutes…

Photo: Susan Schoenian, Baalands Farm

- Pasture management to meet nutritional needs of various small ruminant production classes
- The necessity for improved pastures
  - Desirable forage species
  - Enabling the instinct to browse for goats (maybe hair sheep)
- Ensuring forage availability
  - Goal: year-round feed supply
  - Emphasizing the use of legumes
- Reducing internal parasite load
  - Novel forages
  - ***Rational*** grazing

Pasture basics

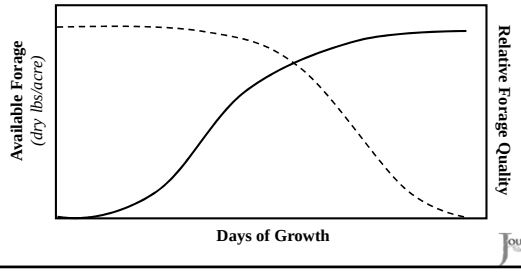
- Soil type/texture (percentage sand, silt and clay; i.e. sandy clay loam, loam)
- Soil Health/Fertility
  - Enough nutrients for healthy plants/good yields
  - Optimal pH (target 6.0 to 6.8, near neutral); need appropriate pH to get the most out of fertilizer
  - Good water storage and drainage
  - Low disease and pest pressure

Soil Testing

- Many labs, many different types of tests
- Take a representative sample
  - Soil test handbook available at: http://extension.uga.edu/agriculture/soil/
- Use test to look at long term trends
- Contact your local county extension office for assistance/more information:
  http://extension.uga.edu/about/county/index.cfm

The least used and least understood element of a good forage management plan.

The Paradox of Forage Yield and Quality



Meat Goat Needs*

	Protein (CP)	Energy (TDN)
Bucks (110-220 lb) 2% BW	7%	54%
Dry doe (88 - 154 lb) 2% BW	7%	53%
Late gestation (twins) 2.5% BW	13%	66%
Early lactation (twins) 3% BW	13%	53%
**Growing kid (30 lb; 0.44 lb/day)		
Boer (4.0% BW)	25%	90%
Local (3.6% BW)	21%	89%
Yearlings (66 lb Boer, avg growth, 2.5%BW)	15%	66%

*% BW is all feed/forage eaten on dry matter basis as % of their body weight (NRC, 2007)
**Kids gaining less than 0.44 lb/day would require less; from Dr. Niki Whitley, Fort Valley State University

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SHEEP Needs

	Protein (CP)	Energy (TDN)
*Rams (220 lb, maintenance)	7%	53%
*Dry ewe (132 lb)	7%	53%
Late gestation (twins) 2.75% BW	10%	66%
Early lactation (twins) 3% BW	15%	67%
Weanling (4 mon, 66 lb, max ADG)		
Early maturing - 5% BW	12%	79%
Late maturing - 3% BW	19%	66%
*Yearling ewes (88 lb)	8%	66%

*Based on dry matter intake of *around* 2% of body weight, or BW, unless otherwise noted (NRC, 2007); from Dr. Niki Whitley, Fort Valley State University

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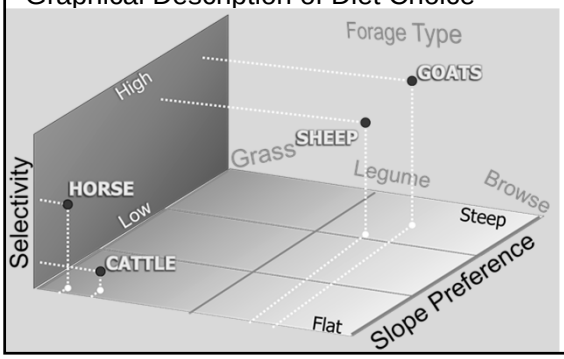
Grazing Habits

Goats prefer to graze above the shoulder. Sheep usually prefer to graze, though they will also eat forbs.

Approximate Diet Selection of Grazing Animals when Given Choice

	Type of Diet		
Animal Species	Grasses	Legumes	Browse
Cattle	65-75	20-30	5-10
Horses	70-80	15-25	0-5
Sheep	*45-55*	*30-40*	*10-20*
Goats	*20-30*	*10-30*	*30-50*
White-tailed deer	30-60	40-50	10-30

Graphical Description of Diet Choice



Stocking Rates on 2-2 ½ Acres

Pasture Type	Cows	Sheep	Goats	Cows + Goats
Excellent Pasture	1	5-6	6-8	1 + 1-2
Brushy Pasture	0.75	6-7	9-11	0.75 + 2-4
Silvopasture	0.5-0.75	4-6	6-8	0.5 + 2-4
*Brush Eradication			9-15	0.5 + 6-8

*Sheep can also be used for brush clearing though it often takes longer than for goats.

Goat Browsing

Photo Credit: Angela Boudro, Oregon St. Univ.

Kudzu

55-60% TDN; 12-18% CP

Photo credit: D. Ditsch and B. Sears, UKCES

Also known to like…

Many browse/weed species:

- Chinese privet
- Pigweeds
- Thistles
- Stinging nettle
- Blackberry/dewberry
- Plantain
- Curly dock
- Multiflora rose
- Sweet gum

Photos: Susan Schoenian, Baalands Farm

Photo Credit: Angela Boudro, Oregon St. Univ.

Photo Credit: Angela Boudro, Oregon St. Univ.

Sustainable Forage System?

Photo credit: D. Ditsch and B. Sears, UKCES

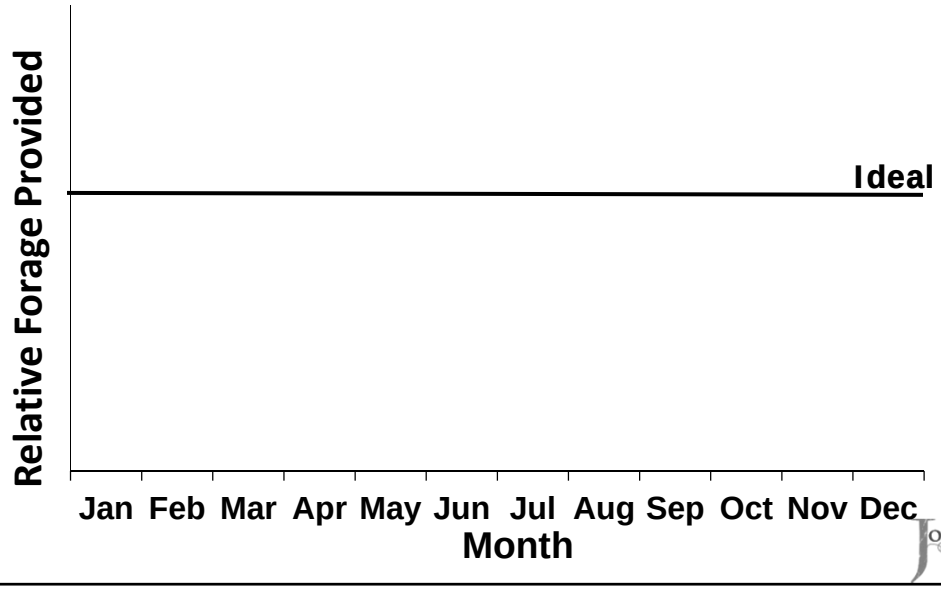
What else do we know about goat grazing behavior?

- Diverse diet
  - But, browse alone may not be sustainable
- Consume undesirable plants
- Co-grazing ability
  - Cattle
  - Horses
  - Sheep
- Preferential consumption of seedling stems
- Resistant to some plant toxins/anti-quality factors

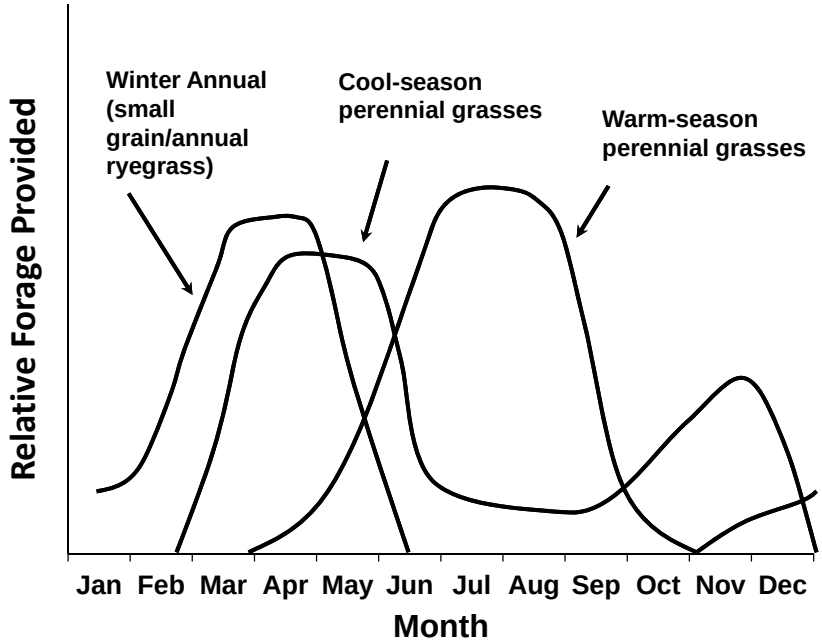
How do we get enough energy in the animal?

- The animal eats more forage.
  - What is the physical limit?
  - Can a doe or ewe eat enough straw to meet her energy needs?
- What forage the animal eats must be high in energy.
  - High digestibility -> High energy
- Bottomline: Every bite has to count!
  - Pre-hensile lips make selective grazing and browsing easy!

Forage Distribution

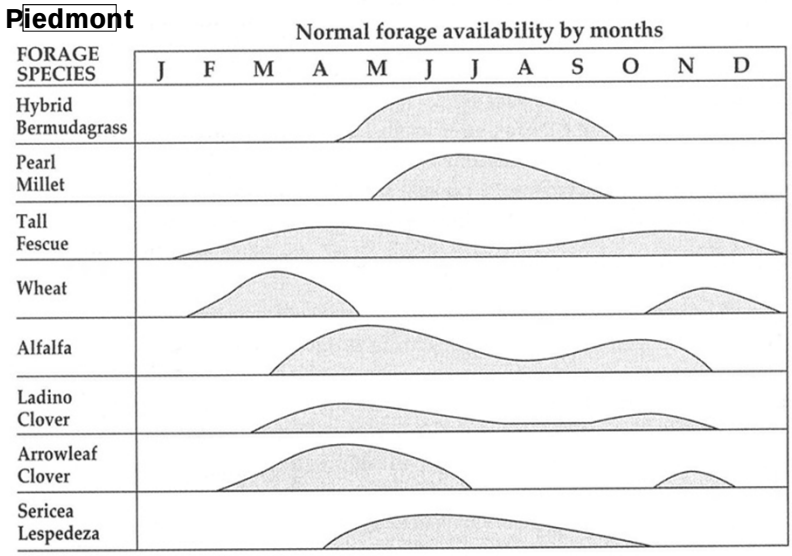


Forage Distribution



Forage Productivity Differs Throughout the Year

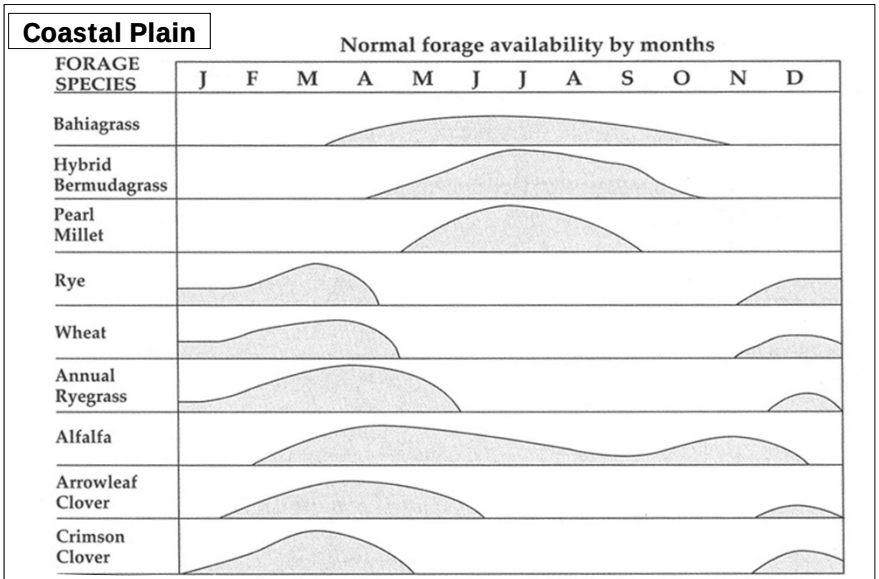
Piedmont



Source: Southern Forages, 5th Edition (2015)

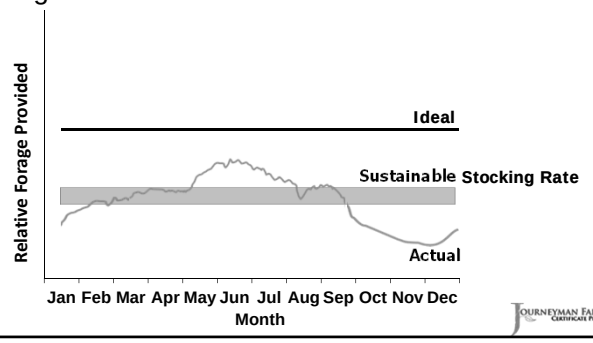
Forage Productivity Differs Throughout the Year

Coastal Plain



Source: Southern Forages, 5th Edition (2015)

Forage Distribution



Goat Grazing Preference Trial

UK Robinson Station
2006

Photo credit: D. Ditsch and B. Sears, UKCES

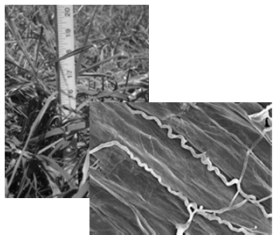
Listed most to least preferred:	Sorghum Sudan White clover Turnip Red clover Chicory Sericea Lespedeza Tall Oatgrass Alfalfa Warm Season Grasses (EGG, Switch, BB, Indian) Reed Canarygrass Orchardgrass Annual Lespedeza Novel Endophyte TF Endophyte Free TF Infected TF Bluegrass Bermudagrass

Photo credit: D. Ditsch and B. Sears, UKCES

Goat Grazing Preference Trial
UK Robinson Station
2006

Cool Season Perennial Grasses - Tall Fescue

- Most widely used forage grass in the U.S.
  - High yields and persistent.
- Endophytic fungus produces toxic alkaloids
  - Fescue toxicosis
  - Alkaloids aid drought tolerance and persistence
- Novel Endophyte TF gives persistence benefit w/o toxicosis problems.

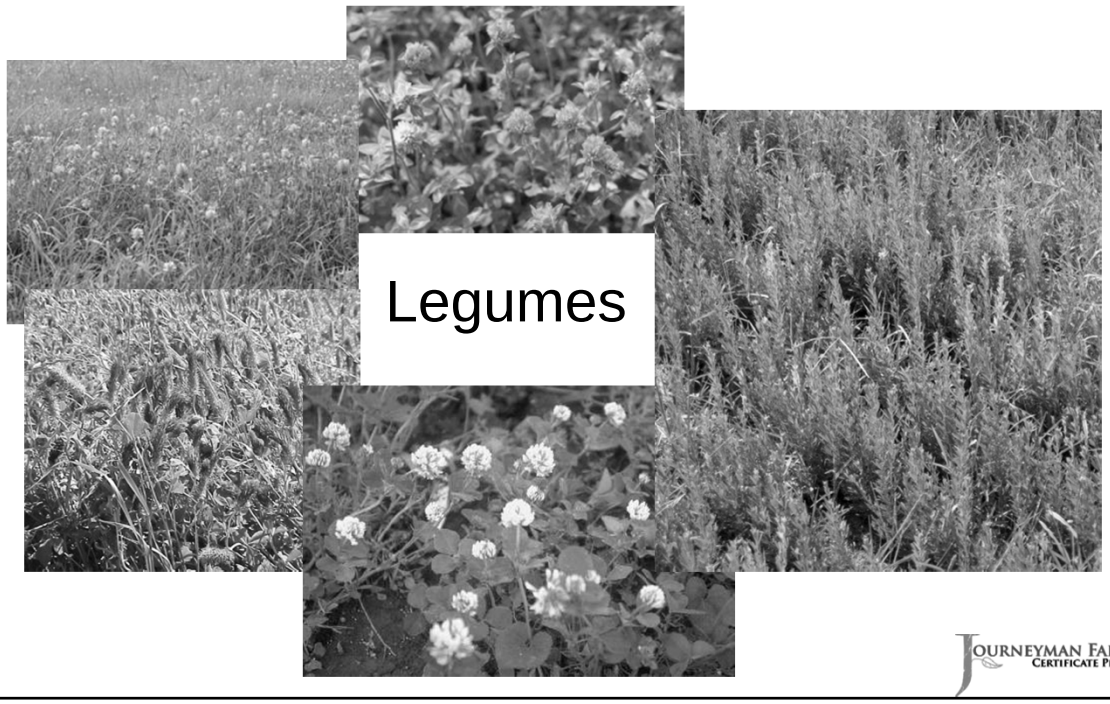


Warm Season Perennial Grasses

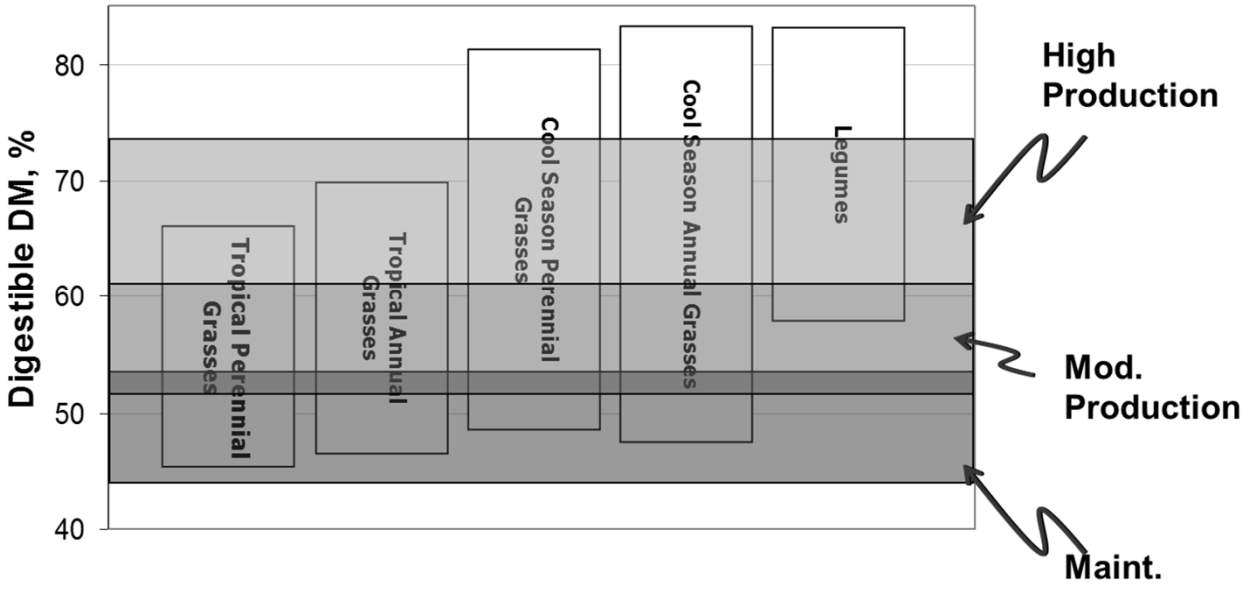
Summer Annuals

Pearl Millet, Sorghum x Sudan, Sudangrass, Brown Top Millet, Proso Millet, ect.

- All have nitrate toxicity potential
- Sorghums have prussic acid potential
  - Sorghums should NOT be fed to horses
- Late plantings result in low yields



Quality Differences in the Major Forage Species



Legumes Help to Offset the Negative Effects of Endophyte-Infected Tall Fescue

We force goats (and sheep) to graze close to the ground.

Grazing close to the ground increases the opportunity for parasitic larva consumption.

Better to graze over 4-6" in height to avoid parasites, however, over-mature (tall) forage can be less nutritious, so it is a balancing act.

Serecia lespedeza

- Has been shown to reduce parasite fecal egg counts in goats and sheep
- Thought to work in part through specific types of condensed tannins
  - Tannin- found in many plants
  - Most research with AU grazer serecia lespdeza

Rational (aka Rotational) Grazing

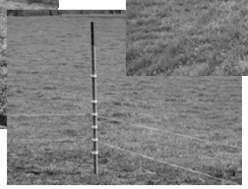
Allows one to:

- Rotate out of heavy parasite pressure
- Optimize selection of highest quality forage
- Prevent overgrazing
- Graze multiple forage species
- Integrate woodlands and grass - legume pastures
- Integrate warm and cool season forage species

Perimeter Fencing

- Goats need better fencing than sheep (stronger, taller)
- Electric will work with the correct number of hot wires (always hot)
- Smaller openings (4x4, 2x4) best with woven wire due to horns (or offset hot wires - always hot)
- Various fencing for cross-fencing to split pastures (i.e. for rotational grazing)

Fencing



3 hot wires: 10, 20, and 36 inches

www.georgiaforages.com

GeorgiaForages.com Email Updates

www.georgiaforages.com

Additional Resources

Forages and pastures

- www.georgiaforages.com
- www.sheep101.info/201/pasturemgt.html
- www.sheepandgoat.com/#!webinars/cu81

Fencing

- www.sheep101.info/201/fencing.html
- www.premier1supplies.com/instructions.php
- www.staytuff.com/PDF/Stay-Tuff Installation Guide final Oct 13.pdf

No products, business, companies or manufacturers are being endorsed.

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

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Developing the Next Generation of Sustainable Farmers in Georgia Grant

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NOTES:

NUTRITION AND FORAGES
LEARNING EXERCISE

The learning objective for this activity is to understand the different requirements of animals based on their age, breed, activity level, environment, species and level of production, and how you might provide those nutrients to your animals.

This exercise is designed to reinforce the information presented on nutrition and pasture management, and help you apply your new knowledge.

For this activity, you will choose the animals from each set of two in the PowerPoint that would need more nutrients (a greater amount of feed or a more nutrient-dense feed for example). You may write your answers and take notes on the discussion in the spaces below.

First slide:
Which needs more nutrients?

1. Not pregnant (open) yearling doe or a lactating yearling doe

2. A ewe with triplets or a large adult ram during breeding season

Second slide:
Which needs more nutrients?

1. A late gestation ewe or late gestation doe?

2. A Boer kid or a Spanish kid?

Third slide:
Which needs more nutrients?

1. Ewes in the spring or ewes in the winter?

2. Early pregnant ewes or open (not pregnant) ewes?

SECOND PART:
How can you provide protein and energy for growth to a young kid or lamb:

1. Using a forage-only feeding system?

2. Using a forage plus feed supplement feeding system?

How can you provide enough energy for weight gain to a very thin doe or ewe just giving birth to triplets:

1. Using a forage-only feeding system?

2. Using a forage plus feed supplement feeding system?

THIRD PART:

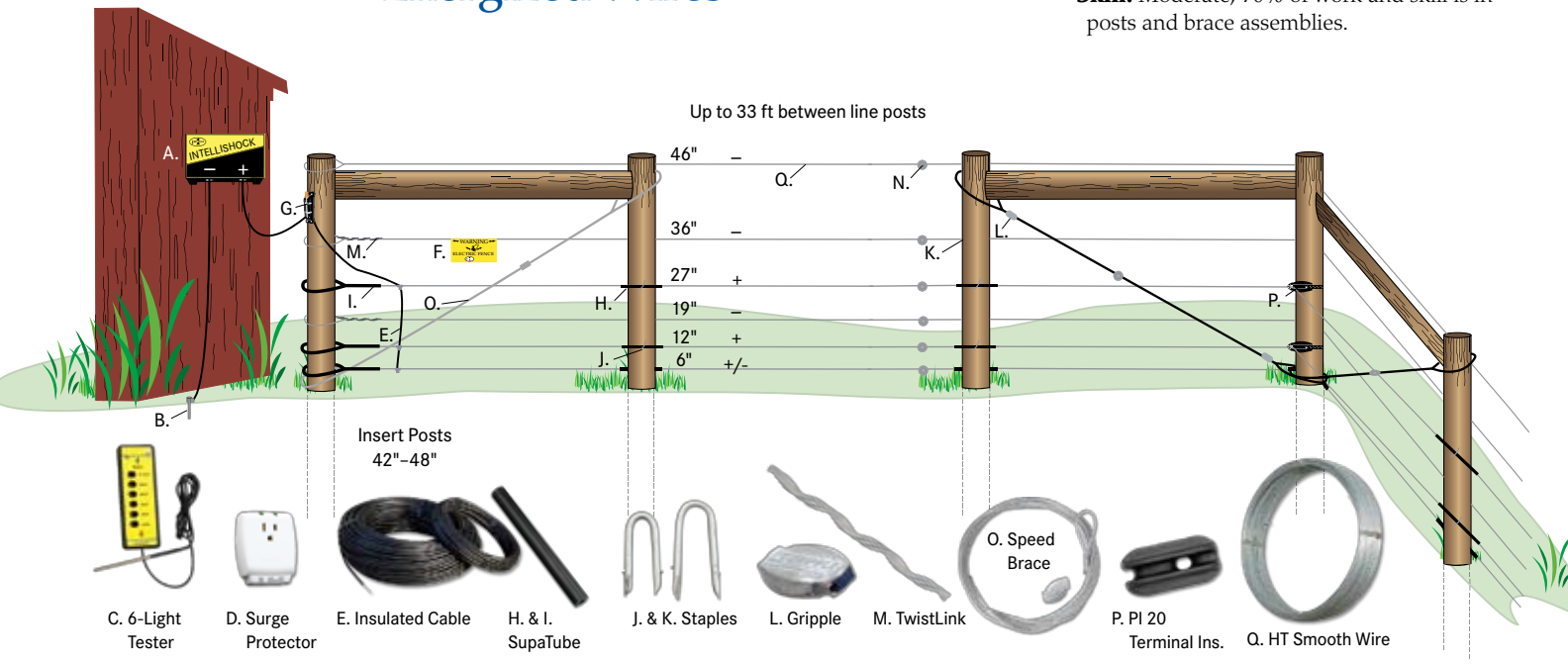
Now that you know even more information, discuss some of the ideas you had for the homework assignment which was to evaluate your farm feeding plan and determine if your feeding system would change based on what you have learned. What additional resources might you need to support proposed changes?

Permanent Fence

HT Smooth Wire with Offset Energized Wires

To install

Tools: Post driver, hammer, HT wire cutters, HT wire dispenser, HT wire strainer, wire twister, Super crimping tool.
Time: Very dependent on site conditions.
Skill: Moderate; 70% of work and skill is in posts and brace assemblies.



Fence diagram

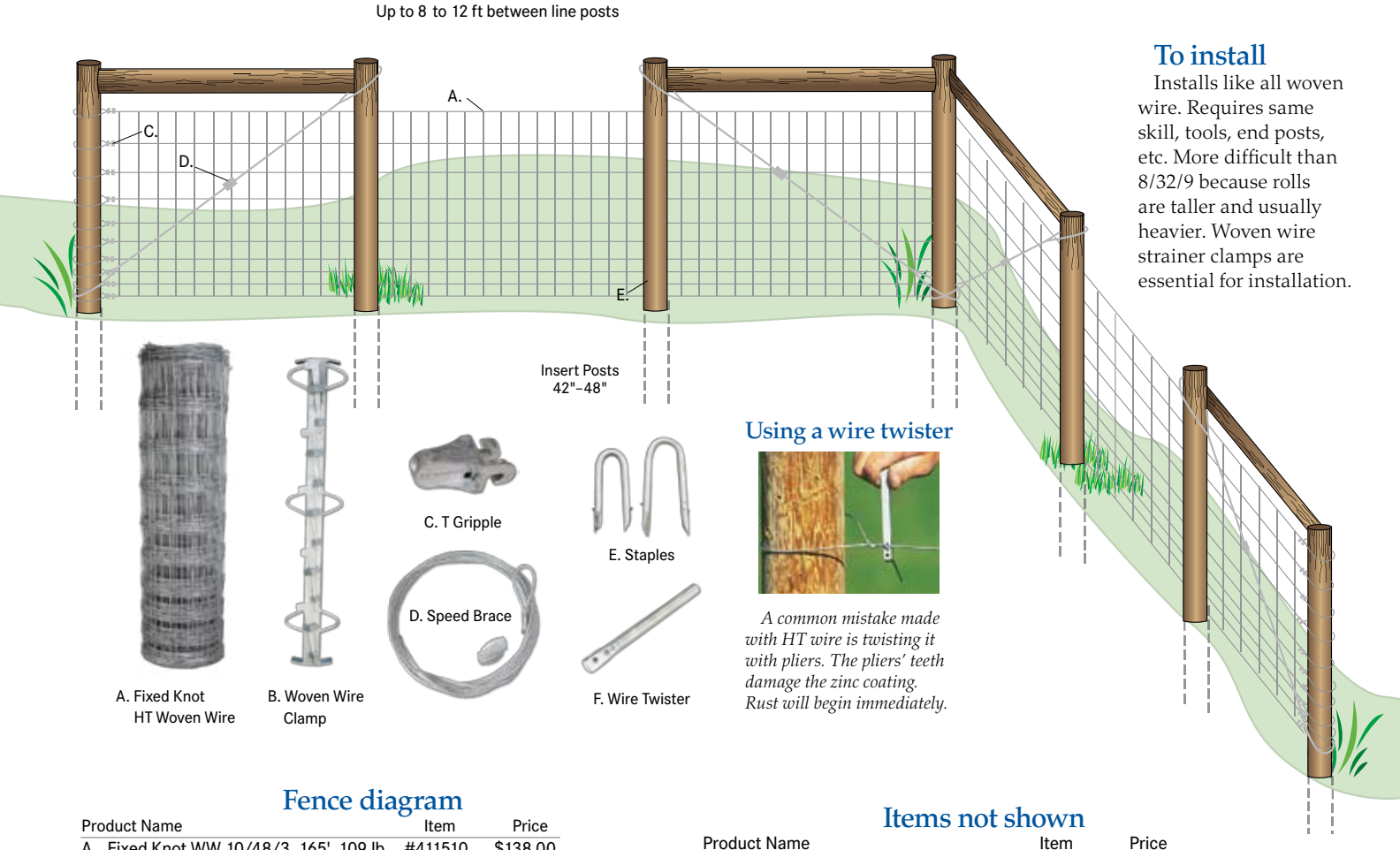
Product Name	Item	Price
A. Battery or Plug-in Energizers		
B. Ground Rod, 6' x 5/8", 6 lb	#151000	$8.00
Stainless Clamp, 0.1 lb	#151800	$1.35
C. 6-Light Tester, 0.2 lb	#134100	$15.00
D. Surge Protector, 0.8 lb	#156500	$10.00
E. Insulated Cable		
F. Warning Sign, 0.1 lb	#346000	$0.80
G. Cut Out Switch, 0.3 lb	#333000	$7.50
H. SupaTube for HT, 5", 0.1 lb	#360500	$0.18
I. SupaTube for HT, 20", 0.2 lb	#362000	$0.69
J. SupaTube Staples, 2", 1 lb	#360000	$1.65
K. HT Wire Barbed Staples, 1.6", 1 lb	#360200	$1.65
L. Gripple, med., 0.1 lb	#336800	$1.30
M. TwistLink, 12.5 gauge, 13", 0.1 lb	#336500	$0.85
N. Round In-Line Strainer, 0.5 lb	#330100	$3.10
O. Speed Brace (2 pack), 2.9 lb	#336840	$15.00
P. PI 20 Terminal Insulator, 0.1 lb	#369000	$1.25
Q. HT Smooth Wire, 2000', 52 lb	#301200	$65.00
HT Smooth Wire, 4000', 105 lb	#301300	$117.00

Items not shown

Product Name	Item	Price
IntelliTest Digital Voltmeter, 0.5 lb	#132000	$54.00
Galv. Steel T Post, 6', 9 lb	#327600	$11.25
SupaTube for HT, 10", 0.2 lb	#361000	$0.38
SupaTube for HT, 48", 0.3 lb	#364800	$1.64
PI 500 Steel Post Insulator, 0.1 lb	#380000	$0.49
T Gripple, 0.1 lb	#336855	$1.39
Round Strainer Handle, 2 lb	#408200	$6.50
HT Wire Dispenser, 24 lb	#402000	$78.00
GreenCote HT Sm Wire, 2100', 55 lb	#301210	$87.00

Permanent Fence

48" Woven Wire with Offset "Hot" Wires as needed



To install

Installs like all woven wire. Requires same skill, tools, end posts, etc. More difficult than 8/32/9 because rolls are taller and usually heavier. Woven wire strainer clamps are essential for installation.

A. Fixed Knot HT Woven Wire

B. Woven Wire Clamp

C. T Gripple

D. Speed Brace

E. Staples

F. Wire Twister

Using a wire twister

A common mistake made with HT wire is twisting it with pliers. The pliers' teeth damage the zinc coating. Rust will begin immediately.

Fence diagram

Product Name	Item	Price
A. Fixed Knot WW 10/48/3, 165', 109 lb	#411510	$138.00
Fixed Knot WW 10/48/12, 330', 105 lb	#411250	$159.00
B. Woven Wire Clamp, 30 lb	#404100	$94.00
C. T Gripple, 0.1 lb	#336855	$1.39
D. Speed Brace (2 pack), 2.9 lb	#336840	$15.00
E. HT Wire Barbed Staples, 1.6", 1 lb	#360200	$1.65
F. Wire Twister, 0.2 lb	#408300	$1.25

Items not shown

Product Name	Item	Price
Hayes Boundary Clamp Strainer, 19 lb	#404105	$115.00
HT Wire Barbed Staples, bucket, 44 lb	#360210	$69.00
HT Sleeves, box of 100, 1 lb	#339010	$21.50
Gripple, med., 0.1 lb	#336800	$1.30
Gripple Tensioning Tool, 1.9 lb	#336830	$69.00

Chapter 13
Predator Control

Brian Pugh

In Oklahoma, goat producers are blessed with climatic conditions conducive to viable goat production. However, they also are burdened with the eastward expansion of predator populations that constantly are increasing. Predator control within a goat herd is probably one of the single most important factors in maintaining profitable returns from a goat operation. In 2004, U.S. losses of goats and kids to predators totaled more than 155,000 head at a value of $18.3 million. Figure 13-1 shows the percentage of sheep and goats lost to various predators in the U.S. during 2005. Comparing these figures to a death loss of 260,200 head with a value of $33.3 million for all other causes (respiratory, viral diseases, weather, age, theft and other causes), shows what a heavy toll predators can take on a goat operation (United States Department of Agriculture, 2005).

What are predators? Many animals qualify as predators with respect to a goat herd. However, coyotes, feral or pet dogs and to a lesser extent bobcats top the list in goat depredation studies (Figure 13-2). Occasionally, foxes, eagles, mountain lions and bears also can cause losses of goats and kids. The day may come where goat losses to these latter species may become more frequent in the forested areas of Oklahoma.

Figure 13-2 shows the percentage loss of sheep and goats by predator species in Oklahoma in 2005 compared with other causes of death. As expected, coyotes are Oklahoma's top predator. It is also apparent from the graph that Oklahoma has a larger problem with goat predation due to dogs than the U.S. as a whole (27 versus 12 percent). This could be contributed to a higher human population density, therefore, dog density when compared to other goat-producing areas in the U.S.

So how do producers deal with predators? Most responses focus on a lethal method of control. Most producers often overlook the easiest and sometimes most efficient methods of minimizing predation, which are management practices keeping the predators away from the prey.

Integrated Predator Management

Most producers are familiar with the concept of IPM (Integrated Pest Management). However, producers should consider the concept of Integrated Predator Management (IPM) for their goat herds. IPM is just that, an integrated approach strategy for reducing and controlling predation within the goat

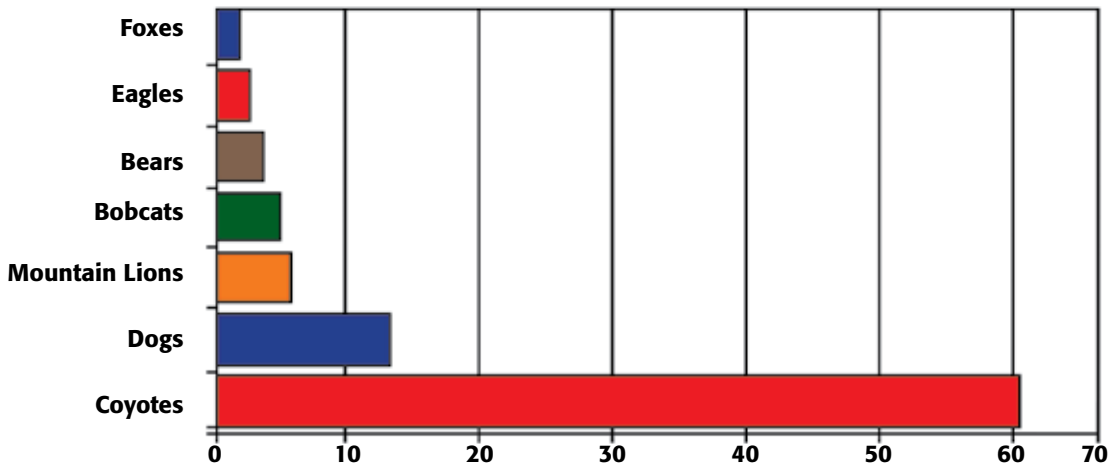


Figure 13-1. The percentage loss of sheep and goats by predator species across the U.S. (USDA, 2005). Note: Data was not available for goat losses only.

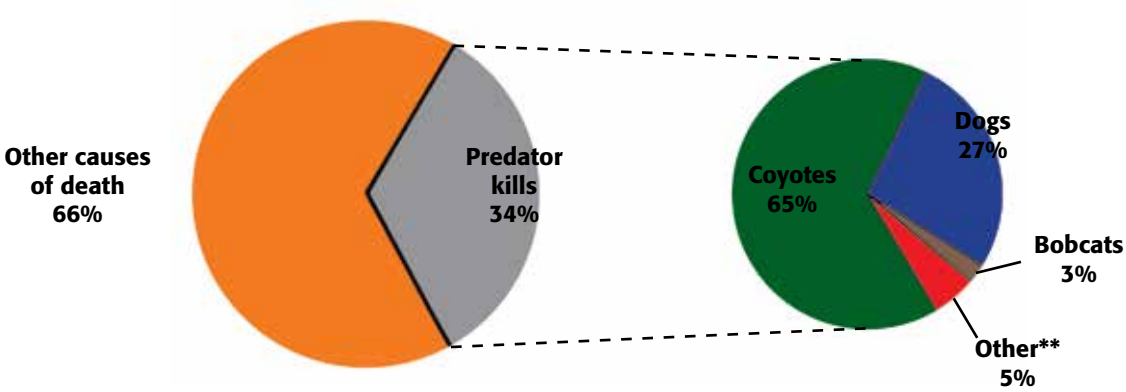


Figure 13-2. The percentage loss of sheep and goats by predator species in Oklahoma (USDA, 2005). Note: Data was not available for goat losses only. ** Other refers to losses from foxes, vultures, eagles, and other small predators.

herd. Many methods are available for predator control, ranging from a very passive control effort to lethal control practices. Each producer has a choice of method to employ. However, no one method of control will completely reduce depredation of the goat herd. Therefore, a number of these methods should be used together to address the prevention and control of predation events.

From an economical standpoint, producers need to prevent predatory losses, rather than control the problem once it has occurred. The method of only greasing the squeaky wheel is the wrong approach for predator control. With predators, the wheel should be constantly serviced to prevent the dreaded failure. Once any predator has killed, that predator will return again to claim another meal. Preventing that first meal is where this chapter will focus its attention.

Basics of Integrated Predator Management

The following methods are examples of nonlethal predator management:

- physical separation (fencing, night penning and sheds)
- cultural practices (herding, carrion disposal, herd checks, culling and habitat management)
- predator determent (fright tactics and guard dogs)

Lethal control predator management would include:

- predator thinning by trapping
- hunting
- using toxicants

Nonlethal Methods of Predator Control (Passive Control)

Nonlethal predator control is the most widely used and trusted method for reducing goat losses. These methods are usually viewed by the public as management practices imposed by the producer and not predator control in the traditional sense. These passive techniques work well because the emphasis is on keeping the goats in a safe, healthy environment before problems arise. Once again, an ounce of prevention is worth a pound of cure.

These methods do not directly address eliminating predators from the area, but dealing with isolating the goat herd from predators. Passive methods used for predator control include: fencing, kidding sheds, day herding, night penning, fright tactics, carrion removal, culling weak animals, frequent herd checks and habitat management. Another popular method used widely across the U.S. is the presence of a guardian animal such as a dog, llama or donkey.

Fencing

A well-constructed fence of woven or high-tensile electric wire can sometimes repel the majority of predators. Coyotes prefer crawling under fences, and they are inclined to dig under an impassible woven-wire fence. An apron fence prevents digging, but is costly. Apron fences should be buried perpendicular to the existing fence and be approximately 2 feet wide. If cost prohibits using an apron fence on a large scale, it is a great option for corrals.

Electric fencing also is a highly feasible option for most goat operations. To adequately deter coyotes and dogs, a 5- to 6-foot fence with top wires no more than 8 inches apart and four bottom strands with a 4-inch spacing should be installed. This con-

figuration will practically eliminate predators from crossing onto the property. An additional electric wire can be added 8 to 10 inches out from the bottom of an existing electric or net wire fence, spaced 6 to 8 inches off the ground to discourage digging or crawling under the fence. Fencing options are discussed in greater detail in Chapter 11.

Kidding Sheds

Kidding sheds are a simple, but effective method of removing goats and their kids from high-risk predation areas. Kidding sheds are structures for use during the kidding season, and they provide not only relief from inclement weather, but also reduce predation. The sheds are usually located in highly visible areas, close to a barn or house. These sheds do not necessarily deter predators from entering, but they do remove doe goats from secluded areas of the pasture during kidding. Kidding sheds are discussed in more detail in Chapter 12.

Day Herding

Day herding is another technique used to reduce predation on the goat herd. There are two forms of day herding, herding by the producer (common in other regions of the world) and herding by a guardian animal. This is a very labor-intensive process if left up to the producer, which requires close supervision of the herd during daylight hours. With many U.S. producers holding down another job during the day, day herding may best be accomplished by a trained guardian animal. This method seems to be the most widely used form of day herding in the U.S., and it can drastically reduce predation during daylight hours. Trained guard dogs will be discussed starting later in this chapter.

However, even with constant supervision during daylight hours, a goat herd is likely to receive the most pressure from predators at night. This minimizes some of the effectiveness of day herding without the use of a full-time guardian animal.

Night Penning

An effective method in both research studies and on goat operations is night penning. As previously stated, predators are most active during dawn, dusk and nighttime. By removing the goat herd from distant and secluded areas (brushy areas) during these times, the contact between the predator and prey can be effectively limited.

The pen must be constructed of impassible wire that neither the goat nor the predator can breech (see Chapter 11). The pens usually are constructed close to the barn or the producer's house for convenience and safety. Again, this method requires intensive labor inputs, but the rewards justify the additional work. The goats must be gathered in the evenings and driven into the pen. In the morning, they can be let out into the pasture on their own accord. This method can be extremely effective with the help of a guard animal, who will learn the penning routine along with the goats and can be the sole protector during daylight hours. Obviously, the size of the herd, grazing distance from the pen, and a producer's penning facilities will dictate whether this is a viable method of protection.

Fright Tactics

Fright tactics also have been tested and used for quite some time. According to some research, fright tactics are only marginally effective for predators. The tactics that work well do not work for very long. Predators are predators for a reason; they learn through experience what is a meal, an enemy or a dangerous situation. What might frighten them for the first few days becomes second nature after a few weeks, and they go back to their predatory ways.

Some tactics have included loud bursts of sound, moving and flapping objects, perimeter lights with motion sensors and even scarecrows. Some research shows that for noise-making devices to be effective, they must be discharged within close proximity of the predator's ear (within 1 to 2 feet). This is very difficult to accomplish, and eventually the predator becomes conditioned to the sound stimulus and learns that it is no real danger.

Other research studies have indicated (Linhart et al., 1984) that timed devices, set to activate at predetermined time intervals were less effective because the predators habituated themselves to the stimuli. A tested device that was triggered every eight minutes during darkness was effective for 91 nights before coyotes returned to predation, indicating that using animal-activated devices (not timed), and devices with varying sounds and movement can delay or even eliminate predator habituation.

However, other studies have shown a very significant decrease in depredation with the use of two frightening devices (Vercauteren et al., 2003): an acoustic device and an acoustic scarecrow device with a strobe light, that when triggered by motion sensors, initiates a moving scarecrow. The study was conducted on 4,500 ewes. After 288,000 sheep/nights (number of sheep times the number

of nights) 240 sheep were killed in the unprotected herds, while no sheep were killed with the use of either device after 12,685 sheep/nights.

Objects that move and flap with the wind or are motorized can have some positive results. However, repetition once again shows the predator these objects are not harmful. On the other hand, one of the main attractants of bobcats is something that flaps and moves with the wind, much like a ball of string or a feather floating on the air is to a house cat. Therefore, producers must use their own judgment when it comes to moving objects. Attracting a highly efficient goat killer onto the property is not desirable.

Some producers hang dead coyotes on their fences in an effort to deter other predators from returning. However, producers must be conscience of how the nonagricultural public sometimes perceives this as blatantly showing disregard for wildlife. No available research shows a reduction in predation when using the dead animal method, although it is often repeated by some producers.

Removing Carrion

Any carcasses, afterbirth and other materials should be disposed of properly and in a timely manner. Predators have excellent noses and once a carcass has ripened a few days, they can smell it from a great distance (Figure 13-3). By disposing of these carcasses by burial, incineration or composting, producers can reduce the odors that attract predators onto the property. Similarly, carcass dumps are excellent places for predators to get a taste of what is on the farm. As soon as does kid, any remaining afterbirth should be transported away from the farm or buried in a location predators are not likely to find it. The goal is for all nearby predators to never acquire a taste for goat meat.

Culling Weak Animals

Weak animals are probably one of the greatest attractions for predators besides carrion. A weak goat in the herd is attractive for every passing predator. Because the animals are weak, it becomes a part of natural selection that only the strong survive. Predators are constantly on the lookout for the easiest meal possible, and will notice these weak members of the herd. These goats should also be culled to increase the herd performance level. A weak or chronically sick goat requires more care and supervision; therefore, increasing costs and labor. Producers need to maintain a healthy, strong herd to reduce its attractiveness to predators.

Figure 13-3. Carrion should be disposed of as soon after detection as possible.

Frequent Herd Checks

Another vital management tool producers can implement to reduce depredation of the goat herd is simply to conduct frequent herd checks. No other management tool can replace actually viewing the animals on at least a daily basis. By observing the herd on a regular schedule, producers can start to recognize problems before they start. If a predator kills two goats a day, producers should realize this the next day and try to remedy the situation as soon as possible. For every day the problem is left unresolved, more goats could be lost. For livestock of any kind, herd observation is crucial to the efficiency and production of the herd.

Habitat Management

Controlling the growth of habitat surrounding the operation and at least around the barns and pens should be of utmost importance. Coyotes rely on ambush tactics to catch and kill larger prey. Brushy areas are excellent habitat for coyotes because it offers them everything they need. They have shelter from weather, other food sources and a means to more easily stalk and ambush goats.

Brush piles and briar thickets also are not a good idea around a goat operation. Rabbits tend to prefer these areas and can reproduce at an alarming rate. Rabbits are a preferred food source for almost every predator, and they are attractive enough to cause predators to linger in the area.

Using goats for habitat management presents a dilemma: how to use goats to control brushy habitat growth that predators love and not lose any goats to the predators. Whether using goats for weed or brush control or just grazing the goats in wooded areas, producers should keep in mind that goats are very vulnerable to predators during these grazing

forays. If possible, the goat's movements should be restricted to only those areas being cleaned, which allows the goats to flash graze the habitat in a short amount of time. The longer they are in this dense habitat, the greater chance a predation event might occur. When the habitat is thick and impenetrable, intensively graze these areas to thin them as quickly as possible, use a guard animal and remove the goats during the night.

Guardian Animals

When choosing a guardian animal for the herd, the options vary widely. Guardian animals are not considered a necessity for a goat herd, although they can be of benefit. Every situation is different for each operation. Guardian animals drastically reduce predation in most research studies. However, some producers have had little or no luck with guardian animals and have had problems such as guard dogs killing goats or never staying with the herd.

For some producers who have implemented many of the passive methods described in this chapter, a guardian animal could be an unnecessary expense. Again, each producer must honestly assess the individual situation and determine what combination of methods will work best for them. However, a well-trained guard dog or other guardian animal kept in a goat herd that is accessible to predators will decrease predation events.

Guard Dogs

The most common guardian animal is the dog. Various breeds of guard dogs are available, yet they all have similar features in common. They should be loyal to their owner, attentive to the herd and fearless when faced by a predator. Some say that a guard dog instinctively protects goats, others say training them is a must. It actually takes some of both. Most breeders agree that by familiarizing the pup with the producer and breaking them to lead and tie, problems are avoided down the road. Most of what a dog uses to deter predators is instinctual, but a dog's friendliness to the goats and the producer hinges on early training.

By breaking dogs to lead and tie, goat herds can more easily be relocated along with their protectors. It is also a necessity if cable snares are used for coyote control. A dog caught in a snare will associate this with being tied, and generally lay down until help arrives. A dog's training should be productive and short. Too much time spent with the pup will build the bond between the producer and the dog, not the desired interaction between the goats and the dog. At a young age, pups should be introduced to the herd, as shown in Figure 13-4, with human supervision at the beginning. If all signs are positive, the dog can be left in a corral with the goats to continue the bonding process.

Although guard dog options are varied, the cheapest pups in the local newspaper are usually not the best option. Most experts agree that contacting a reputable breeder, with known bloodlines, to find dogs compassionate to goats and have the guarding instinct well-bred into their bloodline is a better choice.

Another option is to buy proven adult dogs such as those shown in Figure 13-2, which typically costs more money, but they can be trusted with the herd and used to train future pups. Most proven adult dogs cost from $300 to $500. However, being assured the goat herd is safe from predators and the dog itself is repayment enough.

Unfortunately, the investment does not only consist of the purchase price. Most breeds of guard dogs are of large stature and require an equal proportion of dog food. An adult dog can require about $150 to $250 of annual maintenance costs (such as feed and health care), which can make one of these dogs a sizeable investment.

This investment probably cannot be recovered with a small herd (10 to 15 head), because of the possibility that very little predation would occur on a per head basis. However, if you depreciate the dogs purchase price over five years and add annual maintenance costs ($100 + $200), it takes just $300 worth of goats each year to pay for one dog. At 2007 prices of roughly $1.00 per pound for a 70-pound kid, a competent guard dog need only save four kids to pay for itself (assuming the high range of

Figure 13-4. A puppy should be introduced to the goat herd while still young.

Figure 13-5. Proven adult dogs can usually be trusted with the goat herd.

dog maintenance costs.) Understandably, most experts agree that trying to reduce the yearly maintenance costs is not wise. Hungry guard dogs are more likely to roam away from the herd in search of food, and in some cases malnourished dogs have turned on the goats themselves.

Different breeds are available for guarding a goat herd, yet no available research shows a propensity for one breed over another. However, some of the following breeds are more people friendly than others, and in populated areas, this should be taken into account. In essence, the choice comes down to personal preference and availability of a breed/breeder in the area.

Great Pyrenees

The Great Pyrenees, shown in Figure 13-6, is one of the most popular guard breeds in the U.S. Originally from France, they are a good natured, trainable dog, mildly athletic and attentive to the herd. Problems with hip dysplasia have been evident in the past, more so in this breed than others, which could be due to their popularity and the higher numbers of dogs in the U.S. Great Pyrenees are large white dogs that stand 25 to 32 inches at the shoulder. Their mature weight is from 85 to 140 pounds.

Anatolian Shepherd

Originally from Turkey, Anatolians, shown in Figure 13-7, have immense speed and agility and are fierce in battle. They are trainable and kind to the herd, but can be stubborn. These brown colored dogs stand 27 to 30 inches at the shoulder and weigh from 80 to 150 pounds, appropriate to size and structure. They are very muscular, athletic-looking dogs, with heavier weights evident in the males.

Figure 13-6. Great Pyrenees.

Figure 13-7. Anatolian Shepherd.

Akbash

Originally from Turkey, the Akbash, which means white head, is shown in Figure 13-8. These dogs are calm natured and attentive to the herd. They carry a keen protective instinct for not only the herd, but also property (territory). Adult dogs stand 27 to 31 inches at the shoulder, weighing from 75 to 130 pounds, with males being the heaviest.

Maremma

Another popular guard dog breed, the Maremma (Figure 13-9), is originally from Italy. They are intelligent thinkers, courageous and pos-

Figure 13-8. Akbash.

Figure 13-9. Maremma.

sess a strong distrust of strangers. They have been used successfully for protecting herds and families. However, this tendency against unknown humans should be considered for safety reasons. They are athletic, very active and in constant need of a job to keep them busy. Maremmas are white, mature at a height of 24 to 28 inches at the shoulder and a weigh of 65 to 100 pounds. Maremmas are one of the smaller-sized breeds of guardians, and therefore might be useful for smaller operations not wanting the maintenance costs of the largest breeds.

Komondor

Originally from Hungary, Komondors, shown in Figure 13-10, are the picture seen in many people's minds upon hearing the words sheep dog.

Figure 13-10. Komondor.

Long chord-like hair covering the body characterizes this breed. They have been used successfully to fend off coyotes and bobcats in the western U.S. Komondors are hardy in foul weather, big statured and muscular, although they are not as heavy as they appear. Mature shoulder heights are 27 to 31 inches, with a mature weight of 80 to 100 pounds. Consideration should also be given to the use of this breed in a warm climate, as its hair would likely increase heat stress in these dogs. (Breed information from the Purdue University website, 2006).

Guard Dog Choice

These dogs are not the only breeds available to be used as guard dogs; but these are some of the more popular breeds in the U.S. For further information on different breeds of guard dogs contact the local Extension educator. Breed choices are strictly up to the producer, and recommendations cannot be made as to what breed is the best for any given situation. A study in Colorado showed no difference in success rates for preventing predation between the breeds mentioned above. The study also showed no difference in protection abilities between males, females or neutered males. However, their research did indicate that neutered males were less likely to wander away from the herd than intact males.

Llamas and Donkeys

Llamas, shown in Figure 13-11, and donkeys are another option for use as guardian animals. Some producers have used them successfully to reduce

Figure 13-11. A llama with a goat herd.

predation. The following characteristics are some of the benefits of using these species:

- They are less likely to be affected by traps and snares.
- They are less likely to injure or kill goats in the herd (reported by some producers).
- They eat the same forage available to the goats, thereby reducing labor and costs (any forage consumed by these species is actually a hidden inputs cost).

However, these two species have not shown the same level of protection as the dog in research studies.

Llamas and donkeys do have some drawbacks:

- They will not stand their ground against mountain lions or bears.
- They must be carefully introduced to the herd in the beginning.
- Both llamas and donkeys must be gelded (castrated) to be effective.
- One donkey per pasture/herd is all that is recommended. Any more than one, and the donkeys will bond with each other and ignore the herd.

Again, many options are available for guardian animals that must be assessed by the individual producer. Goat producers who have had a good guardian llama or donkey say they will never own anything but that species. Others have had nothing but headaches from these two species. Producers must use their own judgment and make a selection that will meet their management goals.

Multiple Methods Most Effective

So which one of these methods is the right one for a goat operation? The deciding factor is how intensive is the producer willing to make the management inputs. In reality, using as many of these methods as possible will increase the success of controlling predator losses. The sum of combined methods offers greater protection than the value of each individual method. For example, a well constructed fence, a guard dog, night penning, culling all weak animals and frequent herd checks will result in less predation than if only one method from this list is removed.

Lethal Methods of Predator Control (Active Control)

When passive efforts have been exhausted and goat predation is still occurring, increasing predator control efforts and stepping up to an active control method may become necessary. As the name implies, active control methods usually result in the reduction of predator numbers within close proximity of the goat operation.

However, producers unsure about lethal control practices should not be concerned with totally eradicating the predator, especially the coyote (Figure 13-12). Despite extensive harvest of predators such as coyotes, they continue to increase their populations yearly at an alarming rate. The same adaptation that allows them to live in suburbs, wilderness areas, deserts, and extremely cold regions also allows them to be adept goat killers that are quick to realize human patterns and avoid danger. This self-preservation instinct also is what makes an educated goat killer a very big problem for producers

Figure 13-12. A coyote.

and drastically reduces the methods available for successful control.

First, producers must develop a control plan. They should remember that a coyote is a territorial animal, which means that every individual coyote establishes a home range or territory in which it hunts for food, mates and dens. It must determine its own social rank in the pecking order of other surrounding coyotes. Therefore, every coyote home range is a sign of rank, or status, within a family pack. When one animal dies or is driven away, another animal will claim this territory, either an animal from the family unit, or perhaps a new transient coyote. This is where the problems with eliminating all coyotes on sight begin.

Many research studies have shown that by eliminating local coyotes which no propensity to prey on livestock, the door is being opened for other potential goat killers to take up residence. Therefore, producers must first assess if they are truly surrounded by goat killers. If not, it may be in the best interest of the herd to reevaluate a few of the passive techniques and improve the perimeter barriers.

If producers are interested in active control, it should be because they do have a predation problem already occurring. If this is the case, it might surprise some producers that the bulk of goat kills can be blamed on one or two animals. A 14-year study conducted by UC Berkeley and USDA indicated two very important points to remember when approaching active control methods. The most intriguing find was that sheep losses due to predators were not correlated with predator removal numbers. This result means that by harvesting more predators, producers will not necessarily see a reduction in predation.

However, they also found the dominant alpha coyote was responsible for 89 percent of the 74 dead lambs during a two-year portion of the study. The subordinate betas were responsible for no lamb kills. This indicates that by targeting the alpha leader producers can drastically reduce goat depredation. Regrettably, alpha coyotes are the most difficult to capture because of their survival habits.

Cable Restraints

The use of cable restraints and foothold traps are both excepted methods for capturing wary predators. Cable restraints (also known as snares) are a very effective tool for coyote control because of their ease of use, light weight, the travel patterns of coyote and the willingness of a coyote to enter a restraint. The 3/32-inch aircraft cable is the accepted size for use on coyote restraints; 5/64-inch and even 1/16-inch cables can be used for bobcats and fox. Cable restraints are useful for bobcats if used correctly. However, cats tend to shy away from snares unless the set is perfect.

Crawl-unders are locations where predators have exacavated the soil from beneath the fence creating a crossing. These crawl-unders are an ideal position to hang a restraint, as the coyote is habituated to the crossing location as well as the sight of cable or wire at the set (Figure 13-13). Restraints set in these locations should be supported from the fence, have a 7- to 10-inch loop diameter, and must be 2 inches off the ground. When crawling under a fence, a coyote scoots its front feet on the ground to ease its shoulders under the fence. A restraint loop touching the ground will invariably be tripped and become ineffective.

If the producer wants to capture an animal alive (in case it is a neighbors' pet or guard dog), it is important to stake the end of the restraint away from the fence and nearby brush to prevent entanglement. Some caught coyotes have been known to attempt jumping the fence, and will hang themselves if allowed enough slack. The preferred way to prevent the animal from expiring is to install a snarelock. This device prevents the snare from closing far enough to cause asphyxiation of the restrained animal. Other useful set locations are on a coyote trail leading to carcass disposal locations, near stream crossings and in trails in tall grass.

NOTE: Check local game laws before setting any trap or cable restraint in trails or near exposed bait or carcasses. For more information on setting cable restraints for predators, check with the local

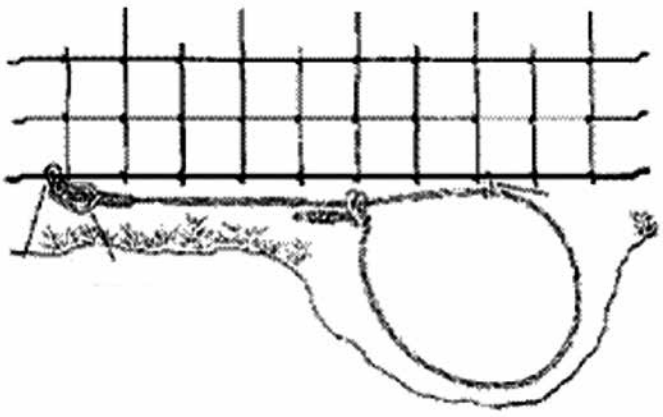


Figure 13-13. A crawl-under cable restraint.

county Extension educator for books and articles published by research universities.

Trapping

Steel Foot-Hold Traps

Steel foot-hold traps have come a long way in the past few decades, and the publics' perception of broken legged animals chewing their foot off could not be further from the truth. Traps are modified with wide jaws to increase surface area and reduce pinpoint pressure and skin abrasion. In-line springs are installed to reduce the force of a predator's movements and eliminate shoulder injury to the animal. Most animals are caught across the pad of their foot, never up on the leg, and very little damage is done.

These trap modifications are in an effort to release all nontarget animals, and in fact incidental catches of guard dogs or pets can be released with little injury. After one capture of a guard dog, it becomes aware of what the traps are and avoids them in the future. However, coyotes can learn the same response from a sprung trap and repeatedly dig up set after set, so caution must be used to catch the predator the first time around.

Live Traps or Cages

Unfortunately, coyotes are almost impossible to trap in live traps or cages. It is against their nature to enter a tightly confined area. However, bobcats can be captured very successfully in just these situations. Some wildlife agencies offer services to producers who need problem predators removed. The local game warden also may be able to introduce producers to a local private trapper who can help with the predator problem. A valid point to remember is that a trap in an inexperienced person's hands can alert local predators to the control efforts. The professionals then have much more difficulty completing the job efficiently once called to the scene.

Denning

Denning is a method of coyote control used throughout the spring when females have their pups in dens. The den is located through observation of the adult female, and the pups are removed from the area. Usually, the female also will leave the area. This method is useful for reducing the number of coyotes in the area. However, it does require a rather large investment of time to find the denning sites of numerous coyotes.

Predator Calling (hunting)

Another method of predator removal is using wildlife callers to effectively hunt these predators (Figure 13-14). Coyotes, bobcats and foxes are lured within gun range by the sound of a dying rabbit (or in some cases, a bawling kid goat for the predators that know what this sound is). A competent hunter in coyote country can be very effective in removing some of the bolder coyotes looking for a meal. As long as hunters understand where they can and cannot hunt and shoot and knows the rules, they should follow on any property, a beneficial partnership can develop for little or no money to the goat producer with very good results.

M-44 (Sodium Cyanide) and Livestock Protection Collars (LPC)

Toxicants, such as M-44 (sodium cyanide) and livestock protection collars (LPC), are illegal to use in Oklahoma and some other states for all parties except wildlife control agencies. The main concern with the use of laced bait and gas discharge toxicants by anyone untrained in their use is the indis-

Figure 13-14. A producer holds a bobcat that was threatening his herd.

criminate death of any animal that comes into contact with these devices. Therefore, if all other methods of control fail and this is the next logical step, please contact the nearest wildlife control agency or Oklahoma chief game warden. The local county Extension educator will also be happy to assist producers in making the initial contact.

Summary

As more and more goats make their way onto Oklahoma farms and ranches, the need for effective predator control increases. Coyote and bobcat populations are on a steady rise, and the occurrence of mountain lion and black bear sightings in southern Oklahoma has increased drastically in the past 10 years. Goat producers will face a predator problem at some point in time.

Again, the key to reducing goat predation to acceptable levels begins with the idea of IPM (Integrated Predator Management.) Producers must realize that any one method will not eliminate predation of their goat herds. A combination of passive methods and active control, when necessary, can result in greatly reduced pressure on the goat herds, without trying to eradicate the predator. Regardless of the producers' decisions, they also must remember that even predators serve a function in the grand scheme of things, and they can be very beneficial for keeping vermin numbers in check. Ideally, the producer should be responsible for controlling the goat herd population, not the local predators.

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JOURNEYMAN FARMER
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Small Ruminant Production

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Session 2
Predator Control

Dr. Jay Daniel
Associate Professor of Animal Science
Berry College

BERRY COLLEGE

Learning Objectives

- Risks that determine the need for predator control
- Types of predator control
- Resources needed for each

Predators

Photo: Jay Daniel

Photos left: Flickr – Pat Gaines, creative commons license

Photos right: Flickr –Tony Hisgett, commercial license

Predators

- Coyote
- Dogs (wild and neighbor's)
- Fox
- Bobcat
- Wolf
- Bear
- Cougar
- Eagle

Photo by: Niki Whitley

Golden Eagle capturing a deer

http://www.youtube.com/watch?v=Yz7FFlFy8eM

Predators

- Vultures
  - In addition to eating the dead, they have been known to kill live animals (especially newborn/those lambing or kidding).
- Crows
  - A flock of crows killed 17 sheep in Loerrach, Germany (February 7, 2003).
- Mustangs
  - Running herds have been reported to trample entire flocks.

Photo: George Gallagher

Control Means

- Adjust management
- Fencing
- Repellants and Frightening Devices
- Trapping/Poisoning/Hunting
- Guard Animals
  - Dogs
  - Donkeys
  - Alpacas/Llamas

Photos: Susan Schoenian, Baalands Farm

Adjust Management

- Avoid attacks
  - Keep animals healthy (sick and weak animals make easier prey).
  - Pen animals at night.
  - Adjust kidding/lambing season (highest coyote losses from late spring to September).
  - Remove and properly dispose of dead animals.
  - Select safer pastures.

Adjust Management

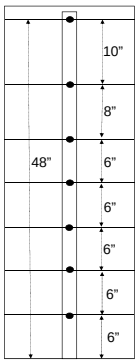
- Avoid attacks
  - If high losses are expect, it may be worthwhile to initiate trapping or other control means before turning animals out.
  - Sometimes removing coyote pups will stop attacks.
  - Weaning can sometimes stop attacks.

Photo: Chris Sasenbach (https://www.flickr.com/photos/kurisu/5742418582/) via freeforcommercialuse.com

Fencing

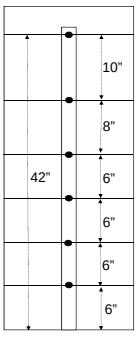
- Must prevent crawling under and jumping over
- Electric fence must be no further than the distance from the tip of the nose to the top of the poll apart.
- Net-wire openings less than 6” high and 4”wide
- Effective deterrent; not 100% preventive

Photo: Niki Whitley



Predator Exclusion Electric Fence

Photo: Susan Schoenian, Baalands Farm



Repellants and Frightening Devices

- Lighted corrals or pens
- Vehicles parked near where losses occur
- Change repellants periodically
- Other devices include propane cannons, horns, sirens, bells, radios with amplifiers, flashing strobe lights

Photo: Jeff P (www.flickr.com/photos/jeffpang/3686267667/) via freeforcommercialuse.com

Traps

- Learn/follow regulations
- Limited effectiveness
- Georgia trapping regulations:
  - http://www.georgiawildlife.com/node/342

Photo: Jay Daniel

Poisoning

- Non-selective
- M-44 device ("Coyote Getter)
  - Sodium cyanide the poison.
  - Limited to trained personnel
- Compound 1080 livestock protection collar
  - Not widely used
  - Used carbofuran as the poison; leaking a problem
  - One on all animals?

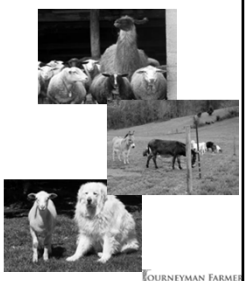
Photo: Jitze Couperus (www.flickr.com/photos/jitze1942/175124102 2/) via freeforcommercialuse.com

Hunting

- Learn the regulations and follow them.
  - http://www.georgiawildlife.com/hunting/regulations
- Calling should be used sparingly.
- A coyote population can be maintained with annual kill rates up to 70%.
- An annual kill rate of 75% would take 50 years to eradicate coyotes.

Guard Animals

- 45% sheep operations use guard animals (alpacas, dogs, donkeys or llamas)
- 82% herded/open range flocks use guard animals
- Dogs most common (30% of sheep operations)



Photos: Susan Schoenian, Baalands Farm

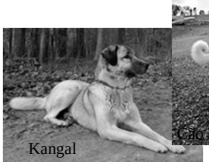
Guard Dogs

Photo Jerry Kirkhart (www.flickr.com/photos/jkirkhart35/ 2886986653/in/photolist-5pgktc-5pkAfy) via creativecommons.org

Photos left and middle: Susan Schoenian

Photo: Schmeegan www.flickr.com/photos/45699481) via creativecommons.org

Guard Dogs


Kangal


Catalan Catle Dog (Gos d'Atura)

Photo: caodegadotransmontano.net/machos.html


Karakachan or Bulgarian Shepherd

Photo: www.sheepmagazine.com/31-2/karakachan_livestock_guardian_dogs/

Photo: Christ vT
(www.flickr.com/photos/chrisvt/7665280990/in/photolist-cFmyZ5)
via creativecommons.org

Guard Animals - Dogs

- Match breed with environment
- Availability
- Adequate number for job
- Adequate fencing
- Proper care (do not let the dog run out of food)

Photo: Susan Schoenian, Baalands Farm

Guard Animals – Dog Training

- Guarding is instinctive.
- At 7-8 weeks of age, place in a small pen with sheep or goats, preferably lambs or kids.
- At about 16 weeks of age, can release them into larger pasture.
- Correct any undesirable behavior (ear chewing, roaming).
- You should be able to catch and handle the dog, but a good guard dog is not a pet.

Photo: Susan Schoenian, Baalands Farm

Guard Animals – Dog Behavior

- Scent marking boundaries
- Warning barks occasionally – should not bark constantly
- Circle animals into a small group
- Run at threat, may run into or roll
- Fight/attack threat

Guard Animals - Donkeys

- Inherent dislike for dogs, coyotes, foxes
- Success highly variable
- Test response to a dog before use
- Respond to dogs/canid predators with braying, bared teeth, running attack, kicking and biting.

Photo: Susan Schoenian, Baalands farm

Photo: https://www.youtube.com/watch?v=YnCA-aDYbPA

Photo: Georgia Outdoor News:
http://www.gon.com/article.php?id=3915

Guard Animals - Donkeys

- Use only a jenny or gelded jack.
- Use only one donkey for each group of sheep or goats (300 head or less).
- Allow 4-6 weeks for the donkey to bond with sheep or goats.

Photo: Jay Daniel

- Remove the donkey during lambing or kidding.
- Use donkeys in small, open pastures.
- Avoid feeds with monensin or lasalocid, which are poisonous to donkeys.

Guard Animals – Llamas (Alpacas?)

- Inherent dislike for dogs, coyotes, foxes
- Use similar to donkeys
- Wool production, but not to mix with sheep wool
- Do not distinguish between predators and herding dogs

Photo: Susan Schoenian, Baalands Farm

Guard Animals – Llamas (Alpacas?)

- Use a gelded male.
- Llamas are browsers and grazers and can be easily managed with sheep or goats; winter supplementation can be one square bale/week.
- Train by exposing to sheep or goats in a small pen for 5-7 days, moving to a larger paddock for 5-7 days, and finally to pasture.

Photo: Jay Daniel

Heifer kills a coyote

Photo: Trey Gafnea, University of Georgia Cooperative Extension

Additional Resources

- Meat goat production handbook (Langston University): www2.luresext.edu/goats/extension/handbookorderform.pdf
- eXtension.org - www.extension.org/pages/27119/goat-predator-control
- Sheep 101 http://www.sheep101.info/201/predatorcontrol.html

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

USDA NIFA Beginning Farmer and Rancher Development Program

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NOTES:

OPTIONAL PREDATOR CONTROL LEARNING EXERCISE

This exercise can be conducted in small groups, individually or as a single class learning tool. It will include discussion of the knowledge of predators, the strategies used to minimize herd losses considering herd size and the economic feasibility of predator control in individual herd management programs.

During the time provided by your facilitator:

FIRST: List (and discuss with others) the types of predators you have on your farm or might have on your farm given the environment. Consider:

a. Those you have seen
b. Wooded areas on our near your small ruminant pastures/housing
c. Underground/cave or rock dwellings that could house predators
d. Attractants for predators (i.e. chicken houses composting dead will attract vultures)

SECOND: List/discuss the issues related to minimizing herd losses on your farm, including:

e. Your herd size
f. Your resources and how you may be able to change them
    i. Pastures/location
    ii. *Type of fencing you have/need
    iii. Barns or shelters you have/need
    iv. **Type of guardians and pros and cons
g. Management choices that could reduce predation

THIRD: For the last part of this activity, list/discuss the economic costs for the types of animal loss management tools you are considering for your farm.

Additional Resources Page

Session 2: Predator Control

Georgia Dept of Natural Resources, Wildlife Division, Nuisance Wildlife: www.georgiawildlife.org/NuisanceWildlife

Georgia Nuisance Wildlife Trappers list (PDF): http://gadnrle.org/sites/uploads/le/pdf/Special-Permits/Nuisance_Wildlife_Trappers_List.pdf

Predator control for goats: http://articles.extension.org/pages/27119/goat-predator-control

Predator control (general; PDF): http://agecon.okstate.edu/meatgoat/files/Chapter%2013.pdf

Dogs for predator control, includes training dogs: http://www.case-agworld.com/cAw.LUgdogs.html

Predator control, Florida ideas: http://lee.ifas.ufl.edu/AgNatRes/Pubs/Controlling_Predation_on_Goats.pdf

Session 2: Pasture Management

Forage species recommended for Georgia (webpage text):
www.caes.uga.edu/commodities/fieldcrops/forages/species.html

Georgia legumes/grasses (available for PDF download):
http://extension.uga.edu/publications/detail.cfm?number=B1347
http://extension.uga.edu/publications/detail.cfm?number=B1351

Planting guide for forage grasses (PDF can print):
www.aces.edu/pubs/docs/A/ANR-0149/ANR-0149.pdf

Planting guide for forage legumes (PDF can print):
www.aces.edu/pubs/docs/A/ANR-0150/ANR-0150.pdf

Forages for goats:
http://articles.extension.org/pages/19396/goat-pastures-and-forages

Sheep pasture management:
http://www.sheep101.info/201/pasturemgt.html

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Small Ruminant Production

Health and Diseases

Breeding

Lambing and Kidding

Session Three

Participant Notebook

UGA extension

FVSU extension
Knowledge for Inspiring Lives!

Session 3: Health and Diseases; Breeding; Kidding/Lambing

Handouts: Vital signs; First aid kit; Basics of breeding

Health and Diseases (30 min – Charlotte Clifford-Rathert, Lincoln University)

- Healthy goats
- Common diseases, prevention, and treatment

Learning Objectives*:*

- List some of the most common diseases seen in small ruminants and understand how to prevent or treat them

Activity (30 min) – Health and Diseases Learning Exercise

Ideas for how you can use this at home – Evaluate herd health status and biosecurity protocols and determine if changes are needed to help prevent the most common diseases seen in small ruminants.

BREAK

Breeding (10 min, Dr. Niki Whitley, Fort Valley State University)

- Reproduction/breeding

Lambing and Kidding (30 min, Dr. Kevin Pelzer, Virginia Polytechnic University)

- Pre-parturition care
- Normal lambing and kidding
- Problems that may occur during lambing and kidding

Learning Objectives*:*

- Understand best management practices for breeding and for lambing or kidding

Ideas for how you can use this at home – Search the internet and view birthing videos online; determine what resources are already available and those that may still be needed for lambing or kidding.
www.youtube.com/watch?v=nMMCEJpi2Cg

Supplementary Information

Session 3: Health and Diseases

Vital Signs:

Vital Sign	Sheep	Goats
Rectal temperature	101.5-104°F	102-104°F
Heart beat	70-80 beats per minute	70-90 beats per minute
Respirations (breaths)	12-20 breaths per min.	15-30 breaths per min
Rumen movement	1-3 per minute	1-3 per minute
Ideal body condition score (1-5)	2-4 (2.5 to 3.5 best)	2-4 (2.5 to 3.5 best)

First Aid Kit

- Rectal thermometer
- Sterile syringes and needles
- Sterile gloves
- Exam gloves
- 7% tincture of iodine
- Probiotics, anti-stress drench
- Broad-spectrum antibiotic
- Hoof trimmers
- Hoof treatment product
- **Phone number of your veterinarian!**
- **Note pad and pen!**

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PURDUE EXTENSION

AS-595-W

Animal Sciences

EXPERT REVIEWED

UK UNIVERSITY OF KENTUCKY College of Agriculture

Common Diseases and Health Problems in Sheep and Goats

Lynn Pezzanite, Animal Sciences Student, Purdue University
Dr. Michael Neary, Extension Small Ruminant Specialist, Purdue University
Terry Hutchens, Extension Goat Specialist, Univ. of Kentucky
Dr. Patty Scharko, Extension Veterinarian, University of Kentucky

A sound management program to keep animals healthy is basic to production of both sheep and goats. Producers must observe animals closely to keep individual animals and the whole herd or flock healthy and productive. If the heath status of a herd is compromised, that operation will not be as efficient as possible.

There are some human health risks when dealing with diseased animals. While most diseases affecting sheep and goats do not pose any human health risks, some are zoonotic and it is important to protect not only caretakers, but anyone else that may come in contact with diseased animals.

Sheep and goats share many health problems. While there are some important differences between the species, this publication gives a broad overview of diseases and health problems. For further information on specific diseases, references and sources of additional information are available at the end of this document.

Evaluating Animal Health Status

To recognize clinical signs of diseases common to sheep and goats, it is important to be familiar with what is normal. Producers should assess the herd or flock's general health on a regular basis, including vital signs, body condition, and coat.

A normal temperature range for sheep and goats is between 101.5°F and 103.5°F. The respiration rate for sheep and goats is about 12 to 15 breaths per minute (depending on environmental temperature), and heart rate should be between 70 and 80 beats per minute.

Animals should exhibit a healthy hair coat or fleece, while maintaining a body condition score appropriate to their production stage. Both coat and body condition score are good indications of nutritional adequacy and overall health. Signs of an unhealthy animal include isolation from the rest of the herd/flock, abnormal eating habits, depression, scouring or diarrhea, abnormal vocalization, teeth grinding, or any other abnormal behavior.

Prevention of Disease

Biosecurity begins with the goal of preventing the spread of infectious agents from infected to susceptible animals. A biosecurity plan must take into account all modes of transmission, including direct animal contact within a herd, contact with wild animals or other domesticated species, airborne transmission, contaminated feed or water, and visitors or vehicles that come onto the farm.

The most basic method of disease control in individual herds/flocks is to avoid introduction of disease agents. If possible and practical, producers should keep a closed herd/flock. Most diseases of a contagious nature are introduced into operations when new animals are added. Disease agents can be introduced when breeding animals are added to an operation; when animals co-mingle at a fair, show or sale; or when animals contact wildlife. If a closed herd/flock is not feasible, then use an animal quarantine program. A useful isolation program consists of a facility that prevents co-mingling of animals for at least 30 days, including separate water supplies.

Restricting traffic in and out of a facility can reduce the potential introduction of pathogenic agents. Producers should minimize the number of people and vehicles that enter premises or require a sanitation and disinfectant plan to prevent spread of disease agents.

Other important management tasks that can prevent or help minimize disease issues are sanitation of facilities (especially shared livestock trailers), good ventilation or air turnover, proper stocking or animal density rates, and a good nutrition program.

Utilizing a Veterinarian

Many sheep and goat producers complain that they cannot find a veterinarian who is knowledgeable or interested in sheep and goats. Some veterinarians are very interested in small ruminants and act as important resources for producers. Producers share some of the blame for not attracting knowledgeable animal health professionals to practices that include sheep and goats. Too often, producers only utilize a veterinarian when they have an emergency. Often, these emergency situations do not turn out as successfully as the veterinarian or the producer would like.

However, producers can adopt strategies to attract a veterinarian to service their animal-health needs. First they should cultivate a relationship with the veterinarian as a trained professional to help in whole-herd health maintenance and not just as a source of free information or emergency service. Proactive management tasks such as breeding soundness exams on rams or bucks, tailoring a vaccination program to the producer's farm, purchasing supplies and vaccines from the vet, and using their services for other animals such as household pets are just a few examples. Additionally, producers can work together to obtain services from a veterinarian. Producers who coordinate with other sheep and goat producers in a geographic region are more likely to attract the attention of a veterinarian who is interested in sheep and goats.

Advice and treatment from a veterinarian is almost an absolute in preventing and controlling health problems in a herd/flock. Veterinarians can recommend vaccination programs; help with parasite control programs; assist with reproductive management; deal with emergency situations; prescribe drugs that may be useful, but are not approved for sheep or goats; do necropsies on dead animals; and perform a host of other important management tasks.

Vaccination Programs

Vaccinating the herd/flock can provide some insurance against specific common diseases. However, each vaccination program must be tailored to an individual operation. It is also important that producers understand what they are vaccinating for and why it is important. This is another instance where a veterinarian's assistance can be critical.

Just because there is a vaccine available for a specific disease does not mean producers should use it. There should be economic or other justification to vaccinate for specific diseases. Producers should work through the risk factors and other control programs with a veterinarian and decide whether or not it makes sense to vaccinate.

The clostridial vaccines are the only ones that can be recommended on a blanket basis for almost all sheep and goats. All other vaccination programs need to be developed specific to a herd/flock.

Sheep and goats should be vaccinated for *Clostridium perfringens* Types C and D and tetanus (CD&T) at appropriate times. Combination vaccines (7- and 8-way) are also available against other clostridial diseases, such as blackleg and malignant edema. These vaccines are inexpensive, and when used properly, are very effective in preventing losses.

Clostridial diseases are endemic to all sheep and goat operations. They are caused by specific bacteria that commonly live in the gut and manure of sheep and goats and, under specific conditions, can affect both sheep and goats. More information on these diseases will be discussed in the next section.

When handling vaccinations, it is important to follow label directions, as vaccines must be stored, handled, and administered properly. Only healthy livestock should be vaccinated.

Clostridial Diseases

Enterotoxemia Type C, or bloody scours, can occur in two distinct forms. The first form, known as struck, is seen in adults that do not normally exhibit clinical signs. Ulcerations of the small intestine are noted upon necropsy. The second form, known as enterotoxic hemorrhagic enteritis, occurs in lambs or kids within the first few days of life. It causes an infection of the small intestine, resulting in bloody diarrhea or sometimes death without clinical signs. Enterotoxemia is often related to indigestion. It is predisposed by an overabundance of milk, possibly due to the loss of a twin. The risk of enterotoxemia can be reduced with

adequate hygiene at parturition, such as eliminating dung or dirt tags in the wool and cleaning udders.

Enterotoxemia Type D, also known as pulpy kidney or overeating disease, is seen more frequently in sheep than goats. It can occur in lambs less than two weeks old, those weaned in feedlots, those on high carbohydrate diets, or sometimes in animals on lush green pasture. It normally affects the largest, fastest-growing lambs or kids. A sudden change in feed causes this organism, which is already present in the gut, to reproduce quickly, resulting in a toxic reaction. In some cases, animals exhibit uncoordinated movements and convulsions before death.

Tetanus, or lockjaw, is caused by *Clostridium tetani*, when the bacteria gains entry to the body through a contaminated break in the skin. Most cases of tetanus in sheep are secondary to tail docking and castration, especially when rubber bands are used in the process. Animals with tetanus become rigid, exhibit muscle spasms, and eventually die. Treatment is usually unsuccessful, but the disease can be prevented with vaccination and good hygiene. Tetanus can be transmitted to humans, so care should be taken when handling an outbreak.

It is important to vaccinate, especially with CD&T, at appropriate times to utilize the vaccine to the herd's best advantage. If ewes and does have not been vaccinated with CD&T before, or if more than a year has passed since their last vaccination, they should be vaccinated twice with CD&T, with the last vaccination occurring 20 days before parturition. They would then only need one annual booster in subsequent years about 30 days before lambing/kidding. The vaccination 30 days before parturition will confer passive immunity to the offspring via the colostrum. These maternal antibodies will protect the offspring for five to eight weeks. Lambs and kids should then be vaccinated at six to eight weeks, and given a booster shot two to four weeks later.

Soremouth

Soremouth, also known as contagious ecthyma, is a viral skin disease. The condition is caused by a Pox virus that requires a break in the skin to enter the body. Clinical signs of a soremouth infection include scabs or blisters on the lips, nose, udder and teats, or sometimes at the junction of the hoof and skin of the lower leg.

Soremouth results in loss of condition, depressed growth rates, increased susceptibility to other diseases, and death by starvation, since affected animals are less willing to eat while the infection persists. The most serious problem with sore mouth, however, is in susceptible lactating females that have never been infected or vaccinated, as they can get the lesions on the teats. This makes it painful for them to allow their offspring to nurse, which can lead to premature weaning and even mastitis. There is a commercial vaccine available. Normally, the infection will resolve itself in one to four weeks, with immunity lasting for several years.

Soremouth is transmitted by direct contact with affected animals or contact with equipment, fences, feed, and bedding that have been exposed to the virus. The condition will resolve on its own, but can be treated topically with iodine/glycerin solution. It is important to not use a brush or other utensil to rub or abrade the area of a sore mouth lesion as it will spread it further on the face or other tissue. Often, the best way to deal with sore mouth lesions is to leave them alone and let them clear up over time. If flies or other insects are a concern, treat the affected area with an insecticide.

These sheep have soremouth.

It is important for handlers to wear gloves when dealing with soremouth, as the virus is contagious to humans. When humans contract sore mouth, it is termed orf. It can cause painful and contagious lesions on the skin, very often on the hands or fingers. Care should be taken when handling animals with soremouth, handling animals that have been recently vaccinated, and handling the vaccine.

The vaccine is a live virus that, when applied, actually causes the disease locally. The live vaccine for soremouth will cause soremouth lesions at a specific location on the body chosen by the handler. A hairless area of the animal, such as the inside of the ear, under the tail, or inside of the thigh, is scratched, and the vaccine is applied to this area. Because the vaccine is a live virus, it is important to only vaccinate for the virus if it is already present in the herd, as it will introduce the virus if it is not already there. Producers that have closed herds/flocks and don't have sore mouth probably have no need to vaccinate for sore mouth. Once soremouth is introduced to an operation, either from vaccination or other means, it usually returns yearly to susceptible animals.

Internal and External Parasites

For more in-depth information on parasites, refer to Purdue and Kentucky Extension Publication AS-573-W on *Managing Internal Parasitism in Sheep and Goats*.

Parasites pose a significant threat to the health of small ruminants. Parasites can damage the gastrointestinal tract, and result in reduced reproductive performance, reduced growth rates; less productive animals in terms of meat, fiber and milk; and even death.

General clinical signs that an animal is suffering from a parasitic infestation include diarrhea, weight loss or reduced weight gain, unthriftiness, loss of appetite, and reduced reproductive performance. Factors that may affect an individual's susceptibility to parasitism include natural genetic resistance, age, and reproductive stage.

Goats are generally more susceptible to internal parasites than sheep. The groups most susceptible to parasitism are young animals, lactating ewes and does, and those in late gestation or around the time of parturition. The animals least susceptible to parasites are mature, dry ewes.

Internal Parasites. Several types of internal parasites affect sheep and goats, and all sheep and goats have a low level of parasite activity. However, excessively high parasite levels are often detrimental to the health of the animal. The most common internal parasite is the roundworm that lives in the abomasum and small intestine of sheep and goats. There are several types of roundworms that infect sheep and goats, including *Telodorsagia* (*Ostertagia) circumcincta, Haemonchus contortus,* and *Trichostrongylus colubriformis.*

The most dangerous parasite affecting sheep and goats is the gastrointestinal roundworm *Haemonchus contortus*, also known as the barber pole worm. This voracious bloodsucking parasite has a tremendous capacity to reproduce through egg-laying. Clinical signs include anemia (pale mucous membranes), edema, protein loss, and death. Animals suffering from *Haemonchus contortus* become weak and lethargic, often straggling at the back of the herd when driven a distance. Edema, or the accumulation of fluid under the skin, is usually seen as a swelling of the lower jaw, a condition known as bottle jaw.

Tapeworms can cause weight loss, unthriftiness, and gastrointestinal upset. A tapeworm infection can be diagnosed by yellowish-white segments in the feces. Lambs and kids become resistant to tapeworms quickly, so infections are most common in animals younger than four or five months of age. The biggest problem with tapeworms is that producers can actually see the segments in fecal matter and can become overly concerned. Infections by other internal parasites are more serious than a mild tape worm infection.

Coccidia are protozoan parasites that damage the lining of the small intestine. Since the small intestine is an important site of nutrient absorption, coccidia can cause weight loss, stunted growth, and diarrhea containing blood and mucous. Other clinical signs include dehydration, fever, anemia, and breaking of wool or hair. Fly strike and secondary infections can also result from coccidiosis. Coccidia are usually found in animals in confinement or intensive grazing systems, as a result of poor sanitation, overcrowding, and stress. Animals between one and six months of age in feedlots or intensive grazing systems are at highest risk for coccidiosis. Outbreaks of coccidiosis can be controlled by implementing good sanitation techniques, providing clean water, rotating pastures, and avoiding overstocked pens. Outbreaks of coccidiosis can be treated with sulfa drugs. Coccidiostats can be administered to inhibit coccidial reproduction.

Anthelmintics are drugs that either kill egg-laying adults or kill larvae before they grow into adults and become capable of laying eggs. An anthelmintic is normally administered as an oral drench, a thick liquid suspension deposited at the back of the animal's tongue. There are challenges associated with using anthelmintics, since few are approved by the FDA for use in small ruminants (although many are safe), and resistance to the drugs can develop due to overuse and improper dosing. Fecal Egg Count (FEC) Tests can be done to determine when it is necessary to deworm, and to help determine the level of pasture contamination.

A system known as FAMACHA has been developed to identify those animals affected by *Haemonchus* that require anthelmintic. In this method, producers observe the color of the conjunctiva of the lower eyelid to determine the level of anemia that an animal is experiencing. The goal of FAMACHA is to delay resistance by only selectively treating animals in a herd that are showing signs of a parasitic infection. Sheep and goat producers should be trained in the use of the FAMACHA system as it can reduce the need for anthelmintic use and delay anthelmintic resistance.

External parasites may damage the fleece and reduce pelt value. Parasites common to sheep or goats include lice, keds, and mites. External parasites are especially common in the winter when sheep or goats are in closer confinement. Pour-on treatments are a common form of management for many external parasites, and are more effective on shorn sheep or short-haired goats.

This picture shows a goat with bottle jaw, a symptom of parasitic infection. *Photo courtesy of Dr. Ray Kaplan, DVM, University of Georgia*

The many species of lice that parasitize sheep and goats are generally divided into chewing lice and sucking lice. Chewing lice feed from dead skin cells, while sucking lice feed by sucking blood. Lice can be detected by the presence of their eggs, called nits, which are not susceptible to insecticides. Sheep or goats exhibiting wool or hair loss should be checked for nits. Chewing lice are eradicated with pour-on topical insecticides, while sucking lice can be treated with specific anthelmintics that control them.

Keds pierce the skin and suck blood, and are usually found on the neck, shoulders, and flanks. Ked bites are very irritating to sheep, causing them to scratch, rub, and bite themselves, which damages the wool. Keds also cause wool discoloration, which further reduces the value of the fleece. Ked bites affect the hide quality as well. Shearing sheep will remove most adult keds and larvae, and is especially important before lambing. Further treatment with pour-on insecticides after shearing or injection of Ivermectin are both effective methods to wipe out a ked infestation.

Unlike lice and keds, mites burrow beneath the skin instead of living on the surface. This irritates the skin, causing the sheep and goats to itch, which results in wool or hair loss and lesions or scabs. Mange can be diagnosed by doing a skin scraping. Administering injectable Ivermectin or topical insecticides can help affected animals.

Respiratory Problems

Respiratory infections, or pneumonia, are a common and serious disease in sheep and goats. A number of different types of pneumonia complexes affect sheep and goats. Many times, a combination of viral and bacterial agents infect the lungs as a result of stress such as weaning, transport, change of weather, poor air quality (high ammonia in confinement or dusty conditions in corrals), or a combination of factors.

Clinical signs of pneumonia include fever with a temperature over 104°F, along with a moist, painful cough and dyspnea (difficulty breathing). Anorexia and depression may also be observed in an animal suffering from pneumonia. Treatment of pneumonia upon diagnosis involves administration of antibiotics. Because there are different types of pneumonia, it is important to work with a veterinarian to identify the type of pneumonia present and determine the most effective treatment.

To reduce the incidence of pneumonia, it is important to implement optimal sanitation and air quality practices in herd housing. Making sure buildings have adequate ventilation and reducing dust are very important. Any environmental condition that irritates the lungs gives infectious agents a chance to affect the animal. Minimize transportation stress, and quarantine new animals before introducing them to the rest of the herd to prevent the spread of outside pathogens. Provide good nutrition and water, and supplement with trace minerals to enhance immune function as necessary. For more in-depth information on footrot, refer to Purdue and Kentucky Extension publication AS-596-W, *Footrot in Sheep and Goats*.

Foot Scald / Footrot

Footrot is a bacterial infection prevalent in warm, moist areas. Footrot is caused mainly by the synergistic action of the bacteria *Fusobacterium necrophorum* and *Dichelobacter nodosus.* The *D. nodosus* bacteria can cause various degrees of involvement of the sole. Footrot can have a range of clinical signs, depending on the specific strain(s) of *D. nodosus* present.

Foot scald infects only the area between the toes and often clears up quickly with treatment or with improving environmental conditions. Virulent footrot is much more of a problem, as the bacteria enter the hoof and digest the hard, horny tissue of the sole that protects the fleshy tissue of the hoof. Virulent footrot in sheep and goats causes much economic loss and increased management effort. Once it infects a herd/flock, it is difficult to eradicate.

This picture is of a goat with foot scald. *Photo Courtesy of UK and KSU Goat Producers Newsletter, December 2008.*

Clinical signs of foot scald include redness and inflammation between the toes and a bad odor. In advanced cases, the hoof horn becomes under run and actually can separate from the hoof wall. Foot scald and footrot can cause lameness, reduced weight gain as animals are less willing to move to feed, and decreased reproductive capabilities. These conditions result in production losses, treatment and prevention costs, premature culling, and reduced sale value of infected animals.

Both sheep and goats are susceptible to footrot. Moreover, some of the different strains of *D. nodosus* affect both animal species. In general, goats are usually less severely affected by footrot than are sheep.

Footrot commonly appears on a farm when an infected sheep or goat is brought into the herd. The *D. nodosus* bacteria can not live in the environment for more than about 14 days, so almost always, the source of the bacteria in an unaffected herd/flock is a carrier animal. Footrot occurs more commonly when feet are not trimmed frequently enough and in crowded housing situations. Some individuals are genetically more susceptible than others, and 5 to 10 percent of infected sheep become chronic carriers of footrot. These animals should be culled to prevent them from re-infecting the rest of the herd.

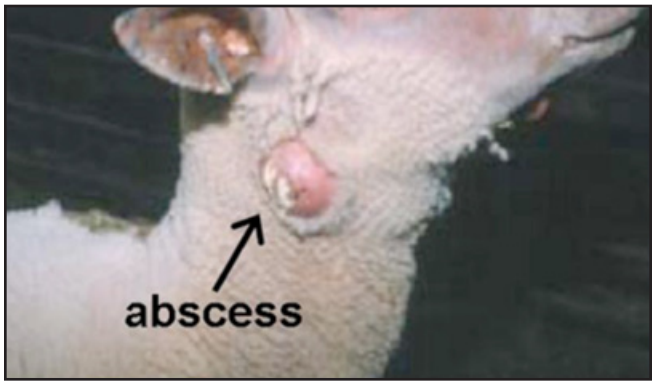
While not as likely as with carrier animals, footrot can also be spread on boots, tires, feeders, or handler's hands, so care must be taken if footrot is present in the herd. Producers should not purchase animals with footrot or from infected flocks, and should not use areas or vehicles that infected sheep have inhabited. Quarantine any new additions to the herd for 30 days, and trim feet before introducing them to the other animals.

To prevent footrot, it is absolutely imperative to avoid the introduction of the disease to a footrot-free herd/flock. Other management tasks that help maintain good foot health include regular hoof trimming and sound nutrition. Foot soaking baths using zinc sulfate can be constructed to treat footrot in conjunction with systemic treatment. Vaccines are effective 60 to 80 percent of the time, and can be used with other management practices to reduce the prevalence of footrot. A combined treatment plan of foot trimming, foot baths, vaccination, and antibiotic treatment (for the most severe cases), can be effective in controlling the physical clinical signs of footrot. To eliminate footrot from the herd takes a dedicated and labor-intensive plan of action that includes treating animals, separating infected from non-infected animals, and culling of animals that can not be cured.

Caseous Lymphadenitis

Caseous lymphadenitis (CL) is a condition that affects the lymphatic system, resulting in abscesses in the lymph nodes and internal organs. When it affects the internal organs, CL becomes a chronic wasting disease, with economic losses due to reduced hide value and carcass trimming. CL can also result in decreased weight gain, wool growth, milk production, and reproductive capabilities. Affected animals are often culled early and may die.

Caseous lymphadenitis is caused by the bacteria *Corynebacterium pseudotuberculosis*. An abscess can develop either at the location where the bacteria enters the body or at a lymph node nearby. From there, the infection can spread through the blood or lymphatic system, causing abscesses to form in other lymph nodes or internal organs throughout the body. The organs most commonly affected are lung, liver, kidneys, and their associated lymph nodes. Abscesses, though not painful, grow slowly over time, and may rupture if close to the skin. The disease is spread by direct contact with an infected animal or through contaminated equipment or a contaminated environment.



This sheep has caseous lymphadenitis. *Photo Courtesy of Dr. Justin Luther, Ph.D., and Dr. Charlie Stoltenow, DVM, North Dakota State University*

While infected animals may show no clinical signs, CL can cause anemia, anorexia, weight loss, and fever. Caseous lymphadenitis is a significant human health risk as well, since it has zoonotic potential. The disease can be contracted by humans through consumption of raw milk from infected sheep and goats, or if humans come in contact with infected carcasses and the bacteria enters a break in the skin. The spread of CL to humans can be prevented by reduced contact with contaminated objects, and through the pasteurization of milk before consumption.

A vaccine for this disease is available in two forms. The first is a toxoid for the bacteria causing CL alone, and the second can be combined with the CD-T vaccine. The vaccine works best in animals that do not already show signs of CL infection. Do not vaccinate for CL in the last trimester of pregnancy to avoid vaccine-induced abortions. The vaccination does not treat for existing infections; animals must be vaccinated prior to exposure for the vaccine to be effective. The use of this vaccine is controversial, and producers should seek the advice of a veterinarian before making it a part of their herd management program. It does not provide complete protection, so cases will still occur on a farm infected with CL, but the incidence will decrease.

Listeriosis

Listeriosis is a bacterial infection caused by the bacteria *Listeria monocytogenes*. Natural reservoirs for the bacteria are the soil and the GI tracts of mammals. Sheep and goats usually ingest *L. monocytogenes* by grazing pastures contaminated by feces containing the bacteria. The bacteria can also gain entry to tissue via wound or inhalation.

Listeriosis is also a concern when animals are consuming ensiled forages such as haylage or corn silage. Try to not feed the moldy portion of silage to animals and limit soil contamination when putting up silage, as listeriosis is most prevalent in the soil and in molded areas of silage.

Listeriosis can result in abortion, septicemia, or meningoencephalitis. Clinical signs of listeriosis include anorexia, depression, disorientation, facial paralysis, excessive salivation, and in severe cases, affected animals may fall on their sides and exhibit involuntary running movements. Abortions due to *L. monocytogenes* usually occur during the third trimester of gestation, and may occur at a rate of up to 20 percent in affected sheep flocks. Encephalitis and abortion do not usually occur simultaneously in a flock.

L. monocytogenes affects sheep and goats of all ages and both sexes. Onset is fast, and death may occur 24 to 48 hours after onset of clinical signs. Diagnosis of listeriosis is confirmed by isolation and identification of *L. monocytogenes*, usually from the cerebrospinal fluid. Bacteria have also been isolated from nasal discharge, urine, feces, and milk of affected animals.

Listeriosis should be treated aggressively with high doses of penicillin or tetracycline, along with supportive therapy, including fluids and electrolytes. As *L. monocytogenes* can be transmitted to humans who handled aborted lambs or kids, or during necropsy of septicemic animals, precautions should be taken. While cases of human listeriosis are rare, mortality rates can be as high as 50 percent, and there is the risk of abortion for pregnant women who contract the bacteria.

Abortive Diseases

Abortion refers to a female losing her offspring during pregnancy or giving birth to weak or deformed babies. Abortions can be due to infectious or non-infectious agents. Non-infectious abortions can be caused by trauma such as fighting or rough handling, but are much less common. The main infectious agents that cause abortion in sheep and goats are Vibriosis (*Campylobacter)*, *Chlamydia* (also known in sheep as Enzootic Abortion of Ewes or EAE), Toxoplasmosis, and Leptospirosis to a lesser extent. In addition, Border disease virus, Cache Valley virus, *Listeria*, and *Salmonella* have been known to cause abortion in sheep and goats in specific regions of the United States.

Care should be taken when handling aborted fetuses or placentas, as all the pathogens that cause abortion in sheep and goats can be transmitted to humans.

Campylobacter infections result in late pregnancy abortions or stillbirths. They are seen much more commonly as a cause of abortion in ewes than in does. If the abortions are due to an infection by *Campylobacter* bacteria, infected animals are often responsive to either tetracycline or sulfa drugs to prevent further abortions. A vaccine is available to prevent Campylobacter infections.

Chlamydia infections cause abortions during the last 2 to 3 weeks of gestation, resulting in stillbirths and weak offspring. Ewes and does infected by this bacterium rarely abort more than once, but can continue to shed the bacteria from their reproductive tract, infecting other herd members. It is likely the infectious agent is *Chlamydia* bacteria if the abortions occur in ewe lambs or young ewes. Abortions due to *Chlamydia* bacteria can be stemmed by treating ewes with tetracycline given in the feed or by injections. There is also a vaccine for *Chlamydia*.

If ewes or does contract ***toxoplasmosis*** early in gestation, they usually reabsorb the fetus. When infected later in gestation, abortions are common. Toxoplasma abortions are unique in that Toxoplasma is a protozoan parasite, not a bacterim, so the manner in which ewes are infected is different. Toxoplasma is a parasite of cats and rodents, who shed the agent into the environment (hay or feed) through their feces, where it can be ingested by sheep or goats. The only treatment for toxoplasmosis is prevention. It is important for producers to cover stored feed and discourage stray cats from hanging around barns that house gestating ewes or does. Feeding a coccidiostat, such as Monensin or Decoquinate, mixed into feed can also be effective in preventing abortion due to toxoplasmosis. Not all coccidiostats are FDA-approved for sheep and goats, so a veterinarian should be consulted if this method is considered, as several can be effective.

Leptospirosis, caused by the bacteria *Leptospira interrogans*, can cause abortion in goats, though sheep are less susceptible. It is generally transmitted when animals come into contact with standing water, such as a lake or pond, with the bacteria. Clinical signs of infection may also include anemia and icterus. Icterus, also known as jaundice, is a condition where the skin and white of the eyes appear yellow due to an accumulation of bilirubin in the blood caused by the breakdown of red blood cells. It can be a symptom of anemia or liver disease. A diagnosis of Leptospirosis can be made conclusively by testing the dam's urine, the aborted fetus, or the placenta.

Q fever is a bacterial infection that can cause abortion, especially in goats, but also in sheep. It is caused by the bacteria *Coxiella burnetii*, which are shed in milk, urine, feces, placental tissue and amniotic fluid, as well as spread through the air. Pasteurization is effective in killing the bacteria in milk. Clinical signs in ruminants include anorexia, abortion, and lesions. The disease is usually diagnosed by bacteria from an infected placenta, which will be covered with a gray-brown secretion. Outbreaks can be managed by administration of oral tetracycline, separating pregnant animals inside from the rest of the herd, and burning or burying reproductive waste. The disease can be spread to humans, especially farmers, veterinarians, and researchers who assist in the birthing process, who often exhibit flu-like clinical signs.

Even if a specific infectious agent is suspected as the cause of abortion in a herd or flock, it is still necessary to submit an aborted fetus and placenta to a diagnostic lab for confirmation. It is important to include the part of the placenta where lesions are present as this is critical to identification. Producers can work with veterinarians when packaging and shipping the fetus and placenta. To prevent the spread of infectious agents while waiting for results from the diagnostic lab, aborting ewes or does must be isolated from the rest of the herd, and aborted fetuses or placentas should be removed from the pen.

Specific management practices can help to reduce the incidence of infectious abortions in the herd or flock. Any new additions to the flock or herd should be quarantined or, if they are pregnant ewes or does, penned separately until they give birth. *Campylobacter* and *Chlamydia* bacteria are often spread to a non-infected herd or flock when a purchased animal is introduced from another farm. Feeding high doses of tetracycline prior to lambing or kidding has been effective in reducing *Chlamydia* and *Campylobacter* abortions. Ewes or does should not be fed on the ground, as *Campylobacter* and *Chlamydia* are transmitted by ingestion of materials in contact with infected feces or fetal and placental fluids. Vaccination for *Campylobacter* and *Chlamydia* is important for flock or herd health as well. There is, however, no vaccine for toxoplasmosis available in the United States.

Polioencephalomacia

Polioencephalomacia is a condition found usually in feedlot lambs between 5 and 8 months of age, but can affect sheep of all breeds, sex, and ages. Losses are most often sustained in animals on a high plane of nutrition.

There are two levels of this disease, subacute and acute. In the subacute form, animals show signs of incoordination, weakness, tremors, blindness, and depression. In the acute form, lambs are found dead or comatose, experiencing involuntary muscle contractions or seizures. Body temperature is not affected. At necropsy, lesions in the central nervous system and necrosis of the cerebral cortex of the brain are found.

Polioencephalomacia is thought to be caused by thiamine deficiency as a result of diets or water containing toxic levels of sulfur. A thiamine-like substance is produced in the rumen during digestion of high-sulfur diets. This thiamine-like substance competes for thiamine receptors in the rumen and binds some of the receptors in the place of thiamine. As a result, less thiamine is absorbed by the body, even though thiamine production in the rumen is sufficient. This decreased thiamine absorption results in neuronal degeneration and death of brain cells. Traditional diets do not contain high levels of sulfur.

Polio seems to be endemic to certain farms, probably due to types of feedstuffs or water available. Some water wells contain high levels of sulfur in the water, and some feedstuffs are known to contain high levels of sulfur. Fish products and by-products from corn distillation for ethanol (distillers' grains) have high levels of sulfur. If polio is a problem on specific farms or if feed ingredients with high sulfur content are fed, then thiamine should be routinely added to grain mixes fed to sheep and goats.

A diagnosis of polioencephalomacia can be made when clinical signs such as blindness are observed in animals with normal temperatures, or lesions are found during necropsy. To treat the condition, thiamine hydrochloride can be administered twice daily for several days. Affected animals should be isolated to provide easy access to feed and water. Intravenous (IV) fluids, electrolytes, and nutrients can be given using a stomach tube if necessary. Complete recovery depends on the extent of damage done to the brain.

Mastitis

Mastitis refers to an inflammation of the mammary glands due to a bacterial infection. Udder damage, often caused by mastitis, is one of the leading causes of culling in sheep and goat operations. The risk of developing mastitis increases with poor sanitary conditions, systemic infection, or trauma inflicted by offspring. Mastitis can occur as an acute or chronic condition, and may be localized to a single gland or both.

Mastitis can be diagnosed through physical examination of the udder of the animal or by looking at a sample of milk from an affected gland on a strip cup against a black background. Acutely mastitic mammary glands are warm, swollen, and painful, and may produce milk that is abnormal in consistency or color. If mastitis becomes septic, meaning that bacteria have entered the bloodstream, the condition may be accompanied by signs of fever, anorexia, depression, and lethargy. In chronic mastitis, the main symptom observed is offspring that are failing to thrive, as affected dams are reluctant to let them nurse.

Mastitis can be treated with both intramammary and systemic antibiotics treatment. If mastitis is a chronic problem in an operation, then the causative agent should be cultured, and antibiotic choice based upon those results. It is helpful to work with a veterinarian to develop a mastitis control strategy, as individual cases, even if treated properly, result in udder damage.

White Muscle Disease

White muscle disease is a degenerative muscle disease found in sheep and goats. It is caused by a deficiency of selenium and/or vitamin E. Selenium deficiency is associated with areas where the soil is deficient in selenium, while a vitamin E deficiency reflects poor forage quality. White muscle disease is most often seen in newborns and fast-growing animals.

White muscle disease may affect skeletal muscles, heart muscle, or both. When the skeletal muscles are affected, the animal will arch its back with a hunched appearance, and have a stiff gait. When the heart muscle becomes affected, the animal may present with difficulty breathing; fever; and frothy, blood-stained nasal discharge.

Other clinical signs associated with selenium and vitamin E deficiency that may be seen along with white muscle disease include reproductive losses such as lower conception rates, fetal re-absorption, dystocia, retained placenta, reduced milk production, reduced semen quality, and reduced immune response.

White muscle disease can be treated with an injection of both vitamin E and selenium since the condition may be caused by a deficiency in one or both. Affected animals will usually respond to a single treatment within 24 hours, and a second dose of vitamin E (though not selenium) may be given if individuals are unresponsive. Treatment should not exceed two doses on a short-term basis.

Selenium and vitamin E deficiencies occur when animals are fed feedstuffs low in one or both compounds. Indiana and Kentucky, and most surrounding states, are known to have selenium-deficient soils. The disease can be prevented through feed and mineral supplementation. Injections of selenium and vitamin E can also be given, but a producer should get advice on the use of these injections from a veterinarian.

Pregnancy Toxemia

Pregnancy toxemia (ketosis) affects ewes or does during late gestation. It occurs more commonly in sheep than goats. It occurs most commonly in either fat or thin animals that carry two or more feti. The condition develops when the ewe or doe cannot ingest enough nutrients to meet both the glucose requirements of the growing fetus and her own body metabolism. During early gestation, the dam's increased appetite is enough to encourage her to compensate for the increased nutrient needs. By late gestation however, the growing feti are taking up more space in the dam's abdomen, and she is often physically incapable of eating enough to meet her needs unless more nutrient-dense feeds are provided.

If adequate energy is not available to the gestating ewe or doe, she can metabolize body fat to meet her own nutrient requirements. When fatty acids are metabolized at high rates, ketone bodies are produced, which can be dangerous in high levels. The condition where excess ketones are present in the bloodstream, known as ketosis, results in depression and anorexia until the ewe or doe becomes too weak to stand.

Producers can take steps to prevent pregnancy toxemia by properly managing the weight of ewes or does throughout the year, and especially prior to breeding and during gestation. Ewes and does should be body-condition scored at breeding, as overweight and excessively thin ewes or does are at a higher risk for ketosis. They can also be ultrasounded during pregnancy to determine fetal number, and animals gestating multiples can be fed and managed differently than those with singles. If possible, ewes or does should then be divided into two pens and managed differently during gestation to minimize their risk of toxemia. While it is acceptable for overweight ewes or does to lose weight during the first two trimesters, they should be gaining weight by the third trimester.

Feeding grains with increased energy density during the third trimester, or about six weeks prior to lambing or kidding, will help to prevent pregnancy toxemia. Providing higher quality hay is also a good idea for gestating ewes or does. Shearing ewes also makes it easier to monitor body condition and causes increased feed intake.

Lactic Acidosis

Ruminal lactic acidosis, often referred to as grain overload, develops as a result of animals consuming large quantities of carbohydrates. Excessive consumption of carbohydrates, specifically grain, results in a lowered rumen pH. The lowering of ruminal pH, or making the stomach more acidic, occurs because the microbial population of the rumen is not able to metabolize high levels of lactic acid produced during starch breakdown. In general, sheep or goats with the condition demonstrate symptoms of discomfort, anorexia, teeth grinding, muscle twitching, ruminal stasis, and diarrhea that may be off in color with a watery consistency.

The type and intensity of clinical signs depends on acid quantities, which in turn depend on the amount of starch consumed and the ability of microorganisms to metabolize the acids. In sub-acute acidosis, animals may simply decrease intake of high grain or starch diets, while in severe acute cases of grain overload, animals can become extremely sick and the mortality rate is high.

To avoid inducing lactic acidosis in sheep and goats, high grain diets should be introduced slowly over a period of 10 to 14 days to allow rumen microbial adjustment to the diet. Dietary buffers, such as limestone or calcium carbonate, can also be fed to neutralize acid present in the rumen and keep appetite and feed intake high. Do not store grain in areas where sheep or goats can access it easily. Carbohydrate engorgement, resulting in lactic acidosis, can be potentially fatal and result in large economic losses for the producer.

Copper Toxicity

Sheep are especially sensitive to copper poisoning, which may occur in either an acute or chronic form. Acute poisoning can result from accidentally providing excess amounts of copper in mineral mixes or incorrectly balanced grain rations. Low levels of molybdenum or sulfate in the diet can also affect copper metabolism and often predisposes sheep to chronic copper poisoning. Chronic copper poisoning is brought about when sheep ingest too much copper over an extended period of time.

Sheep are especially sensitive to copper in their diet, because they do not excrete copper from the body as efficiently as other species. Ingested copper is bound very tightly in the liver. When the liver becomes saturated, large amounts of copper are released into the bloodstream, resulting in destruction of red blood cells and further tissue damage. Often, sheep do not even exhibit noticeable clinical signs before death.

Preventative management strategies are the best way to minimize the risk of copper toxicity in sheep. This includes providing only feed that is formulated for sheep—with the appropriate levels of copper. Be wary of beef and dairy products as they may contain high levels of copper. Feeds and forages can be tested for levels of copper, molybdenum, and sulfur. Molybdenum can be supplemented at a rate of 3 ppm if levels are low.

Treatment of sheep with copper toxicity should be done by a veterinarian. It usually involves drenching or feeding ammonium molybdate, sodium sulfate, and penicillamine over several weeks. Recovery is variable, so prevention is the best way to reduce the incidence of copper toxicity.

Nutrition and General Management

Nutrition is vital for raising healthy livestock and for proper reproductive management. Flushing, or feeding females so that they gain weight prior to breeding, will help them to conceive. Forages should be used as much as possible when feeding sheep and goats, but producers may need to supplement with protein or energy, depending on nutritional demands. Important times to supplement are during late gestation, during lactation, during growth of replacement breeding stock, and prior to breeding.

Minerals and salt should also be provided year-round in a block, mixed in feed, or loose. Minerals used should be designed and formulated for the species of animal being fed. Goats should be fed minerals formulated for goats, and sheep should be fed minerals formulated for sheep. Remember to pay particular attention to copper content of feeds and minerals used for sheep as they are very susceptible to copper toxicity. Proper mineral nutrition can enhance the immune system of animals. Well-fed livestock are more resistant to diseases and parasites, so balanced rations appropriate for production stage should be fed in order to maintain body condition and control losses due to parasitism and infectious diseases. Any changes in feeding should be made gradually.

Summary

Check List for Maintaining Health of Sheep and Goats

1) Implement a vaccination program, primarily for clostridial diseases and tetanus.
2) Have an effective parasite control program; consider implementing FAMACHA.
3) Quarantine new additions to the herd for at least 30 days. Require visitors to cover feet so they do not track infectious agents between farms.
4) Provide adequate nutrition for optimal reproductive capability and to reduce susceptibility to disease and parasitism.
5) Maintain clean, well-ventilated housing without drafts.
6) Keep a closed herd/flock to avoid many health problems.
7) Establish a working relationship with a veterinarian to prevent and treat health problems.

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PURDUE AGRICULTURE 9/09

JOURNEYMAN FARMER
CERTIFICATE PROGRAM

Small Ruminant Production

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Session 3
Health and Diseases

Charlotte Clifford-Rathert, DVM
State Extension Specialist - Small Ruminants
Lincoln University

Learning Objective

- List some of the most common diseases of goats and sheep and understand how to prevent or treat them

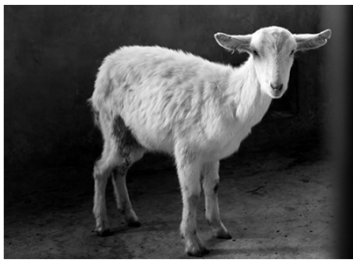
Know What 'healthy' Looks Like

- Runs to feed
- Bouncy, springy step
- Bright eyes
- Carries head upright
- Flashy tail
- Healthy coat
- Playful
- Round solid pellets (stool)

Photos: Susan Schoenian

Signs of Problems

- Depressed, not getting up and moving around
- Standing hunched with head and tail down
- Coughing, wheezing, and/or breathing hard
- Not interested in others and playing
- Off feed/not eating
- Grinding teeth
- Dull eyes
- Diarrhea
- Runny nose
- Lameness
- Poor body condition



Photos: Susan Schoenian

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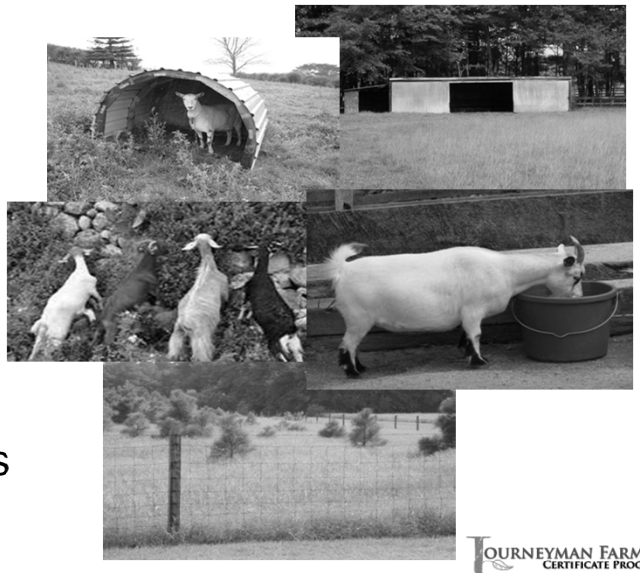
Good Management = Good Health

- Adequate Facilities
- Quarantine / Isolate
  - Prevent introduction of disease and parasites to animals on farm
- **KEEP RECORDS**!
- Adequate forage & water (1-4 gallons head/day; warm in winter, cool summer)
- Good NUTRITION supports the immune system; learn to body condition score



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Basic Vaccination Program

- Vary from farm to farm, vaccinate production animals annually
- Lambs and kids: 5-6 weeks of age, booster at 8-9 weeks
- CD&T vaccine, prevent “over-eating disease”/ bloody scours; especially important when:
  - Feeding high concentrate diets
  - Dehorning and castrating, to prevent tetanus
- 7 or 8-way (contains 7-8 Clostridium serovars - (Blackleg, Malignant edema, Red Water); if not an existing problem, may be added expense

Photo: Susan Schoenian

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Watch for Signs of Parasites*

- <u>Pale gums and eyelids</u>
- Poor weight gain
- Weight loss
- Bottle Jaw
- <u>Diarrhea</u>
- Decreased milk production
- Poor hair coat
- Parasites are worse when it is hot and humid

*More information will be provided in another session on parasite control.

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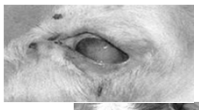
Pinkeye
(a.k.a. infectious keratoconjunctivitis)



Photos: C. Clifford-Rathert

- Highly contagious
- Many different infective agents: Chlamydia, certain viruses, and mycoplasma (different from cattle)
- Usually completes its course in three weeks
- Eye medications containing antibiotics may be helpful
- No effective vaccines available

Soremouth (a.k.a.Orf or Contagious Ecthyma)

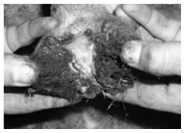
Photo above: C. Clifford-Rathert
Photo below: N. Whitley

Photo: Susan Schoenian

- A ***contagious/zoonotic*** disease - ***other animals/humans can get; reportable in GA***
- Isolate animals to prevent contamination
- Clean all feed and water buckets thoroughly (CHLOROX)
- If you remove the scabs, **wear** gloves, scrape off scab until raw and treat with 7% iodine to control
- A vaccine is available for prevention if a problem on the farm

Footrot and Foot Scald

Photos above: Susan Schoenian



Foot scald photo: www.county-vets.co.uk/

- From standing in muddy/wet areas
- Bacteria: *Fusobacteria necrophorum* (common in soil) and *Dichelobactor nodosa* (found on skin; survives 2 wks if not in hoof)
- Starts with lameness
- May affect one foot or more, and may be periodic, the foot be swollen and red with a bad odor and painful to the touch
- Successful treatment requires early diagnosis

Treatment

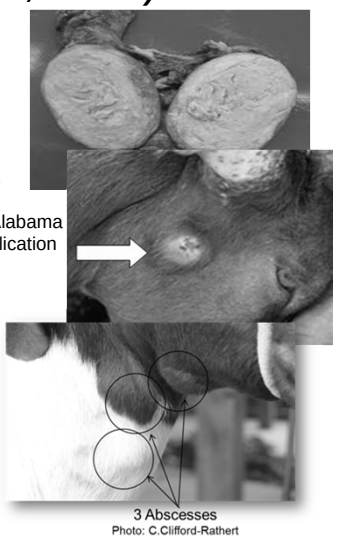
Photos: Susan Schoenian

- Isolate infected animals
- Penicillin
- Tetracycline
  - Intradigital (LA-200)
  - Crumbles on top of feed
- 10% copper sulfate foot bath
- 10% zinc sulfate foot bath
- Hydrated Lime / drylot
- Therapeutic foot trimming

Caseous lymphadenitis (a.k.a. CL, CLA)

(boils, abscesses, cheesy gland disorder)

- *Corynebacterium pseudotuberculosis*
- Pale green then cream colored “cheesy” pus
- Bacteria get in through a wound or breathing/eating it
- External or internal abscesses
- Treatment - isolate infected animals and:
  - Lance, drain and flush + antibiotics (Vet)
  - Infuse with saline flush + antibiotics (Vet)
  - **NOT FORMALIN**
- Prevent/control: do not buy, disinfect areas where abscesses have drained and all equipment, prevent spread at shearing time, vaccine (not goats), blood test, CULL
- Reportable in GA



Photos: Alabama CES Publication UNP-85

3 Abscesses
Photo: C.Clifford-Rathert

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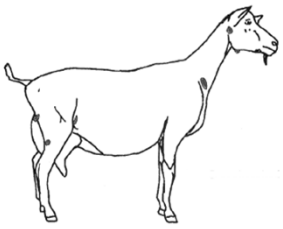
External Abscesses

More common in goats

- One or more abscesses
  - Sheep – shoulder (near the neck), thigh (near the flank)
  - Goats – under the jaw or on the neck
- Easily spreads to other animals if it bursts
- Decreases pelt value
- Transmissible to humans



Goat Medicine by Dr. Mary Smith and David Sherman

Internal Abscesses

More common in sheep

- Involves the lymph nodes and other organs (kidney and liver)
- Causes weight loss, poor health, reduced wool and milk production
  - “Thin ewe/doe syndrome”
- Third most important cause of carcass condemnation

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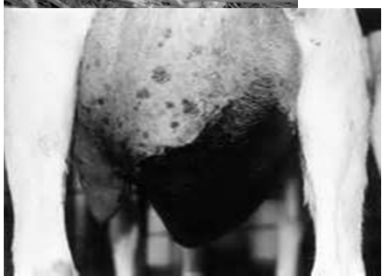
Mastitis

- Inflammation/swelling of the mammary gland or udder
- Udder painful, hot, and hard; will not allow lambs/kids to nurse
- Can lose milking ability in the udder (or part of the udder completely)
- Control with good management practices (clean, dry areas for lactating animals; start drying up does/ewes before weaning)
- Isolate infected animals
- Peppermint oil helps with swelling
- Antibiotics/pain meds



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Listeriosis

- Caused most commonly by *Listeria monocytogenes*
- Three main forms:
  - Neurological (encephalitis/brain) – off feed, depressed, excessive salivation, leaning to one side, circling, stumbling, standing against wall, death within 24-48 hr (treated early 30% recover); usually <2% flock/herd infected
  - Abortive – usually last trimester and with no signs
  - Septicemic/visceral – chronic diarrhea; not common but increasing in small ruminants (has been found in US)
- Treatment (with vet) – very high doses penicillin or other effective antibiotic
- Bad silage can host it; dogs, cats, wild rabbits and other small mammals can transmit it

Photos: www.nadis.org.uk

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Ovine Progressive Pneumonia (OPP)

- Chronic progressive pneumonia of sheep; long incubation (2-4 years)
- Clinical signs in older animals but can affect lambs
- Mastitis ("hard bag"), pneumonia, arthritis, encephalitis, and rarely hind limb paralysis
- Chronic wasting despite good appetite
- Death within 1 year of symptoms
- Can test for it
- Reportable disease

Photo: Susan Schoenian

Caprine Arthritis Encephalitis Virus (CAE)

- Common dairy goat problem
- Lifelong infection
- Several forms:
  - Neurological (young kids 2-6 mo)
  - Decreased/no milk (young does)
  - Arthritis (2 yrs & older) – front legs
  - Respiratory disease (adults any age)
  - Weight loss
- Passed on through milk/colostrum not heat treated; can test animals for it; avoid getting it, if have it, work with vet to get rid of it

Dairy goat - photo by: Susan Schoenian

Johnes Disease (Paratuberculosis)

Mycobacterium avium paratuberculosis

- Chronic wasting disease
- Goats do not get diarrhea like cattle
- Transmission is fecal-oral
- Clinical signs: progressive weight loss without diarrhea, appetite remains intact initially but decreases later on, leading to severe emaciation
- Goats 2-3 years of age
- No known treatment
- More prevalent in dairy goats

Overeating

(a.k.a Enterotoxemia, Acidosis, Grain Overload)

- Caused sudden change in diet – i.e. grain eaten by animals not used to it or a lot eaten by very hungry animals
- Can occur 6-12 hours after ingestion
- "Feed-bunk Disease"
- Signs: off-feed, dull, irritable, swollen belly, severe diarrhea, dehydration, sunken eyes, staggering, collapse, coma and death.

Photo: Susan Schoenian

Treatment

- Best to **PREVENT**!
  - Remove cause (feed properly)
  - Do not feed grain free choice to animals not used to it or starving animals
  - Vaccinate properly with CD &T (combination enterotoxemia and tetanus toxoid)
  - If putting in feedlot, changing diets or stressing them, give a booster 3-4 weeks beforehand
  - Feedlot: one injection as brought in (at weaning), booster 3-4 weeks later

Photo: Susan Schoenian

Pregnancy Disease (Ketosis)

- A nutritionally based disease
- Common in overweight does/ewes carrying twins or triplets; also seen in poor condition animals
- Brought on by stress including storms, transport, fasting, excessive heat, and poor nutrition
- Causes low blood sugar leading to ketosis and death
- Signs: stumbling, no energy, no appetite, wandering, leaning on things, twitching ears, eyes, tail; teeth grinding, urine ketones, blindness, loss of reflexes, paralysis, lying on chest, coma, death

Treatment

Photo: Susan Schoenian

- Need a vet!
- Not always successful
- Treat with glucose-producing substances such as propylene glycol, maple syrup
- Give intravenous (i.v.) fluids with dextrose (Vet)
- Remove of kids/lambs by c-section or by inducing labor
- Give steroids per veterinary recommendation
- Best to prevent: proper weight/body condition during pregnancy; feed adequate energy in late pregnancy; reduce stress

Chlamydia (*Chlamydophola abortus*)

Ovine Enzootic Abortion - OEA

Photo: Susan Schoenian

- Most common cause in North America
- Zoonotic potential- placenta, uterine fluids, feces and lungs
- Usually late term abortions; recovered females a immune
- Diagnosis: placenta cotyledons are gray-brown and leathery
- Isolate affected ewes/does
- Can prevent future/additional abortions with antibiotics (usually tetracyclines; consult vet)

Campylobacter- Vibrio

Photo: Susan Schoenian, Baalands Farm

- *Campylobacter fetus* and *jejuni**
- Not sexually transmitted in sheep
- Ingestion of organisms
  - Can have carrier state 20-70%
- Abort late gestation, last 6-8 weeks
- Lambs born weak or dead
- Ewes are sick and can die, but will recover and be immune next year but become carriers
- Diagnosis – need placenta and fetus (for stomach fluid and liver); Fetus is edematous (“Water belly babies”)

Toxoplasmosis

Photo: Susan Schoenian

- Cats shed oocysts in feces
  - Oocysts survive a long time in the environment
- Zoonotic potential
- Placenta is infected 14 days after ingestion
  - Infection: <50 d gestation = fetal death/ reabsorption
    60-100 d gestation = fetal death
    120 d gestation= no affect on fetus
- Abortion late pregnancy = 15-20%
- Diagnosis - need placenta and fetus
- Feeding monensin in mineral suppresses infection (Vet Rx)
- Prevent: control cat population, store feed in container

Scrapie

- A fatal degenerative disease (TSE) that affects the central nervous system of goats and sheep. Incubation period is 2-5 years
- Clinical signs develop slowly: behavioral changes, tremors, scratching and rubbing against objects, incoordination (high stepping, hopping like a rabbit, swaying in the back end)
- An infected animal may appear normal if left undisturbed at rest. However, when stimulated by a sudden noise, excessive movement, or the stress of handling, the animal may tremble or fall down in a convulsive state
- Reportable Disease in all states
- Tag and keep records of all goat and sheep sales and purchase. Save and maintain records for five years.
- All goats or sheep leaving farm premises should be tagged
- Prevention: testing and genetic selection, maintain closed herds/flocks

State ID Requirements: Georgia

- In addition to Federal requirements, Georgia requires official individual identification of all high-risk goats (those in contact with sheep) as well as official ear tags on all sheep going to a livestock market; new proposed protocol will likely include ALL goats
  - Complete information is available by contacting:
  - Dr. Robert Cobb Jr, SV
    Ph: 404-656-3671
    Email: Robert.cobb@agr.Georgia.gov
  - Dr. Stan Crane
    Designated Scrapie Epidemiologist
    Ph: 404-656-3667
    Email: stan.crane@agr.Georgia.gov
- If in doubt, tag them!!!
- Scrapie tags are FREE and available by contacting the USDA
  - 1-866-USDA-TAG (1-866-873-2824)

Basic Rules to Remember

- **Don't buy sick animals.**
- Select for healthy genetic lines.
- Don't believe everything you hear from someone trying to sell you an animal.
- BEWARE of sale barn buys.
- Keep in mind…there is as much bad info as there is good info…be selective learners.
- KEEP GOOD RECORDS!
- Practice good biosecurity on the Farm!!!!

Additional Resources and References

- Goat Medicine, Dr. Mary Smith & Dr. David Sherman
- Sheep and Goat Medicine, Dr. David Pugh
- Dr. Margaret Masterson, Ohio State University, College of Veterinary Medicine
- www.extension.org/goat
- www.extension.org/sheep
- www.sheepandgoat.com

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

USDA NIFA Beginning Farmer and Rancher Development Program

Developing the Next Generation of Sustainable Farmers in Georgia Grant

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NOTES:

HEALTH AND DISEASES
LEARNING EXERCISE

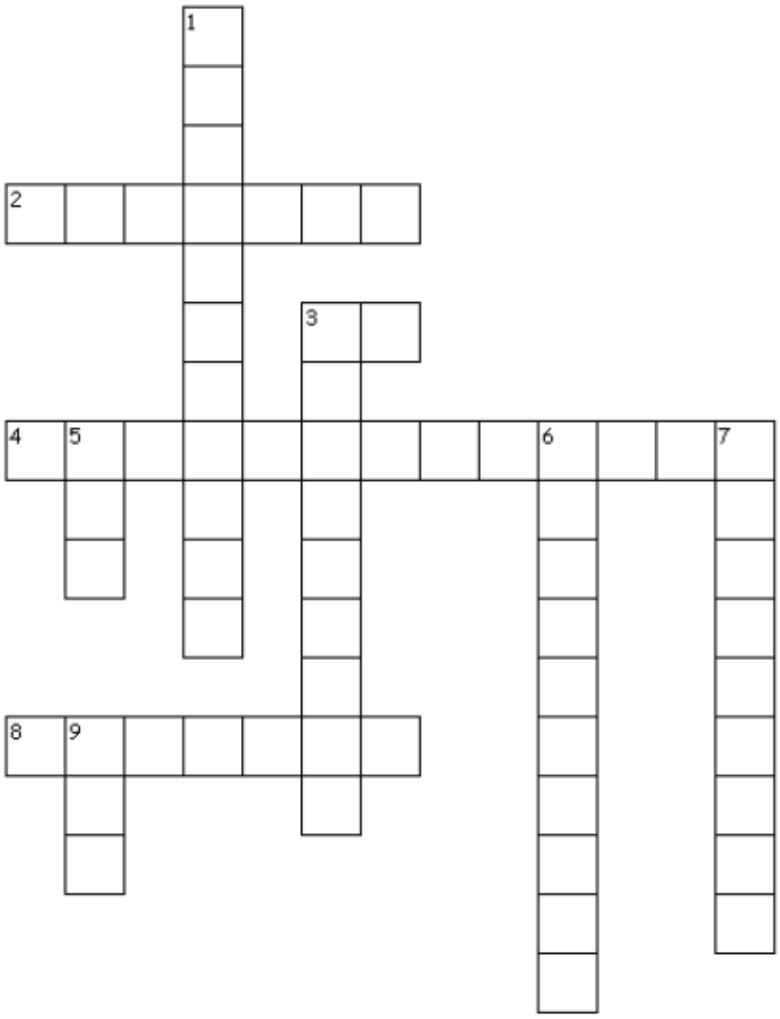
This exercise is designed to reinforce the information presented during the Session and help you apply your new knowledge. It will be used to stimulate discussion and will not be assigned a grade or score.

1. Name at least two diseases that you will be sure to ask breeders if they have had problems with on their farm before buying animals from them. Why did you choose these two? Discuss the answers with the group.

2. True or False (circle one). If the animal and herd it came from looks healthy, it is not necessary to quarantine for a period of time prior to introduction into your herd. Discuss your answer.

3. True or False (circle one). It is important to wear gloves when handling newborn lambs and kids or placenta, even if they are apparently healthy. Discuss your answer.

HEALTH AND DISEASES
OPTIONAL LEARNING EXERCISE



CLUES:

Across

2. Two words no spaces - highly contagious foot or hoof problem caused by two organisms; the hoof wall is eaten away; causes extreme lameness
3. Likely zoonotic disease that causes abscesses or knots near lymph nodes, commonly on the neck near the head externally in goats, but can be found internally and externally in both sheep and goats
4. Abortions spread by cats
8. Mad-cow like disease that is extremely rare; Georgia has a mandatory ID/tagging program for this

Down

1. Zoonotic disease that causes neurological signs (stumbling, circling) but can also cause abortions and chronic diarrhea
3. Also called Enzootic Abortion; late term fetal losses, may get some immunity after have it the first time so may be seen more with the first pregnancy if a problem on the farm
5. Disease with symptoms like pnuemonia, weight loss and hard bag in sheep
6. Two words no spaces; enterotoxemia caused by fast change in diet or eating too much high starch feed at one time
7. Zoonotic disease that causes painful blisters and scabs around the mouth that can spread to any area of exposed skin like the udder and underside of the tail
9. Disease more commonly seen in adult dairy goats causing arthritis, neurological symptoms and chronic wasting (with good appetite)

Goat and Sheep Production – Basics of Breeding
Fact Sheet

Developed by Dr. Niki Whitley, Fort Valley State University

In most areas of the U.S., goats and sheep are seasonal breeders. Although breeding activity is higher in the Fall/Winter (short days) animals may breed at other times with lower fertility and fewer offspring born. If males are kept with the females year-round, proper animal management is challenging. It is difficult to feed properly when animals of all ages-babies, yearlings, and adults-and production statuses-not pregnant, pregnant, and nursing-are all housed together. In addition, vaccinating properly would be difficult, if not impossible, and managing for differences in how easily they get parasites (worms) cannot be accomplished. Therefore, a controlled breeding season, or only putting the male in with females for a set time period, is recommended.

A controlled breeding season (goats 45 days, sheep 35 days) allows a producer to:

- Determine the time period in which offspring are born to better schedule time/labor
- Schedule birthing so animals are ready to be sold around the time of popular holidays or for certain markets – most buyers like larger numbers of animals that are similar sizes.
- Schedule health management procedures such as pre-birthing vaccination and deworming checks; females at the time of birthing and offspring at weaning are more likely to get worms.
- Determine which females and offspring to keep for breeding and which to cull, or remove from breeding herd.
    - It is easier to keep records for breeding and birthing, and you can detect reproductive problems in your females or males sooner if you know when breeding should occur.
    - Animals born at different times will perform differently, so comparing offspring born at different times may not allow you to select those with the best genetics.

Before breeding:

- Make sure females and males are in good body condition (use body condition scoring)
- Deworm if needed, trim feet and check for issues (udder problems or other reasons to cull)
- Decide how you will handle birthing and nursing periods – examples of things to think about: shelter for winter, shade for summer, more parasite issues with late spring/summer born offspring, feeder space, pens for animals that need help during birthing
- Decide on your market, and schedule breeding to have offspring ready for that market; note that it is often more profitable to market at, or soon after, weaning
- Set up a breeding pen(s) considering 1 mature male per 20-30 females or 1 young male (at least 8 months old, prefer at least a year old) per 10-15 females; could stagger breeding groups if very large herd (100+) so start new breeding period every 30 days
- Consider feeding extra energy 3 to 4 weeks prior to breeding and 2 to 3 weeks after to increase chances of twinning (1 – 1.5 lb/head/day of a high energy diet)

Reference: UNP-0117, ACES, Controlled Breeding Season Management for Meat Goats

For more information, contact your local County Extension Center or Fort Valley State University Cooperative Extension Program (478-825-6296).

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Small Ruminant Production

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Session 3
Sheep and Goat Breeding

Dr. Niki Whitley
Extension Animal Science Specialist
Fort Valley State University

Slides/pictures from Dr. Kevin Pelzer, Virginia-Maryland CVM and Susan Schoenian, University of Maryland Extension)

Learning Objective

- Understand best management practices for breeding

Reproductive Characteristics

Characteristics	Sheep	Goats
Age at puberty	5-7 months	5-7 months
Length of estrus (heat) cycle	17 days	21 days
Duration of estrus	36 hours	30-40 hours
Gestation length (around 5 months)	144-151 days	147-155 days

Basic breeding information

- Seasonal breeders (mostly Fall/Winter)
  - Some can breed before or after that time but usually fewer get pregnant and they have fewer babies (mostly singles)
  - Can use hormones to breed out of season (i.e. CIDRs - approved for sheep only)
- Females: Breed first time at 75% of mature body weight and 8-10 months of age
- Males: Usually a minimum of 8-10 months of age (only a few non-aggressive females); preferably at least 1 year; can breed as early as 4 months of age

Estrus (Heat) Behavior

Ewe
- Seeks ram
- Swollen vulva

Doe
- Seeks male
- Wags tail
- Vocalizes
- Swollen vulva
- Clear-cloudy-milky white mucus

Photos: Susan Schoenian

Breeding Management

- Goat females seem to come into heat at the same time when exposed to buck
- If during the breeding season, can use hormones to get the does (or ewes) into heat at the same time for birthing at same time (so can schedule labor) and for marketing
- Prostaglandins, i.m., two shots, 9-11days apart or single shot (60-70%); do not use if previously exposed to males – may abort them; use with veterinarian input
  - CIDRs (use as directed; approved/sold for sheep)

www.zoetisus.com

No products, companies or manufacturers are being endorsed

Breeding Management

- Fewer females per male if synchronized to be in heat at the same time
  - 1 mature, proven male per 30-40 females not synchronized
  - 1 mature, proven male per 15-20 females synchronized
  - Depends on age, breed and time of year (younger males – 1 per 15-20)
  - Large groups: 3-5 males/100 females

Photo: Susan Schoenian

Breeding Management

Two-four weeks prior to breeding

- Feed extra to ewe/does to increase twinning
  - At least 2 weeks prior to introducing breeding males
  - Feed ½ lb of grain per head per day above normal
  - Place on lush/new pasture
- Trim feet and deworm if needed
- Vaccinate for Chlamydia and Campylobacter if needed
- Breeding Soundness exam for males if possible
- Check udders
- Move into breeding groups?
- Male lease?

Breeding Season

- Sheep minimum 28 days, Goats minimum 32 days; controlled season usually around two heat cycles plus a couple of days
- Watch for weight loss in males
- Marking harness can help determine females bred (mounted)/which male bred which female
- Can breed one female at time (hand-mating)

Photo: Susan Schoenian

Photo: Niki Whitley

Breeding Season

- Artificial insemination (AI)
  - Easy with goats (can learn yourself); common with dairy goats
  - Can use expensive/rare breed male (frozen semen)
  - Sheep usually surgical AI (laparoscopic), not as good pregnancy rates
  - VSU doing research into fresh semen and vaginal AI in sheep with pretty good results; teaching producers in their area

Photos: Susan Schoenian

Pregnancy Diagnosis

- Did they come back in heat?
- Trans-rectal/Transabdominal; ultrasound; if experienced can tell at 24 days after male removal (easier the farther along they are)
- Blood test (Biopryn: www.biotracking.com); no earlier than 30 days after male removal

Additional Resources

Goats:

- http://articles.extension.org/pages/19720/goat-reproduction-puberty-and-sexual-maturity
- http://www2.luresext.edu/goats/training/reproduction.html
- http://aces.nmsu.edu/pubs/_d/D704.pdf

Sheep:

- http://aces.nmsu.edu/sheep/sheep_reproduction/breeding_habits.html
- http://ag.ansc.purdue.edu/sheep/articles/repromgt.html
- www.sheep101.info/201/ewerepro.html

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Reproductive Management of Sheep and Goats

The success of a sheep and goat operation depends on the number of lambs and kids raised, weaned, and marketed each year. The percentage of ewes, does, ewe lambs, and doelings conceived early in the breeding season; the lambing, kidding, and weaning percentages; and the percentage of ewes, does, ewe lambs, and doelings lambing and kidding unassisted are some of the most important factors influencing profits in the sheep and goat business.

In other words, production is equal to reproduction.

Although the genetic quality of a sheep and goat herd is important, reproductive traits in sheep have low heritability. Trying to improve the reproductive efficiency of a sheep and goat herd by genetic selection is slow and difficult. Table 1 shows that improving reproductive efficiency in sheep through genetic selection is highly unlikely. Reproductive traits are responsive to environmental influences, however, and they respond to careful herd reproductive management. Some important factors sheep and goat producers must carefully consider are age, weather, season, and nutrition.

Age

Puberty, the time of first sexual activity, has a marked effect on lifetime production. Breed and potential size at maturity create considerable variations in the time of first sexual activity in sheep and goats. Regardless of these factors, puberty is a function of both age and body weight. Nutrition is, therefore, a factor influencing the start of puberty. Overfeeding ewe lambs and doelings to get them to a heavy weight quickly, however, does not guarantee that a high percentage will show estrus early. They must also be old enough to cycle. Overfeeding ewe lambs before they reach puberty at 2 to 4 months has a detrimental effect on mammary development because they deposit excess fat in their udders, which affects subsequent milk-producing ability.

Table 1. Heritability Estimates for Reproductive Traits in Sheep

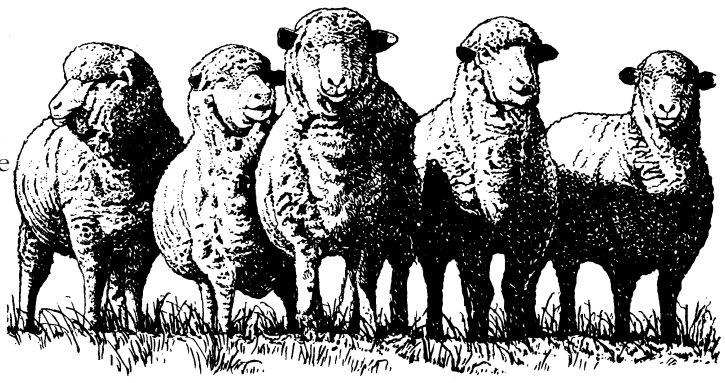
Trait	Heritability (Percent)
Ewe fertility	5
Prolificacy[a]	10
Scrotal circumference	35
Age at puberty	25
Lamb survival	5
Ewe productivity[b]	20

[a] Lambs born per ewe lambing
[b] Pounds of lamb weaned per ewe exposed
Source: Adapted from *Sheep Production Handbook* 2002 edition, Volume 7

Weather—Temperature and Humidity

Sheep are more susceptible than goats to high temperatures and humidity. Stress caused by high environmental temperatures can seriously affect fertility, embryo survival, and fetal development. High humidity increases the risk of heat stress at any air temperature. A rise in body temperature is what actually causes reproductive problems. Increased body temperatures occur most commonly from high environmental temperatures but can also be the result of disease, fever, or any other factor that increases body temperature for an extended time.

If a ewe or doe cannot maintain normal body temperature, ovulation and conception rates decrease and the embryo is less likely to survive when conception does occur. The most critical period for conception and embryo survival in the ewe and doe is the first 21 to 30 days after breeding.



As with ewes and does, fertility in rams and bucks is also affected by temperature and humidity. Heat stress created by environmental conditions or fever caused by diseases that significantly elevate body temperature for an extended time can interfere with sperm production and development, thus affecting semen quality. The fertility of rams and bucks can be affected within days of exposure to extreme heat, and it can take at least 6 to 10 weeks before sperm quality returns to normal.

Shearing the ewe flock and rams 2 to 4 weeks before breeding can help reduce heat stress. Rams can also be turned out only at night during hot weather to minimize heat stress. Extremely cold temperatures can be harmful too, especially during bitterly cold weather with high wind and wind chill. The scrotum and even the testicles can freeze in such extreme conditions. Stress from periods of sickness can also slow or stop sperm production temporarily.

Nutrition

The nutritional status of a herd is the most important factor influencing reproduction. It is also the factor over which the producer has the most control by either increasing or reducing nutrient consumption.

The body condition of a ewe or doe strongly affects the following:

- the time at which puberty starts
- the conception rate at first estrus in ewe lambs and doelings
- the length of the postpartum interval
- the health and vigor of newborn lambs and kids

Body condition or changes in body condition before and during the breeding season affect reproductive performance in terms of services per conception, lambing and kidding intervals, and the percentages of open ewes and does. Ewes and does should be in good body condition at lambing and kidding and should maintain good body condition during the breeding season. Bucks and rams should also be evaluated for proper body condition.

The beginning of sexual activity is called puberty, which is the first time a ram or buck produces sperm cells capable of impregnating a ewe or doe. Most rams and bucks reach puberty between 5 and 9 months depending on body weight, nutrition, breed, and various environmental factors. Puberty in the ewe lamb and doeling is the time when she shows her first heat with ovulation, which is the release of the egg from the ovary. Puberty in the ewe lamb and doeling is also affected by many factors.

Sheep and goat producers usually breed ewe lambs and doelings at the same time. Replacement ewe lambs and doelings born early in the season reach puberty earlier than those born late in the season because of their increased age and body weight. Ewe lambs and doelings will reach puberty by 5 to 8 months if they have gained sufficient weight. Recommended target weights are 50 to 70 percent of adult weight. However, a ewe lamb or doeling should weigh at least 60 percent of her mature weight when she is bred for the first time. Ewes and does that lamb and kid early breed back earlier in the next breeding season. Therefore, it is essential that ewe lambs and doelings reach puberty early in a breeding season so they can be bred as early as possible.

Estrus, Sign of Estrus, Length of Estrous Cycle, and Ovulation

Estrus, or heat, is the period of time when the female is sexually receptive to the ram or buck. Sheep and goats are seasonally polyestrous and short-day breeders, meaning they will cycle regularly starting with the shortening days of fall. The most natural time for sheep to breed in Alabama is from August through December. For goats, the most natural time is usually from late July through December, but tropical breeds may cycle throughout the year.

The signs of estrus in ewes are less noticeable than they are in does. A doe in heat is restless, bleats and urinates frequently, and wags her tail rapidly. She may also experience loss of appetite and rub against other goats in the herd. Other signs include redness and swelling around the vulva, which may have a thin mucous discharge.

The signs of estrus in the ewe are not as easily detected when the ewe cannot hear, smell, or see the ram. Sheep and goats do not mount, or stand to be mounted, as often as cattle do. They will demonstrate this behavior when they are in heat by seeking out a ram or a buck and standing to be mounted by him or other ewes and does.

The estrous cycle is the period of time from the beginning of one heat period to the beginning of the next. The average cycle length is 17 days for sheep and 21 days for goats, with most cycles falling between 14 and 20 days for sheep and between 18 and 22 days for goats. Estrus can last from 24 to 36 hours in ewes and 24 to 48 hours in does. Ovulation normally occurs toward the end of estrus. Typical ovulation times for the ewe are about 24 to 27 hours from the beginning of estrus and about 24 to 36 hours from the beginning of estrus in the doe. An ovulation rate is the numbers of eggs produced per cycle. For ewes and does, the rate ranges from 1 to 2 per cycle; up to 3 eggs are occasionally ovulated. In both sheep and goats, the ovulation rate increases with age and reaches a maximum at 3 to 6 years, then declines gradually. Following ovulation, sheep and goat eggs are generally capable of fertilization for 10 to 25 hours.

Conception and Early Pregnancy

When a ewe or a doe is successfully bred to a fertile ram or buck, sperm cells meet the eggs in the oviduct. One sperm cell enters the egg and conception occurs. Maternal recognition of pregnancy in sheep occurs by day 13 and in goats by day 15 following conception. In sheep, embryonic implantation occurs by day 21 after conception. In goats, the fertilized embryo becomes firmly attached to the uterine walls by day 52. Implantation allows nutrient exchange and hormonal communication between the developing embryo and uterus.

Middle and Late Gestation—Fetal Growth and Maternal Support

During middle gestation, the ewe and doe have their lowest nutritional requirements. In late gestation (the last 50 days), nutrition is critical because 70 percent of fetal growth occurs during this time. Lack of adequate nutrition for the pregnant ewe or doe during the latter part of gestation will influence the offspring's birth weight, vigor, and survival. Poor nutrition during this period will also reduce the ewe's or the doe's level of milk production and, thereby, reduce the lamb's or kid's weaning weight. A ewe or doe should not be allowed to lose weight during this period.

An unborn lamb or kid receives its nutrients from the maternal blood circulation across the placenta. It is like a parasite living within the mother. Fetal development and growth have priority over any maternal needs, often at the expense of the ewe's or doe's own well-being.

Lambing and Kidding

Lambing and kidding time, known as parturition, is a very critical period in a producer's management schedule. Lambing and kidding usually occurs at the end of a 147- to 155-day pregnancy. Proper preparation, good breeding records, and personal notes will allow you to increase the survival rates of newborn lambs and kids. Table 2, based on a 148-day gestation period, can assist you in predicting the date of lambing and kidding. You should, however, watch your ewes and does closely beginning about 142 days after breeding. If you do not know breeding dates, a good rule of thumb is to watch for udder development and looseness of the vulva. Enlargement of the udder can be seen as early as 4 to 6 weeks before lambing and kidding. This development is less noticeable in first-time pregnancies than it is in later pregnancies. Both psychological and anatomical changes indicate impending lambing and kidding. Many ewes, does, ewe lambs, and doelings appear restless as lambing and kidding time approaches. Some separate from other animals and look for a secluded area in the pasture or barn. Swelling of the vulva and relaxation of the pelvic muscles and ligaments are noticeable. The tail may rise, and the lambs and kids will appear to have dropped in the abdomen. The udder will become hard because of a mammary secretion, known as colostrum, near the time of parturition. The teats become swollen and enlarged. Signs of impending parturition are useful, but they vary so much that producers should be cautious when interpreting them.

Lambing and kidding are divided into three distinct stages of labor and can last from a few to several hours. Ewe lambs and doelings generally have a longer labor than ewes and does, and assistance may be required. The first stage of labor involves the beginning of uterine contractions and dilation of the cervix, which can last several hours. During the first stage, the ewe or doe will frequently separate herself from the herd. The end of stage one is sometimes marked by the appearance of a thick, clear, whitish mucous discharge in sheep, and of a tan, sticky substance smeared about the hind parts of the doe.

Stage two involves the actual birth of the lamb or kid and can take a few minutes or as long as 3 to 4 hours. As labor progresses, the ewe or doe will spend more time lying down on her side, with her head in the air or extended forward with front and rear legs touching the ground. The uterine and abdominal muscles have strong contractions during this stage. Soon a large bubble or water bag will appear, break, and expel the water. At this time during a normal birth, the tip of the nose and front feet of the lamb or kid can be felt; they are ready to enter the vagina. As labor progresses, the lamb or kid is forced along the vagina until its toes and nose are visible at the vulva. When the head has passed the vulva, the lamb or kid is born quickly. As soon as the ewe or the doe has delivered her lamb or kid, she starts cleaning it—licking its nose and the remainder of its head. If the ewe or doe is to have multiple births, interest in the previous lamb or kid will usually cease after the head is cleaned. She will return to labor, a water bag will appear, and soon another lamb or kid will be born.

The third stage of lambing or kidding consists of the expulsion of the afterbirth or placenta. The placenta is a red, shiny mass that many inexperienced sheep and goat producers mistake for part of the ewe's interior, a dead fetus, or a tumor. The placenta will have strawberry-like lumps and may have whitish cords. It will be expelled naturally about 2 to 3 hours after final delivery of the lamb(s) or kid(s). In multiple births, each lamb or kid will have a separate placenta. If the placenta is not expelled within a few hours, call your veterinarian. A retained placenta can result in a uterine infection.

You may miss the expulsion of the placenta if you do not check the ewe or doe at regular intervals. Some ewes and does may eat the placenta quickly, because her instincts are to hide the evidence of her lambing or kidding

Table 2. Gestation Table for Lambs and Kids

Aug	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	**Sep**
Jan	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Sep	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	-	-	-	**Oct**
Feb	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	-	-	-	
Oct	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	**Nov**
Mar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Nov	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	-	**Dec**
Apr	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	-	
Dec	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	**Jan**
May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Jan	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	-	**Feb**
Jun	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	-	
Feb	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	**Mar**
Jul	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Mar	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	**Apr**
Aug	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Apr	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	-	**May**
Sep	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	-	
May	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	**Jun**
Oct	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Jun	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	-	**Jul**
Nov	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	-	
Jul	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	**Aug**
Dec	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

Find breeding date in upper line; look below to find lambing or kidding date. Based on a 148-day gestation period.

Source: *Sheep Pocket Guide* AS-989, North Dakota Extension Service, Fargo, North Dakota.

to protect her offspring from predators. Properly dispose any remaining afterbirth so dogs and predators are not attracted to it.

Assistance at Lambing and Kidding

If the lamb(s) or kid(s) are in a normal position in the uterus and the environmental conditions are favorable, no assistance will be required. A normal lambing or kidding usually takes 5 hours—4 hours for dilation of the cervix and 1 hour for the actual delivery of the lamb or kid (Table 3). However, ewes and does that have been in stage two for 30 to 45 minutes without apparent progress may be having a difficult time. Personal experience and judgment are critical. Some people assist after 30 to 45 minutes so the ewe or doe does not become exhausted; others prefer to wait longer until fatigue is evident.

The two main causes of death for lambs and kids at birth are delayed assistance and assistance without sufficient skill. When stage one of labor has been in progress for more than 4 hours with no sign of the lamb or kid and the ewe or doe appears to be in unusual discomfort (standing, arching her back, and spreading her legs as if to urinate), the cause should be determined. Restrain the ewe or doe before attempting to assist her. Follow these three steps: entry, examination, and manipulation. Every lambing and kidding is unique and demands a different action.

Many sheep and goat producers are skilled in areas of production but do not know their limitations. The principal ingredients for success when assisting with lambing or kidding are complete sanitation of the hands, knowledge of the anatomy of the reproductive tract, gentleness, patience, experience, and good judgment. Call a veterinarian if you are unsure of your skills in helping your animal.

Before assisting in the lambing or kidding process, remove all jewelry from your fingers and wrists. Trim your fingernails as close as possible, and scrub your hands and arms up to the elbows, preferably with surgical or highly antiseptic soap. Mild soap, either liquid or bar, will work too. Rinse in clean, warm water. Wash the external genitalia of the ewe and doe with a mild, soapy solution and disposable, sterile gauze or sterile cotton balls.

Lubricate your dominant hand with a sterile jelly. Begin by inserting three fingers in the vagina and gradually enter the entire hand. Carefully work your hand into the vaginal canal and assess the presentation. Quickly determine the

position of the lamb or the kid. When you feel the lamb or the kid, be sure you can tell the rear from the front and the forelegs from the hind legs. If you cannot tell the difference, stop and ask for qualified help. Some of the major frustrations experienced during the examination are working with one hand, feeling blind because you cannot see what is going on, and being unfamiliar with everything you feel with your hand.

Equipment for Lambing and Kidding

To be ready for lambing and kidding assistance, you need two clean buckets, mild soap for cleaning the genital area of the ewe or the doe, disinfectant, and commercial obstetrical lubricant. Do not use soap as a lubricant. Soap is irritating to the vaginal membranes and can cause inflammation and swelling of the reproductive tract that can result in a long uterine involution or recovery from lambing or kidding. You should also have vinyl gloves, KY Gel, Septi-Lube, or mineral oil for your hands to facilitate vaginal entry during a difficult delivery. Always wear disposable gloves to minimize the potential for zoonotic disease transmission. Fingernail clippers and an emery board to keep your fingernails short and smooth should be part of every kit. You might need a lamb puller, obstetric leg snare, or obstetric chain. Paper towels, old towels, and rags to dry newborn lambs or kids should also be part of your equipment.

Another set of equipment should be available to take care of the newborn. The newborn kit should include bottles, nipples, and a stomach tube in case the lamb or kid needs help getting colostrum, a thermometer, and a tincture of iodine (7 percent solution) for saturating and disinfecting the umbilical cord.

Normal and Abnormal Presentations During Parturition

Normal lambing and kidding in sheep and goats should be completed within 2 hours after the water sac appears. The most common types of presentations are anterior and posterior. In an anterior presentation, the front feet, with the head resting between them, appear first. When the head has exited the vulva, expulsion of the lamb or kid quickly follows. The appearance of the hind feet first is called posterior presentation, which may be a little slower than the anterior type and not as easy to deliver. The lamb or kid may also be twisted or turned in many different ways. Following are the common presentations and directions for assisting with each. Remember, when in doubt, call your veterinarian for assistance.

Head first with both forelegs, body right side up (Figure 1). This is an anterior presentation that occurs when the front feet appear first with the head resting between them. Rarely is any assistance necessary. However, when a small ewe or doe is delivering a very large lamb or kid, she may encounter difficulty getting the lamb or kid through her narrow vulva. Lubrication and gentle assistance are sometimes required. Pull downward and only during the contractions. The lamb or kid is usually hung by the shoulders, and the contractions that follow will pass the shoulders through the remainder of the birth canal.

Figure 1. Head first with both forelegs, body right side up

Head first with one foreleg, body right side up (Figure 2). In this situation, you must bring the other foreleg forward. Try to elevate the ewe's or doe's posterior. Sometimes if the rump is elevated, the lamb or kid will recede into the abdominal cavity and naturally reposition itself. However, you will probably have to reach in and bring the other leg up beside the foreleg that is in the correct position. Such action will bring the legs farther in front of the head than normal. The head will often turn back when an attempt is made to pull both legs and the head into the birth canal. Be gentle as you work your way in. Use only one or two fingers if possible. A synthetic sterile cord (⅛ inch in diameter) may be required but only as a last resort. Make sure you bring up a foreleg and not a hind leg.

Figure 2. Head first with one foreleg, body right side up

Head bent down with forelegs correct, body right side up (Figure 3). This presentation, though abnormal, is neither unusual nor very difficult to correct. Push the lamb or kid back into the uterus. Try to elevate the ewe's or doe's rump so the lamb or kid will recede into the abdominal cavity and give you more room to move your hand in the uterus. Place the head on the forelegs. The contractions that follow will usually force the lamb or kid out as long as it maintains the correct position.

Figure 3. Head bent down with forelegs correct, body right side up

Head thrown back with forelegs correct, body right side up (Figure 4). This is almost the same presentation as shown in Figure 3. Remedial procedures are the same. Remember that you must move the head far enough back to turn it around.

Figure 4. Head thrown back with forelegs correct, body right side up

Hind feet first, body right side up (Figure 5). This is a posterior presentation that is slow and laborious but not abnormal. The hind legs are identified by feeling the hock joint and upper leg curvature instead of a straight knee and forearm on the forelegs. When the hind legs are out, you must help. With a very clean rag or towel, grasp both hind legs and pull downward gently with the contractions. Twist the lamb or kid gently from side to side and lubricate it with oil if it becomes too dry. When the rump appears, pull very hard when the ewe or doe pushes. When the lamb or kid starts to move, keep it coming. Be careful to avoid breaking the umbilical cord prematurely.

Figure 5. Hind feet first, body right side up

Hind feet first, body upside down (Figure 6). A large ewe or doe may deliver a lamb or kid in this position without assistance. This happens sometimes with the second presentation in a triplet birth when the birth canal is already enlarged and lubricated by the birth of the first lamb or kid. If assistance is needed, reach for both hind feet, twist, and gently pull downward when the ewe or doe pushes. Continue with assistance as explained above.

Figure 6. Hind feet first, body upside down

Breech position with rump and tail, no feet visible (Figure 7). A lamb or kid cannot be delivered in a breech position. However, patience is advised because a little time may bring the appearance of the hind feet into the birth canal. If the hind feet do not appear after a short time, assistance is required.

Figure 7. Breech position with rump and tail, no feet visible

Sometimes this presentation is confusing because the body is completely in the uterus. Or, if the body is in the birth canal, the rump may resemble the head. Feeling for the tail will help you to discern the presentation. Also check the direction the toes are pointing. If the toes point downward, the presentation is breech. If you feel only the tail, the hocks of the lamb or kid may be against the pelvis and no progress can be made. Bring the hind legs out one at a time, and be very careful to avoid entanglement with the umbilical cord. Continue as with a hind-feet-first presentation.

Head first with one foreleg, body upside down (Figure 8). This is much simpler than it looks if you recognize the presentation from examination. Reach over the top of the lamb or kid by pressing its head down. Then gently grasp the hind feet and pull them into the birth canal. The presentation will be changed into a hind-feet-first presentation, as in Figure 5.

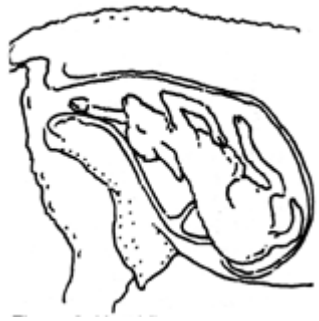


Figure 8. Head first with one foreleg, body upside down

Head alone, no feet visible (Figure 9). Lambs and kids cannot be delivered in this position. Early in the lambing or kidding process, if both feet are not under the nose, push the head back into the uterus. If the lamb or kid does not rearrange itself, then reach in the uterus, grab the forelegs, and place them under the lamb's or kid's head. Resist efforts to expel the lamb or kid by the ewe or doe. Reach under the lamb's or kid's neck with one finger and

hook a leg to pull it forward under the chin. Repeat this procedure with the second foreleg.

Figure 9. Head alone, no feet visible.

Assistance After Lambing and Kidding

In normal lambing and kidding, the ewe or doe can usually take care of the newborn; therefore, it is best not to interfere. Let them establish their bond, but be sure the ewe or doe claims each of her lambs or kids and allows it to nurse before you leave the area. In unusual cases, it may be necessary to wipe the mucous from a lamb's or kid's nostrils to permit breathing. Stimulate breathing by rubbing the inner nostril with a feather or a straw. Artificial respiration methods may be required for some lambs or kids. The first minutes are critical, and any measures must be taken without hesitation to get breathing started.

Nutrition of Newborn Lambs and Kids

A vigorous lamb or kid will attempt to nurse within a half hour to an hour after birth. A weaker lamb or kid takes a longer time before it is up and nursing. Make sure the lamb or kid receives adequate colostrums, the first milk produced by the ewe or doe for a short period following lambing and kidding. Newborn lambs and kids need colostrum soon after birth. It is very important because it provides energy, protein, vitamins, and minerals as well as antibodies that help the lamb or kid resist infections. Colostrum also has laxative properties, removing fecal matter that has accumulated in the digestive tract. Because lambs and kids are born with a low level of vitamin A, colostrum, which is rich in vitamin A, is essential to build up vitamin A reserves. A lamb's or kid's ability to absorb antibodies from colostrum decreases rapidly after birth, and after 36 hours, the newborn is unable to absorb any more antibodies from the colostrum. For optimum immunity, newborn lambs and kids should ingest 10 percent of their body weight in colostrum during the first 24 hours of life. The extra colostrum produced by high lactating ewes and does during the first 24 hours following lambing and kidding can be frozen for later use when needed. Only the first milking from healthy animals should be frozen for later feeding. Colostrum from older animals that have been on the premises for several years is typically higher in antibody content against endemic pathogens than is colostrum from first fresheners. Ice cube trays are ideal containers: once frozen, cubed colostrum can be stored in larger containers and the trays used for another batch. Ice cubes are the perfect size for newborn lambs and kids, thus thawed colostrum is always fresh, and waste is minimized. Thaw colostrum either at room temperature or at a fairly low temperature. Do not warm it in a microwave oven because the heat will destroy the antibodies in the colostrums. Do not dilute colostrum with water.

Lactation—Nutritional Demands

Lactation has priority over all the other physiological functions in the ewe or doe and, most important, over resuming the estrous cycle. If a ewe or doe gives birth during the breeding season, she will be lactating during a time when she not only has to meet the needs for the start and maintenance of lactation, which receives top priority,

Table 3. Stages of Lambing and Kidding, Related Events, and Duration

Stage	Events	Ewe lamb or doeling duration	Ewe or doe duration
Stage One: Preparatory (dilation of cervix)	Lamb or kid rotates to upright position. Uterine contractions begin. Female is very restless.	6 to 12 hours	4 to 8 hours
Stage Two: Delivery (expulsion of fetus)	Lamb or kid enters birth canal. Water sac appears. Water sac ruptures. Front feet and head protrude first. Lamb or kid is delivered.	1 to 4 hours	Less than 1 hour
Stage Three: Cleaning (expulsion of placenta)	Ewe or doe straining decreases. Button attachment between uterus and placenta relaxes and separates. Placenta is expelled.	1 to 8 hours	1 to 8 hours

Source: Adapted from G.H. and D.B. Hudson. 1988. Assisting The Beef Cow At Calving Time. Univ. of Nebraska—Lincoln. Agricultural Publication G81-539A.

but she must also maintain her body condition, repair her reproductive tract, and resume her reproductive cycle. The ability of the ewe or doe to meet these requirements correlates to both her body condition at lambing or kidding and to the level of nutrition she receives after giving birth.

Return to Cyclicity—Hormones

Without estrus and ovulation, there will be no more lambs or kids. The major problem producers have is the lack of estrus activity, which is called anestrus. Lack of estrus is normal during three reproductive stages: (1) before reaching puberty, (2) during pregnancy, and (3) depending on the timing of lambing and kidding, for a short period after parturition. Because ewes and does are seasonal breeders, postpartum estrus is greatly affected by the season.

Breeding Soundness Exams for Rams and Bucks Before the Breeding Season

To help reduce production losses due to infertility, rams and bucks should be evaluated by a veterinarian for breeding soundness 30 to 60 days before the breeding season, allowing time to recheck or replace subfertile rams and bucks. Remember that a good ram or buck is an important part of a breeding program, and a poor ram or buck can ruin your entire breeding program. Evaluation for breeding soundness may be one of the most neglected management practices. The evaluation should include the following:

- Physical examination
- Reproductive tract examination
- Semen evaluation

The physical exam should include observation of all that may interfere with a ram's or buck's ability to locate ewes and does in heat and successfully breed them. The ram or buck must be able to move freely, have adequate senses of sight and smell, carry sufficient body condition to work the length of the breeding season, and be free of diseases. Watch the ram or buck walk. All rams and bucks should be free of structural defects that may affect their ability to breed. Look for conditions, such as lameness, that can affect mobility. The rear legs are especially important because they must support his weight while breeding. Check the feet for swelling and overgrown hoofs. Reject any ram or buck that has poor feet and legs. Any indication of disease, internal parasites, or external parasites should be managed properly. The head and eyes should also be checked carefully.

The reproductive tract exam consists of both an external examination of the reproductive organs and a rectal examination of internal reproductive structures and accessory glands.

Scrotal Circumference

Scrotal circumference is one of the most useful measurements of a ram's or buck's breeding ability. Research indicates that scrotal circumference is highly related to improved semen quality, quantity, and reproductive success. Rams and bucks with larger testicles also tend to sire ewe lambs and doelings that reach puberty at a younger age. Table 4 shows how rams can be classified according to scrotal circumference.

Table 4. Minimum Recommended Scrotal Circumference by Age in Rams and Bucks

Age	Minimum circumference
5 to 6 months	29 centimeters
6 to 8 months	30 centimeters
8 to 10 months	31 centimeters
10 to 12 months	32 centimeters
12 to 18 months	33 centimeters
18 $^{+}$ months	34 centimeters

Make sure the testicles are the same size and firmness and that they slide freely within the scrotum. The epididymis, which carries sperm from the testicles, can be felt at both the top and bottom of the testicles and can also be checked in this way for any abnormalities.

The penis, urethral process, and prepuce should also be examined. Check for sores, swellings, or blood clots that may indicate penile or preputial injuries. Rams and bucks occasionally suffer from adhesions on the penis, making it difficult or impossible to extend for breeding. While this problem can be corrected surgically, it is an inherited defect and these rams and bucks should be culled.

Semen Quality Evaluation

The semen evaluation can be conducted more than once if a less than satisfactory result is obtained the first time. Table 5 shows normal semen parameters in the mature ram and buck. A good sample will have a milky or creamy appearance. Under a microscope, a drop of semen will have the appearance of boiling or rolling with the activity of millions of sperm. A veterinarian will also stain some sperm to evaluate the percentage of normal and abnormal sperm. Use judgment in culling a young ram or buck on the basis of one semen evaluation, because the first sample can be misleading. From the time sperm cells begin to form in the testicles, it is 40 to 60 days before they are ejaculated.

Rams and bucks can experience temporary periods of poor semen quality due to stress. Higher than normal temperatures caused by weather or infection are the most common causes. If a ram or buck has poor semen quality, do a second semen evaluation within 30 days. Exposure to extreme environmental temperature can damage semen quality for up to 45 days.

Table 5. Normal Semen Parameters in the Mature Ram and Buck

	Ram	Buck
Volume (mL)	1 (0.8 to 1.2)	0.8 (0.5 to 1.0)
Sperm concentration (billion and ml)	2.5 (1 to 6)	2.4 (2 to 5)
Motile sperm (%)	75 (60 to 80)	80 (70 to 90)
Morphological normal sperm (%)	90 (80 to 95)	90 (75 to 95)

Post-breeding Season Pregnancy Check and Ewe and Doe Physical Exam

Responsible culling improves flock and herd productivity and efficiency. Cull ewes and does early. Failing to check and cull open ewes and does can allow the spread of diseases that affect reproduction. At the same time, check the eyes, mouth, feet, legs, and udders. Ewes and does must have good eyes and teeth to get the forage they need for milk production and fetal growth. Missing teeth, or badly worn teeth, are sure ways of getting your ewes and does in poor body condition, and ewes and does in poor condition do not breed early in the breeding season, if at all. Cull ewes and does with poor teeth. Ewes and does with bad feet and legs get lame. A good udder, well-balanced with well-spaced teats, is necessary to raise a good lamb or kid to weaning. A good quality, heavy-weight lamb or kid has a dam that produces and dispenses plenty of milk. Lactating females with pendulous, large teats should be culled because the newborn will have a hard time nursing and getting the essential colostrum as soon as possible after birth.

Body Condition Exam Before Lambing and Kidding

Improper nutrition before parturition negatively influences a lamb's or a kid's birth weight, vigor, and survival. Also, poor nutrition before lambing or kidding also causes a longer postpartum interval, reduces the level of milk production, reduces weaning weights, and may cause other metabolic abnormalities for the ewe or doe.

Breeding for the Marketplace: When to Lamb and Kid and When to Wean

In Alabama, sheep and goat producers typically lamb and kid their herds January through June so relatively few lambs and kids are born in July and August. While the demand for lamb is not built around ethnic considerations, the demand for goat meat is derived from religious and social traditions. Accordingly, the demand for goat meat increases at specific times of the year including Easter and Christmas. One of the greatest challenges to the meat goat industry is reaching mainstream consumers and not just specific ethnic groups. Another challenge is the excessive supply of animals on the market during certain times of the year and the scarcity during other times.

If producers want to market a lamb or kid for a specific ethnic religious holiday, they should first identify the date for that specific holiday and the type of lamb or kid preferred. For example, if the market prefers milk-fed lambs or kids between 30 and 55 pounds for a particular holiday, the producer can follow this timeline: For a lamb or kid weighing 6 pounds at birth to grow to 55 pounds—assuming an average daily gain of one-half pound—he or she will need 98 days; for the lamb or kid to grow to 30 pounds, he or she will need 48 days. Use the average 150-day gestation period for sheep and goats to calculate when the lambs or kids need to be born. This means you definitely want your ram or bucks in the herd 150 days before that birth date. Most ewes and does are stimulated to come into heat by the smell of a ram or buck within a week of the male's sudden introduction into the herd. However, the heat cycle of ewes and does is 14 to 22 days so if you want to make sure your ewes and does have a chance to lamb or kid by the estimated birth date, put the ram or buck in the herd 2 weeks earlier.

Pasture Breeding Management

Pasture breeding and artificial insemination are the two methods of breeding used in sheep and goats, with pasture breeding being the most commonly used. The main advantage of pasture breeding is the reduction in required labor. After the rams and bucks are put in with the ewes and does, all that is required is an occasional visit to the pasture to see that the males are actually with the ewes and does and that the females are being settled. A marking harness can be used with sheep to help determine that the ram is mounting although this does not guarantee that breeding has occurred.

Male and Female Ratios

The number of ewes or does that a ram or buck can service under pasture breeding depends on the length of the breeding season, the age of the ram or buck, and the type of housing (pasture, paddock, range, etc.). Yearlings and two-year-olds are still growing and should avoid excessive loss of body weight during the breeding season. A good management practice in this case limits the number of females to 15 to 30. Generally recommended ram-to-doe and buck-to-ewe ratios are shown in Table 6. These are average numbers only—individual rams and bucks may be able to serve more or less females than the numbers indicated in table 6. Producers must provide supplemental nutrition to young rams and bucks after their first breeding

season to bring their body condition back. Remember, they are still growing.

A young ram or buck should generally not be put in a pasture with an older, more experienced ram or buck because the younger males are often intimidated and sometimes injured by the older ones.

Artificial Insemination

The use of artificial insemination allows producers to use superior rams and bucks to dramatically improve lamb and kid performance in the areas of birth weight, weaning weight, and muscling. However, the rewards of artificial insemination depend on sound management. Estrus synchronization in sheep and goats in the United States is limited by their classification as minor livestock species. The availability of pharmaceuticals for estrus synchronization is restricted, and most applications currently used require the extra-label application of products developed for the major livestock species, such as cattle and swine. Extra-label use of reproductive hormones in food producing animals is illegal according to the U.S. Food and Drug Administration; therefore, producers must learn how to detect heat visually or with teaser animals.

Artificial insemination in sheep and goats is more difficult than it is in cattle because of the small size of the animal and the complex anatomy of the cervix, making insemination into the uterus difficult. Sheep are more difficult than goats. Live, viable sperm must be deposited correctly into the reproductive tract of a female in heat in order to establish a pregnancy. As mentioned previously, ovulation occurs near the end of heat, or estrus. Estrus can last from 24 to 36 hours in the ewe and 24 to 48 hours in the doe. Ovulation occurs toward the end of estrus about 24 to 27 hours from the beginning in the ewe and 24 to 36 hours in the doe.

Producers should have realistic expectations of the results of artificial insemination programs. Many have expectations that are well beyond what is normally achieved. A good benchmark is to compare the results of sheep and goat artificial insemination programs with the results of cattle artificial insemination programs.

Factors that will improve results include adequate nutrition before, during, and after breeding; good animal health; accurate record keeping; organization of the breeding program; the producer's ability to detect estrus; high-quality semen; proper storage and handling of the semen; and availability of working facilities adequate enough to allow easy handling. Even when everything is done properly, it is hard to beat the ram or buck at his own game. Artificial insemination's slow growth in sheep and goat herds is not only due to the illegal extra-label application of products but also to the problems producers have detecting estrus, especially in terms of time and labor. Detecting heat is one of the least popular management practices of any artificial insemination program, and it is a major deterrent to success.

Alternatives to Induce Out-of-Season Estrus and Estrus Synchronization During the Breeding Season

A gestation period of 148 days makes it possible for a ewe or doe to give birth more than once a year. But because of the seasonality of anestrus, ewes and does do not cycle after spring kidding and lambing until late summer or early fall resulting in just one lamb or kid crop per year. If the ewe and doe could be induced to come into estrus and breed during this seasonal anestrus period, they could lamb and kid in the breeding season and produce three in two years (8-month interval) or twice a year (6-month interval). A possible breeding scheme would be to breed in January, then again in September. Out-of-season breeding programs help producers attempting to increase the profitability of their operations by increasing the supply of lamb and cabrito to the marketplace on a year-round basis. Goats generally respond more favorably than sheep to out-of-season breeding. Two methods for inducing out of season estrus are light control (photo period) and the ram or buck effect.

Light Control

Altering the day-length pattern by controlled lighting can be used to induce estrus. The change of day length from long days to short days initiates the estrous cycle in sheep and goats. Rams and bucks as well as ewes and does should be exposed to the same amount of light every day. Exposure of rams and bucks to short days will increase sperm production, mating activity, and semen quality. The amount of light should be reduced gradually over an 8- to 12-week period.

Table 6. Ratio of Ewes per Ram or Does per Buck

Age of Rams or Bucks	Ratio of Ewes Per Ram or Does Per Buck
Ram lambs and buck kids (approximately 8 to 10 months)	15 to 30 ewes or does per 1 ram lamb or buck kid
Yearlings (approximately 12 to 16 months)	25 to 50 ewes or does per 1 yearling ram or buck
Mature rams and bucks	100 ewes or does per 2.5 to 3 rams or bucks

Ram or Buck Effect

When a ram or buck is introduced to a group of females, the ewes and does come into estrus. This effect is known as the ram or buck effect. The male effect works best in breeds that are less seasonal and during the transitional breeding season (July through August) when most ewes and does have not yet begun to cycle but are almost ready. During the nonbreeding season, some females may even be stimulated to ovulate and express estrus. The male effect relies on females and males being totally isolated from each other for at least 1 month. Ewes and does must be far away from rams and bucks so no contact is made by either sight or smell. The initial ovulation will be a nondetectable "silent heat" at 3 to 4 days after the introduction of the ram and buck. Two peaks of estrus activity follow this around days 18 and 25. Ewes that do not conceive may cycle again in 17 days. In does, ovulation occurs 2 to 10 days after introduction of the buck. The male effect works because rams and bucks produce chemical substances called pheromones, the smell of which changes the reproductive physiology of the female and stimulates her to start cycling. The value of the ram or buck effect is the synchronization of estrus activity resulting in large numbers of ewes and does ovulating, conceiving, and birthing in a relatively short period of time. To be effective, it is important to have adequate numbers of young, healthy rams and bucks. Teaser or vasectomized rams and bucks can also stimulate the ram or buck effect.

Management Factors Affecting Out-of-Season-Induced Estrus and Breeding

The management and care of ewes and does have an impact on the success of out-of-season breeding. They must be in good body condition, preferably gaining body weight at the time of breeding. Flush, a term meaning to provide excess energy, the ewe or doe before and during breeding. The start and duration of flushing depends on the body condition of the animals.

Rams and bucks must also be in good body condition. Poor nutrition can decrease testicular size and sperm reserves at a time when the size and reserves are already smaller than during the breeding season. Production of spermatozoa takes 7 to 8 weeks. As a result, supplementary feeding must begin 8 weeks before the start of the breeding season to increase sperm reserves. Seasonal variations with respect to semen production, semen quality, and libido should also be considered. Elevated body temperatures from hot weather can cause temporary infertility. Shear rams 2 months before breeding and be sure that all wool is removed from the scrotum area. Another very important factor is to ensure that adequate ram power is available for out-of-season breeding. Rams are not able to breed as many ewes out of season.

Causes of Poor Reproductive Performance

The goal of this publication is to provide Alabama sheep and goat producers with the most effective measures available to achieve reproductive success. At some point, even the most experienced sheep and goat producer will face the unexpected—the problem whose source is not easily identified (Figure 10).

Sudden low lambing and kidding percentages are always unexpected. Identifying and correcting the problem is seldom easy but must be done for the success of your operation.

Reproductive Management: A Summary

Starting with the premise that production is equal to reproduction, sheep and goat producers must control the reproduction of their flocks and herds. Because reproductive traits are only slowly improved through genetic selection, producers must manage what factors they can control: age, environment, and nutrition.

- Carefully watching for first estrus, or puberty, in ewe lambs and doelings is the first of these considerations.
- Be aware of weather extremes during all reproductive stages. Every member of the flock or herd requires some protection from weather extremes, especially in the hot, humid summer months.
- Monitor body condition, an important factor that producers can control. Body condition in ewes, does, ewe lambs, and doelings influences puberty, conception rate, and the health and vigor of newborn lambs and kids.
- Remember that older ewes and does have different body condition needs than ewe lambs and doelings, which are still growing. Feeding the bred ewe lamb and doeling is feeding a developing fetus as well. The body condition and lambing and kidding performance of a ewe lamb or doeling will have a major effect on subsequent reproductive performance.
- Pay special attention to the pregnancy itself, which is probably more important to the average sheep and goat producer than the physiology of conception. Don't allow the ewe or doe to lose weight while pregnant. Lack of proper nutrition during the last trimester when the lamb or kid is gaining up to 60 to 70 percent of its growth reduces the birth weight and the prospects for survival. Poor nutrition also reduces the level of milk production, thus reducing weaning weight.

- Conduct breeding soundness exams for rams and bucks 1 to 2 months before the start of the breeding season. Ewes and does should also be physically examined at weaning and evaluated not just for body condition score but for soundness of feet, udder, eyes, and mouth. Lame animals have a difficult time grazing, browsing (eating woody plants), and getting to water. Goats sometimes stand on their hind legs to reach leaves and brush. A good udder is necessary to raise a healthy lamb or kid, and a newborn must be able to nurse its dam shortly after birth to receive colostrum. Animals with good eyes and vision are easier to handle and, therefore, you will have less stress when performing the many management practices scheduled during the year. To raise a good lamb or kid, a ewe or doe must also be able to convert forage and browse into milk, starting with a good set of teeth.
- Remember that good reproductive management pays off.

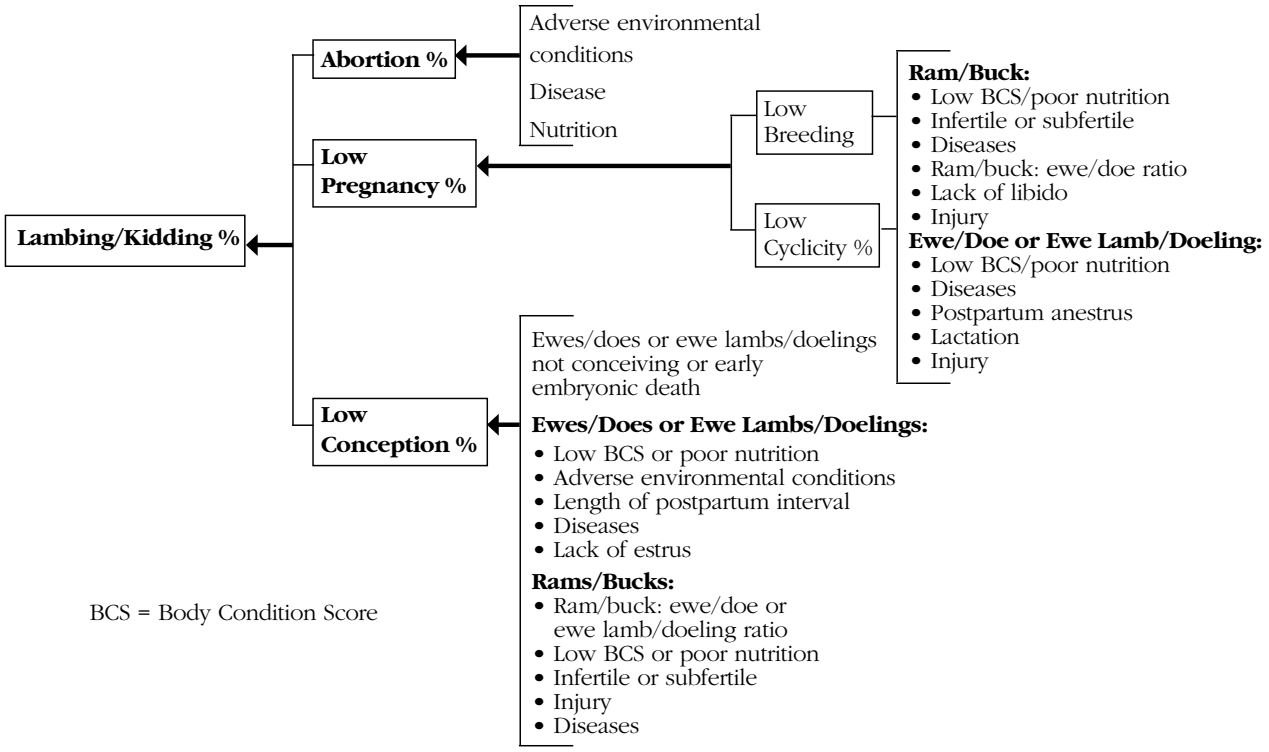


Figure 10. Possible causes of poor reproductive performance

Diego Gimenez, *Extension Specialist,* Associate Professor, Animal Science Management and Reproduction, and **Soren Rodning**, *Extension Specialist,* Assistant Professor, Animal Sciences and Forages, both at Auburn University

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

Issued in furtherance of Cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, and other related acts, in cooperation with the U.S. Department of Agriculture. The Alabama Cooperative Extension System (Alabama A&M University and Auburn University) offers educational programs, materials, and equal opportunity employment to all people without regard to race, color, national origin, religion, sex, age, veteran status, or disability. 3.5M, **New July 2007**, ANR-1316

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Small Ruminant Production

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Session 3

Sheep and Goat Lambing and Kidding Management

Kevin Pelzer, DVM
Professor, Production Management Medicine/Epidemiology
Virginia-Maryland College of Veterinary Medicine

Virginia-Maryland College of Veterinary Medicine

Learning Objective

- Understand best management practices for lambing or kidding

Prepartum Activities

Four weeks prior to lambing and kidding

- Vaccinate for Clostridium CD and T
- Vaccinate for E. coli?
- Deworm (if needed)
- Supplement ½ to 1 lb of grain per head per day above what already getting

Be Prepared

- Have clean environment ready
- Have a "delivery kit"
- Umbilicus supplies
- Colostrum supplies
  - 14 or 16 fr urinary catheter
  - Can buy a kit for 'tubing' lambs and kids, syringe and tube

Delivery kit

- Tool box
- Obstetrical sleeves
- Soap
- Lubricant – KY jelly, OB lube
- Iodine
- Feeding tube – urinary catheter (or 'tubing' kit)
- Paper or cloth towels

Impending Parturition

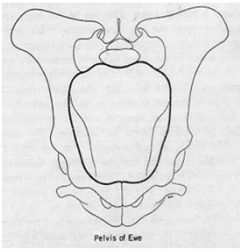
- Bagging up
- Softening of tail head
- Enlargement of the vulva
- Mucus discharge

Stages of Parturition

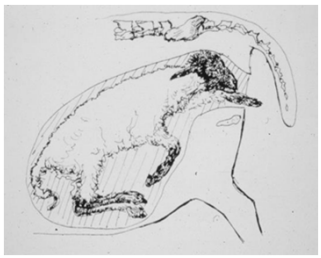
First Stage
- dilation of the cervix
- takes 2 to 12 hours
- don not observe much
  - separate themselves
  - paw at the ground
  - up and down, appear uncomfortable
  - have a far-off stare

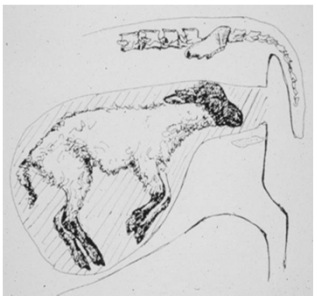
Second Stage
- Expulsion of the fetus
  - 2 hours once ewe starts straining
  - 30 - 45 minutes for twin

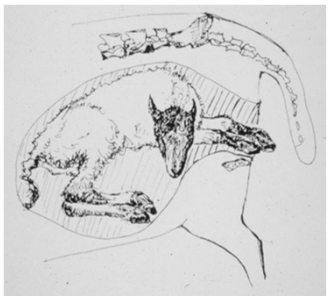
Photos on left: Susan Schoenian

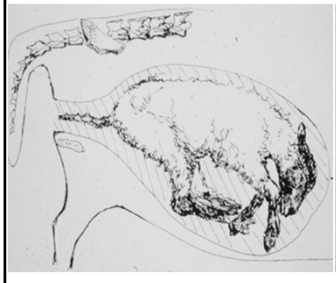


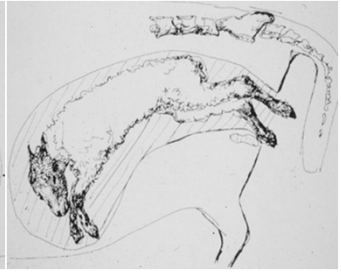
Pelvis of Ewe













At Birth

- Remove excess mucus from mouth and nose
- Rub vigorously with towel and dry off
- Do not hang upside down
- Dip navel
- Evaluate vigor, look for defects


Photo: Susan Schoenian

Third Stage

- Expulsion of the fetal membranes
  - usually expelled in 30 min to 2 hours
  - retained if still attached 12 hr after lambing or kidding
- When to worry?
  - If ewe/doe goes off feed
  - If ewe/doe develops a fever (temp > 103.3)
- Treatment
  - Penicillin 3cc/100lbs twice a day for 4 days, withdrawal is 28 days
  - Gentle pull



Colostrum Management

Nurse
- Should nurse within an hour
- Clean and milk teats to ensure colostrum is present
- Watch to ensure lambs/kids can nurse the teats

Note: consider culling if teats are too big for kids to nurse on their own

Kid/Lamb Care

- Milk out teat
- Make sure baby nurses within 2 hours
- Colostrum
  - 20ml/lb or 3/4 oz/lb first 2 hours
  - 100 -125 ml/lb or 3.5 oz/lb 24 hours

Colostrum Management

- Colostrum banking
  - Should be collected from dams within 12 hours of lambing/kidding
  - Specific gravity 1.029 or greater
  - Cool down and freeze
  - Thaw by placing in warm water
- Colostrum alternatives (make sure has IgG/antibodies)
  - Bovine
  - Colostrum substitutes

$36 - 42
Colostrum Replacer

$7-12
Colostrum Supplement

Supplements

Nutri-Drench bottle says: "Delivers high energy, vitamins, minerals, amino acids, electrolytes and antioxidants in minutes."

No products, companies or manufacturers are being endorsed.

Feeding Milk

- Milk replacer (for your species, can follow directions on bag)
- Feed 1 liter/day by 1 week and 1.5 - 2 by 3 weeks of age
- 20% body weight into 3 feedings/day for 1st 2 weeks
- Can use self feeder (keep full if do) or bucket feeders
- Feed warm or cold

Photos: Susan Schoenian

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20% Body Weight into 3 Feedings for 1st 2 weeks

8 lb kid * 0.20 = 1.6 lbs
1.6 lbs * 16 oz = 25.6 oz
25.6 oz / 3 feedings = 8.5 oz
25.6 oz / 4 feedings = 6.4 oz

10 lb lamb * 0.20 = 2 lbs
2 lbs * 16 = 32 oz
32 oz / 3 feedings = 10.8 oz
32 oz / 4 feedings = 8 oz

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Additional Resources

- www.slideshare.net/schoenian/getting-ready-for-lambing-and-kidding
- www.infovets.com/books/smrm/C/C460.htm
- http://articles.extension.org/pages/27126/kidding-management
- www.sheepandgoat.com (articles)
- www.sheep101.info/201/lambingprocess.html

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

USDA NIFA

Beginning Farmer and Rancher Development Program

Developing the Next Generation of Sustainable Farmers in Georgia Grant

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FVSU extension
Knowledge for Inspiring Lives!

GEORGIA ORGANICS

NOTES:

Additional Resources Page

Session 3: Health and Diseases

Common diseases in sheep and goats:
https://www.extension.purdue.edu/extmedia/as/as-595-commondiseases.pdf
http://extension.psu.edu/courses/sheep/health

How to work with a veterinarian:
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=497

Organic livestock care:
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=520

Merck veterinary manual:
http://www.merckvetmanual.com/mvm/management_and_nutrition.html

Session 3: Breeding

Reproduction and breeding:
www.aces.edu/pubs/docs/A/ANR-1316/ANR-1316.pdf
www.esgpip.org/handbook/Handbook_PDF/Chapter%205_%20Reproduction%20in%20Sheep%20and%20Goats.pdf
http://extension.psu.edu/courses/sheep/reproduction
http://articles.extension.org/pages/19442/goat-reproduction-mating-systems
http://www2.luresext.edu/goats/training/reproduction.html

Session 3: Lambing and Kidding

Preparing for lambing:
http://extension.psu.edu/courses/sheep/reproduction/preparing-for-lambing

Pasture lambing/kidding:
http://smallfarms.cornell.edu/2012/06/27/considerations-for-pasture-lambing-and-kidding/

Lambing/Kidding date calculator:
www.pbsanimalhealth.com/sheepgoatgestation.html

Lambing and kidding:
www.infovets.com/books/smrm/C/C460.htm
www.sheepandgoat.com/#!gettingready/c9f2
www.aces.edu/pubs/docs/U/UNP-2036/UNP-2036.pdf
www.sheep101.info/201/lambingprocess.html
www.slideshare.net/schoenian/tips-for-improving-lambingkidding-percentage

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Small Ruminant Production

Integrated Parasite Managment

Session Four

Participants Notebook

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Session 4: Integrated Parasite Management

Handouts: Parasite Management Principles/Questions

Integrated Parasite Management I (45 min – Susan Schoenian, University of Maryland Extension)

- Anthelmintic (dewormer) resistance issues
- Refugia
- Anthelmintics (dewormers)
- Parasites of small ruminants

Learning Objectives*:*

- Understand dewormer resistance (immunity) issues
- Identify small ruminant anthelmintics (dewormers) and common parasites of small ruminants

BREAK

Integrated Parasite Management II (45 min – Susan Schoenian, University of Maryland Extension)

- Detailed parasite management tools
    - Host immunity
    - Animal management
    - Grazing/forage management
    - Breeding and selection
    - Targeted Select Treatment (FAMACHA©, Five Point Check©)
    - Fecal egg counting (FEC)

Learning Objectives*:*

- List best management practices to avoid parasite infection and keep dewormers working longer

Activity/Homework Assignment (20 min) – Evaluation to reinforce information learned in Integrated Parasite Management I and II; with this Session and activity completed as well as participation in the hands-on FAMACHA© scoring section of animals during Session 6, FAMACHA© certification can be obtained.

Idea for how you can use this at home – Design an integrated, flexible parasite management plan for your farm.

PARASITE MANAGEMENT PRINCIPLES

A. FLOCK MANAGEMENT REQUIREMENTS

• Separation of Groups

Since different classes of animals vary in their susceptibility to parasite infection and its effects, they should be separated into groups which are grazed, treated and managed as distinct entities. The more susceptible animals are young, recently weaned ones, adults in late pregnancy or lactation, or highly stressed animals.

• Separation of pastures

Unless pastures are divided, all animals will be exposed to a similar challenge, regardless of whether they are susceptible or resistant to parasite infection and its effects. Division of pastures is not only good for internal parasite control, it also aids pasture management. Electric fences can be used as temporary pasture dividers.

• Resting of pastures

If pastures can be separated, it is then possible to rest them effectively. If pastures can be rested long enough, this will also have a significant effect on the survival of worm larvae and therefore animal infection rate. Although the time needed for effective resting of pastures will vary with climate, weather and parasite species, a useful rule of thumb is at least 2 months. The longer the rest, the more effective it is.

• Alternate host species

Sheep and goats share the same worm species, so alternating with one another is NOT effective for worm management. However, other species like cattle and horses are generally not susceptible to the parasites of sheep and goats. If they are used to graze pastures before or after sheep or goats (or at the same time), they act as "vacuum cleaners" on the pasture, as they ingest (“kill”) larvae. Sheep and goats can reduce cattle and horse worms the same way. Camelids (llamas, alpacas) share sheep and goat worms and some cattle worms.

• Repair water leaks

Water troughs should not be allowed to leak, the area can become contaminated by larvae.

• Avoid manure buildup and grass in pens

When sheep or goats have to be penned for lengthy periods (usually at night to protect against theft or predation) there can be a large buildup of larvae.

• Fence off moist areas

Areas particularly prone to high moisture and therefore the survival of worm larvae, like streams and marshes, should be separated.

• Strategic movement of flocks

The aim should be to create "safe" (not necessarily "worm free") pastures. By planning changes in paddocks, animals will be exposed to lower challenges and need less treatment. Safe pastures include new pastures, ones mowed for hay, pastures with taller forages (greater than 4”) and/or “browse”, among others.

• Quarantine and treatment

New animals must be quarantined in a worm-unfriendly pen (dirt floor or concrete) and treated intensively using multiple drugs. Perform a fecal egg count to insure counts are zero before mixing new animals with your flock or herd.

• Provide good nutrition

Healthy animals with good body condition can resist infection better because they have a stronger immune system. Feeding increased protein has also been shown to help animals fight worms.

B. GENETIC SELECTION

• Selection for resistance

Resistance is heritable (inherited/passed on) and can be selected for by measuring fecal egg counts (FEC) and using only those animals with the lowest FEC for breeding. For practical and economical reasons, this is usually only done for males (to choose resistant genetics for breeding).

• Selection for resilience

Resilience (the ability to withstand the effects of infection and produce satisfactorily) is also heritable. FAMACHA© and packed cell volume (PCV; only for blood-sucking parasites) help determine resilience. Cull females that regularly need to be dewormed; it is good to choose a male that has never needed deworming.

C. MONITORING SYSTEMS

• Fecal egg count (FEC)

Regular (monthly or bimonthly) monitoring of a composite fecal egg count on a group basis will help to indicate when infection levels are high or when treatment might be delayed or even omitted. Individual animal counts can identify animals infecting the others.

• Fecal egg count reduction test (FECRT) or DrenchRite™

Every farmer should have the farm tested for drug resistance for the worm population on the farm every 2-3 years. If the exact state of anthelmintic (dewormer) resistance on a farm is known, treatment and control recommendations can be made.

• FAMACHA© evaluation

Along with selection and culling, this system also allows frequent, cheap and easy monitoring of the current situation as regards to parasite infection (haemonchosis or barber pole worm infection).

D. OPTIMIZE ANTHELMINTIC USE

• Establish the important parasite species present

Worm management becomes more effective if parasite species on the farm is known. For sheep and goats, a larvae culture and identification must be done.

• Use the most suitable drug

If the parasite susceptibility to anthelmintics is known, it is possible to know which drug(s) and formulations will be the most suitable in each situation.

• Avoid too frequent treatment

The old approach of "dosing clean animals" must be completely abandoned. The aim has to be treat only individual animals and sufficient times to maintain a balance between parasite, host and environment (that is, worm management). Treating all animals and treating too often ensures that *only* resistant parasites can survive. Minimal treatment programs must be the new watchword, but it must be ensured that every treatment is effective.

• Treat all and stay

This is a major departure from the recommendations made for close to a century for "treat and move". If all/nearly all animals are to be treated, they should remain in the pasture/ paddock where they were grazing. This will prevent them from contaminating a new pasture with only resistant parasites which survived treatment, in the process thus unwittingly causing the selection of resistance parasites. In most cases they should remain in the

paddock/pasture for at least 2-3 weeks after treatment to pick up unselected larvae for propagation of the susceptible worms in the new paddock.

• Treat selectively

It is preferable to treat only those animals unable to cope with the current infection/challenge. This can be done with the FAMACHA© system and Five Point Check©. Barber pole worm does not cause diarrhea.).

E. IMPROVED ANTHELMINTIC EFFICACY

• Dose orally and over the tongue

Place the tip of the dosing equipment towards the back of the mouth, over the tongue so the full dose is swallowed.

• Reduce feed intake

It has been shown for benzimidazoles that reducing feed intake for 24 hours prior to treatment will improve the absorption of the drug because of the lower rate of flow of ingesta, resulting in a more effective exposure of the parasite to the drug.

• Repeat the dose

This only applies to benzimidazoles and macrocyclic lactones. Two doses given 12 hours apart will again increase the "killing zone" of these drugs, allowing more time for a cumulative killing effect for resistant worms.

• Increase the dose

This only applies to drugs which rely mainly on peak concentrations for their effect. In this case, a double amount of drug given at one time can overcome drug resistance in worms. This is useful, but care should be taken if using levamisole (Prohibit®/LevaMed™).

• Correct dosage

It may seem too obvious, but a lot of problems are caused by not weighing animals, and not calibrating and checking the dosing gun for accuracy and repeatability. Under-dosing is a major factor leading to anthelmintic resistance and can be the cause of ineffective treatment.

• Drug combinations

Combining drugs from different classes (giving two different drugs at the same time) may temporarily improve the effective clinical action of these drugs.

• Goats are different

Because of differences in the rate of metabolizing drugs, goats must often be given a higher dosage rate than sheep. Note that many anthelmintics may not be approved for use in goats, or that the recommended dose on the label may not be enough for goats (see a veterinarian with goat experience for recommendations and withdrawal times for off-label drug use; dosage charts available at www.wormx.info).

F. EFFECTIVE PLANNING

• Use the expert

Knowledgeable veterinarians, who know the livestock species you are working with, the area, farming systems and risks can construct a simple, practical, economic and effective total strategy. They should consult with parasitologists and get continuing education when necessary.

• Use a program

Unless a basic planned system is in place and is used, actions will inevitably be largely reactive and based on panic decisions.

• Treatment strategy

It is probably true on most farms that animals are either dosed too often, or with inappropriate drugs, or at the wrong times, or with no coherent plan. By setting up a well thought out dosing plan, we can cut out ineffective doses which only add to the selection pressure for parasite resistance.

• Flexibility

The program must be flexible to allow for changes in weather, management and farming systems, drug costs or other factors.

G. OTHER

• Alternatives

Forages such as sericea lespedeza have been proven to reduce fecal egg counts and coccidia. Copper oxide wire particles have been found to be effective in reducing fecal egg counts but care should be taken with sheep since they are sensitive to copper. Ground pine tree bark has also been noted to decrease fecal egg counts and coccidia. Any alternatives should be used a part of, not a replacement for, an integrated parasite control plan.

• Breed/animal selection

Some animal breeds are known to be more resistant to parasite infection than others. Selection of animals from farms testing for resistance to parasite infection could help introduce those genetics on your farm.

• Manage stocking rates

Overstocking reduces forage height and grossly contaminates pastures. A range of 3-7 animals per acre is recommended for parasite control.

• Coccidia

Coccidia are species-specific parasites but they are not worms. Deworming does not control this parasite. Symptoms of coccidiosis include diarrhea, rough hair coat, weakness, depression, anemia, weigh loss and death. Fecal exams for fecal egg counting can confirm coccidia eggs as well as worm eggs. As with gastrointestinal worms, the goal is not "coccidia free" animals, but avoiding sickness due to the parasite.

Created by the American Consortium for Small Ruminant Parasite Control (www.wormx.info); updated/edited September 2016 by Dr. Niki Whitley, Fort Valley State University.

PARASITE MANAGEMENT CHECKLIST

Circle the letter beside the ways you help control parasites below:

a. I put animals into groups based on how easy it is for them to get wormy so I can manage them differently.

b. My pastures are divided so I can rotate and rest them to keep them at or over 4 inches tall.

c. I use cattle, horses or other animal species to help control sheep and goat parasites (and vice versa).

d. There are "safe" or "safer" pastures on my farm, like new pastures, ones with lots of browse (leaves, stems of woody plants) or forbs ("weeds"), those mowed for hay, etc. and I use them for strategic animal movement.

e. New animals on my farm are kept away from all other animals in a worm-unfriendly pen and dewormed with drugs from two or three different drug "classes" that I select with my veterinarian's input.

f. Animals on my farm are in good body condition so they can fight off worms (and diseases) better.

g. I cull (get rid of) animals that always have high fecal egg counts or are always "wormy"; I do not breed them.

h. When choosing breeding stock, either from my farm or those I may buy from other farms, I look for animals that according to records do not have to be dewormed often.

i. I know which dewormers work on my farm by using a fecal egg count reduction test or DrenchRite© test every other year, at least.

j. I use FAMACHA© with other signs of worms to tell if a sheep or goat needs deworming.

k. I deworm based on "need" and not just on a regular schedule so that I do not treat animals unnecessarily.

l. For sheep and goats, I dose orally; and for goats, I use a higher dose based on my knowledgeable veterinarian's recommendations to make sure I do not under-dose.

m. I always give the right dose because I weigh animals or use a weigh tape, and I give dewormer correctly. For oral medications, this means over the tongue in the back of the mouth.

n. I consult with a veterinarian who understands and keeps up with new information about parasite control.

o. I use browse, forbs, and different types of forages, such as ones that grow tall or that have condensed tannins (for sheep and goats), to help control worms.

p. I keep stocking rates low to moderate (three to seven animals per acre of good pasture for sheep and goats).

Please feel free to use this area for ideas on how to improve parasite control on your farm:

_____

_____

_____

_____

This checklist was created by Dr. Niki Whitley and is based on information from "Parasite Management Principles" by the ACSRPC (www.acsrpc.org).

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Small Ruminant Production

USDA NIFA | FVSU extension Knowledge for Inspiring Lives! | UGA extension

Session 4
Integrated Parasite Management I

Susan Schoenian (Shāy nē ŭn)
Sheep & Goat Specialist
University of Maryland Extension

No products, business, companies or manufacturers are being endorsed.

American Consortium for Small Ruminant Parasite Control (ACSPRC)

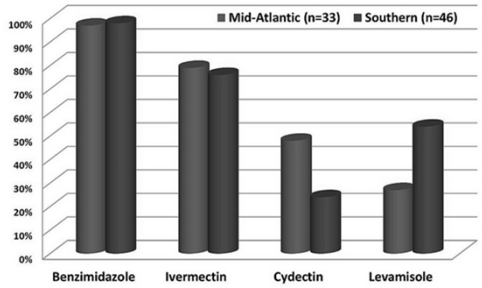
www.acsrpc.org
www.wormx.info

Anthelmintic (dewormer) resistance

- Resistance is inevitable; no treatment will kill 100 percent of worms.
- Worms have developed resistance to all dewormers and all dewormer classes.
- Resistance varies by geographic region and individual farm and is the result of past deworming practices.

Anthelmintic = Dewormer

Percent farms with anthelmintic resistance



Levamisole sold under the trade names of Prohibit® and LevaMed™

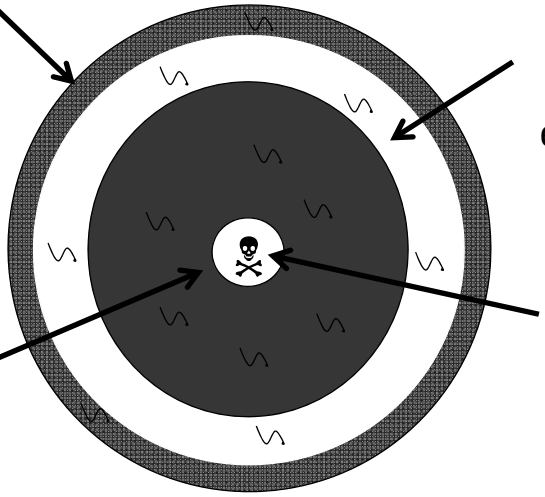
Anthelmintic (dewormer) resistance

- Resistant worms pass their resistant genes onto their offspring; resistance is permanent!
- You cannot prevent resistance, but you can affect the rate by which it develops.
  On most farms, resistance is probably at a level where there is still time to slow it down and enable the continued use of some anthelmintics.

Understanding anthelmintic resistance

95-100% effective. Small number of resistant worms may be present.

80-95% effective. Treatment is effective, but resistance is increasing.



Less than 80%. Production losses become apparent as effectiveness of dewormer moves closer to zero.

Anthelmintic failure. Animals die.

Adapted from Wormer Resistance "The need for change" Meat Promotion Wales

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You can slow drug resistance by increasing refugia.

- Decrease frequency of anthelmintic treatments.
- Do not treat everyone; leave some animals untreated.
- Do not move treated animals to a clean pasture.
- Do not deworm when there is a low level of pasture contamination or infection in animals.
- Re-introduce susceptible worms (?) to your farm.

Refugia are worms that have not been exposed to drug(s): "in refuge".

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Don’t make it easier for worms to develop resistance to the drugs.

Caused by exposing them to sub-therapeutic levels of drug(s); so **DO NOT**:

1)Underdose
2)Inject dewormers
3)Pour dewormer on back
4)Administer drugs improperly
- Do not squirt injectable into mouth
- Do not drench with pour-on

5)Deposit drug into mouth instead of esophagu
6)Use persistent activity dewormer
7)Rotate dewormers

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Do not bring resistant worms to your farm

- Quarantine drenching: to prevent the introduction of resistant worms to your farm, deworm all newly acquired animals with anthelmintics from 2-3 anthelmintic classes.

  1. Moxidectin + levamisole
  2. Albendazole + moxidectin + levamisole

- In Western Maryland Pasture-Based Meat Goat Performance Test, deworming with albendazole, moxidectin, and levamisole at same time (but one at a time) usually reduces fecal egg counts by more than 95 percent (in 6-12 days).

For sale
Ram - $1,000
Resistant worms - free

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Anthelmintics 101
There are only 3 families of drugs.

1. BENZIMIDAZOLES	2. MACROCYCLIC LACTONES	3. NICOTINIC AGONISTS
1. Fenbendazole Safeguard® Panacur®	1. Avermectins a) Ivermectin Ivomec® Primectin® Privermectin® b) Eprinomectin Eprinex® LongRange ® c) Doramectin Dectomax®	1. Imidazothiaoles a) Levamisole Prohibit® Leva-Med™
2. Albendazole Valbazen®	2. Milbimycins a) Moxidectin Cydectin® Quest®	2. Tetrahydropyrimidines a) Morantel Rumatel® Positive Goat Pellet Goat dewormer
3. Oxybendazole Synanthic®		b) Pyrantel Strongid®
1	2	3

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FDA-approved anthelmintics for sheep

	(1) Benzimidazoles	(2) Macrocyclic lactones		(3) Nicotinics
		Avermectins	Milbemycins	
Adult worms	✓	✓	✓	✓
Immature worms (L4)	✓	✓	✓	✓
Hypobiotic larvae	✓	✓	✓	✓ ?
Lung worms	✓	✓	✓	✓ +
Tape worms	✓			
Adult liver flukes	✓			
Coccidia				
External parasites		✓	✓ (Nose Bots)	
Persistent activity			✓	
Safety	Restricted use during early pregnancy	++++	++++	++
Resistance	++++	+++	++	+
FDA-approved	**Valbazen®**	**Ivomec®**	**Cydectin®**	**Levamisole®**
Labeled dosage	3 ml/100 lbs.	3 ml/26 lbs.	1 ml/11 lbs.	2 ml/50 lbs.
Meat withdrawal	7 days	11 days	7 days	3 days

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FDA-approved anthelmintics for goats

	SafeGuard®	Valbazen®	Rumatel®
Adult worms	✓	✓	✓
Immature worms (L4)	✓	✓	
Hypobiotic larvae	✓	✓	
Lung worms	✓	✓	
Tape worms	**Not labeled**		
Adult liver flukes		✓	
Coccidia			
External parasites			
Safety	**++++**	**Restricted use during early pregnancy**	**+++**
Resistance	**++++**	**na**	**?**
Labeled dosage per 100 lbs.	2.3 ml	4 ml	0.44 g
Meat withdrawal	6 days	7 days	30 days
Milk withdrawal	NA	NA	0 days

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Extra-label anthelmintics for goats (Rx)

	(1) Benzimidazoles		(2) Macrocyclic lactones		(3) Nicotinics
	SafeGuard®	**Valbazen®**	**Ivomec®**	**Cydectin®**	**Prohibit®**
Adult worms	✓	✓	✓	✓	✓
Immature worms (L4)	✓	✓	✓	✓	✓
Hypobiotic larvae	✓	✓	✓	✓	✓ **?**
Lung worms	✓	✓	✓	✓	✓ **+**
Tape worms	✓	✓			
Adult liver flukes		✓			
Coccidia					
External parasites			✓	✓	
Persistent activity				**?**	
Safety	**++++**	**Restricted use during early pregnancy**	**++++**	**++++**	**++**
Resistance	**++++**	**++++**	**+++**	**++**	**+**
Dosage per 25 lbs.	1.1 ml	2 ml	6 ml	4.5 ml	2.7 ml
Meat withdrawal	16 days	9 days	14 days	17 days	4 days
Milk withdrawal	4 days	7 days	9 days	8 days	3 days

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Zolvix® (monepantel): a new anthelmintic

- New drug class: amino-acetonitrile derivative.
- Unique mode of action.
- First new anthelmintic in 25 years.
- Kills worms that are resistant to other drugs.
- Resistance already reported in Australia (in goats).
- Not yet available in US.
- Will be available by prescription (Rx) only. ELDS is. goats.
- Will be expensive (?).

"Alternative" (non-chemical) dewormers

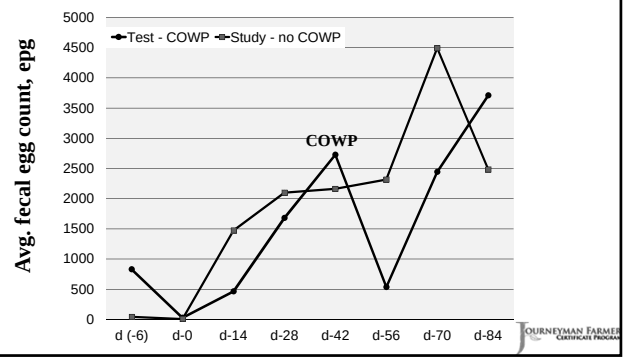
- Many natural compounds are said to have "anthelmintic-like" properties; the list is overwhelming!
- Studies are lacking, inconsistent, and/or not repeatable.
- Some natural anthelmintics are potentially toxic to the animal, e.g. copper sulfate, nicotine sulfate.
- Considerable research is being done on alternative or natural "dewormers."

COWP bolus

2014 Western Maryland Pasture-Based Meat Goat Performance Test
Anthelmintic effect of copper oxide wire particles (COWPs)

- Mid-way through the test, at day 42, which was the end of the "parasite challenge phase" of test, test bucks (n=77) were given a gel cap containing ~0.5 g of copper oxide wire particles (COWPs).
- On day 42, nine (9/77) bucks required deworming (based on FAMACHA© and 5 Point ✓©) and were also dewormed with a commercial dewormer (levamisole or moxidectin).
- Fifteen (15) bucks from our pen vs. pasture study (pasture group) served as controls: they did not receive any treatment.

Treatment		# goats	July 17 Avg. FEC	July 31 Avg. FEC	Avg. FECR
Dewormer	Effective	8	8735	103	98.6
	Ineffective	1	500	275	45.0
COWP	Effective	53	2768	388	81.7
	Ineffective	8	723	2000	< 0
No treatment (Control)	Pasture	15	2164	2371	< 0
	Pen	12	1216	758	37.7



My perspective and recommendation on alternative "dewormers"

- Alternative dewormers are <u>not likely</u> to replace commercial anthelmintics.
- Alternative dewormers may <u>complement</u> commercial dewormers by:
  - + Disrupting the free-living stage of the parasite (e.g. inhibit egg hatching or larvae development)
  - + Improving natural immunity of animal
  - + Improving overall management of the herd

  = **Reducing the number of animals that require treatment with a commercial dewormer.**

- It's okay to use alternative dewormers so long as animals are monitored regularly for signs of parasitism and need for deworming with effective drug.

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Determining anthelmintic resistance

- It is recommended that you test for anthelmintic resistance every 2-3 years.
- FAMACHA© and the Five Point Check© don't work if you don't have an <u>effective</u> treatment(s) for clinically-parasitized animals.
- Clinically-parasitized animals will almost always <u>die</u> without an <u>effective</u> anthelmintic treatment (deworming).
- There are <u>two</u> ways to test for anthelmintic resistance.
  1) Fecal egg count reduction test (FECRT)
  2) DrenchRite® Assay

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1) Fecal egg count reduction test (FECRT)

- Determines how effective dewormer is
- Best time to do is when *Haemonchus* (barber pole worm) is most active
- Collect fecal samples (FECs $\geq$ 250 epg) from animals at and after treatment (ideally, n $\geq$ 15) for each dewormer you want to test
- If possible, include a group of controls (same number) that you will not treat
- Favor animals with higher FAMACHA© and dag scores and lower BCSs

→Doing a fecal egg count reduction test on one or a few animals may suggest resistance or effectiveness, but it does not prove it.

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Fecal egg count reduction test (FECRT)

- Compare pre- and post-treatment fecal egg counts
  a) 8-10 days for benzimidazoles (SafeGuard®, Valbazen®)
  b) 14-17 days for macrocylic lactones (Ivomec®, Cydectin®)
  c) 5-7 days for levamisole (Prohibit®)
  d) 10-14 days for all dewormers

http://www.uaex.edu/Other_Areas/publications/PDF/FSA-9608.pdf

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Fecal egg count reduction test
2012 Western Maryland Pasture-Based Meat Goat Performance Test
[Pre-test Tx: albendazole + moxidectin + levamisole]

- 49 animals; Most had 100% reduction; one had only 68.8% and another 88.9%. Others (10) that were not 100% were above 90%.
- FEC ranged from 0 to 15150 epg

TEST ID	2-Jun FEC-0	14-Jun FEC-1	14-Jun FECRT
AVERAGE	2532	29	97.7%
MEDIAN	1266	0	100.0%
STDEV	3373	76	5.77%

2) DrenchRite® or larval development assay

- Determines resistance for all drug classes at the same time using a pooled fecal sample.
- Determines which parasites your animals have.
- Collect a fresh pooled fecal sample from at least 10 animals with FECs ≥350-500 epg.
- Follow instructions for collecting, handling, and shipping sample to Dr. Ray Kaplan's lab at the University of Georgia.

DrenchRite Report Form

	BZ	LEV	IVM	MOX DD
Critical Well/ Delineating Dose	10.5	3	6.5	10
Resistance Status	R	S	R	S

Pooled fecal egg count: 2050 epg

COMMENTS: Coproculture results-96% Haemonchus, 3% Trichostrongylus/Teladorsagia mix, 1% Oesophagostumum*
*There were several strongyloides present on both FEC and on the coproculture

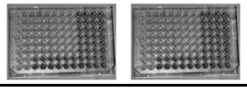
A comparison of tests

FECRT

- Takes 7-14 days to get results, longer if someone else does FECs.
- Cost for 75 samples
  (15 samples x 4 drugs + control group)
  75 x Labor = ?
  75 x $5 = $375
  75 x $10 = $750
- Need more animals
- Results: % efficacy
- Results can vary by animal, so need to do enough animals for results to be valid.

DrenchRite® Assay

- Labor-intensive lab test
- Only one lab in US does DrenchRite® Test (UGA)
- Takes 3-4 weeks to get results
- Results: S, SR, R
- Cost $450 per sample



Small ruminants are affected by many internal parasites, but only a few are usually important.

Multi-cellular (helminths)

a) Nematodes
   Roundworms
b) Cestodes
   Tapeworms
c) Trematodes
   Flukes

Single-cell (protozoa) like coccidia

Roundworms - nematodes – *strongyle*-type

Primary

1. *Haemonchus contortus*
   Barber pole worm
2. *Teladorsagia circumcinta (Ostertagia)*
   brown stomach
3. *Trichostrongylus* spp.
   black scour/stomach/ hair

Secondary

- *Cooperia* (small intestinal)
- *Nematodirus* (thread/thin necked intestinal)
- *Oesaphagostomum* (nodule worm)
- *Bunostomum* (Hookworm)
- *Trichuris ovis* (Whipworm)
- Strongyloides
- Lungworms
- *Parelaphostrongylus tenuis*
  Meningeal, deer, brain worm

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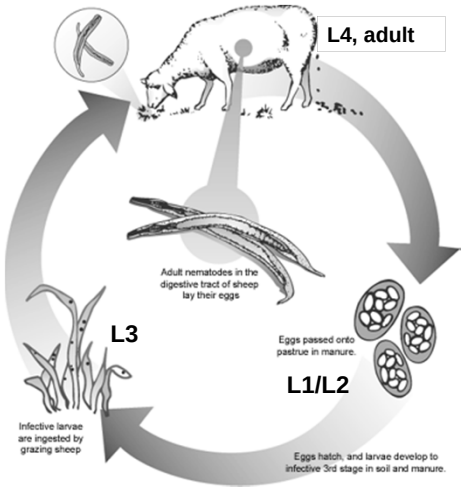
Haemonchus – Trichostrongylus – Teladorsagia

- Short, direct life cycles (avg. 3-4 weeks) that are weather-dependent.
- Can overwinter on pasture.
- Ability to go into hypobiotic (arrested) state (in host) when environmental conditions are not conducive to their development (hot, dry or cold, dry).
- Vary in their egg laying ability.
- Eggs look same under microscope.



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Haemonchus contortus - Barber pole worm

- Primary parasite in warm, moist climates and/or during summer grazing season (in more northern climates).
- One of the most pathogenic parasites
- Prolific egg layer
- Blood sucker/feeder
- Causes anemia and bottle jaw.
- Other symptoms: weight loss, loss of body condition, poor stamina, anorexia -- but not usually diarrhea.
- Death can also be sudden (acute haemonchosis).

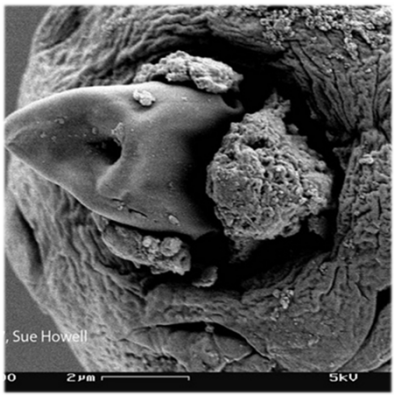


Image from University of Georgia

Other strongyle-type
Teladorsagia and *Trichostrongylus*

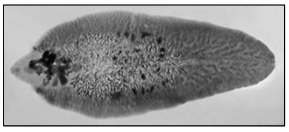
- Usually of secondary importance.
- Usually part of mixed infections with barber pole worm.
- Cause production loss, weight loss, dagginess (scours/diarrhea) - only occasional death.
- May be more problematic in cooler, wet climates, e.g. Pacific Northwest, UK, and Canada.

Lungworms

- Direct or indirect life cycle
- Larvae visible in feces (microscope)
- High loads – respiratory symptoms: coughing, fluid on lungs, pneumonia
- Difficult to diagnose in live animal; usually diagnosed at necropsy.
- Drugs which control GI parasites will also control lungworms.

Liver flukes
Fasciola hepatica

- Regional problem: mostly Pacific Northwest and Gulf States.
- Require open water and aquatic snails as intermediate host.
- Similar symptoms as barber pole worm (anemia, bottle jaw).
- Treat adult liver flukes with albendazole (Valbazen®) or Ivomec® Plus (clorsulon).



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Tapeworms *(Moniezia expansa)*

- Only worm visible in feces
- Indirect life cycle; pasture mite intermediate host.
- Usually non-pathogenic (so no benefit to treatment) but high loads rarely cause blockages or occasionally affect gut motility.
- Treat with SafeGuard® (2x dose, Rx), Valbazen® [Rx], or praziquantel* [Rx] (Quest Plus®, Equimax®, or Zimecterin Gold®).
- Sheep and goats are intermediate host for one species of tapeworm that also infects dogs.

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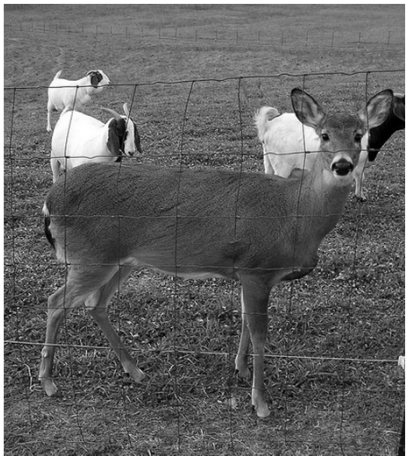
Meningeal worm *(Parelaphostrongylus tenuis)*

- Parasite of white tail deer; sheep, goats, and camelids are abnormal (and dead end) hosts.
- Has indirect life cycle: snail or slug required is intermediate host.
- Causes neurological symptoms that vary in severity; no definitive diagnosis in live animal.
- Treatment protocols involve high doses of anthelmintics and anti-inflammatory drugs.
- Fenbendazole (SafeGuard®) and ivermectin (Ivomec®) are drugs of choice for meningeal worm [Rx].
- Cornell University is working on vaccine and treatment protocols.



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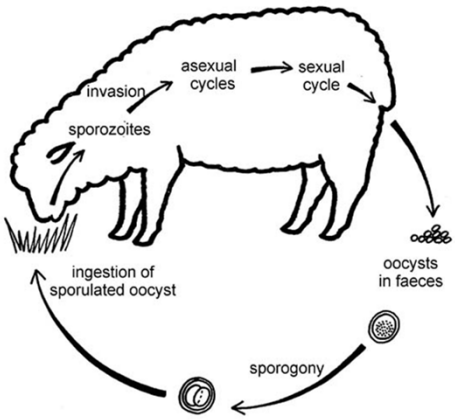
Coccidia (*Eimeria* spp.)

- Single-cell protozoa
- Species-specific
- Not all species pathogenic
- More complicated life cycle than roundworms.
- Damages lining of small intestines, affecting nutrient absorption; damage can be permanent.
- Causes diarrhea (not always), ill thrift, and death.



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Coccidia (*Eimeria* spp.)

- Prevent mostly with good management and sanitation.
- Prevent with coccidiostats in water, mineral, feed, and/or milk replacer.
  - Lasalocid (Bovatec®) [sheep], toxic to horses
  - Monensin (Rumensin®) [goats], toxic to horses
  - Decoquinate (Deccox®) [sheep, goats]
  - Amprolium (Corid) [Rx]
- Treat with Corid [Rx] or sulfa antibiotics [Rx]*
- Sericea lespedeza pellets may provide "natural" control of coccidiosis.

http://www.wormx.info/Resources/Topics/SL-SS.html

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End - Integrated Parasite Management First Presentation, Part 1 Continued in Part 2

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NOTES:

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Small Ruminant Production

USDA NIFA | FVSU extension | UGA extension

Session 4
Integrated Parasite Management II

Susan Schoenian (Shāy nē ŭn)
Sheep & Goat Specialist
University of Maryland Extension

Integrated parasite management (IPM)
Using chemical and non-chemical means to control parasites

Non-chemical
- Host immunity
- Laming/kidding and weaning management
- Nutritional management
- Pasture and grazing management
- Genetic selection

Chemical
- Proper use of anthelmintics, including Targeted Selected Treatment (TST)
  - FAMACHA©
  - Five Point Check©
- Testing for anthelmintic resistance/fecal egg counts

Host immunity
Animals vary in their susceptibility to parasites

Most susceptible
- Lambs and kids
  - Weanlings
  - Early weaned
  - Spring born
  - Late-born
  - Artificially reared
- Periparturient females
  - High producing
  - Yearlings
- Geriatric animals

Less (but still) susceptible
- Mature males
- Dry females
- Pets

Birthing and weaning management

- Can manage lambing/kidding to lessen parasite problems
- Optimal time to lamb/kid will vary (climate, other factors)
- Some producers who lamb/kid in fall/winter report less parasite problems
- Housing indoors during late gestation/early lactation to minimize effect of periparturient egg rise
- Weaning age affects susceptibility
- Pros and cons to different weaning ages

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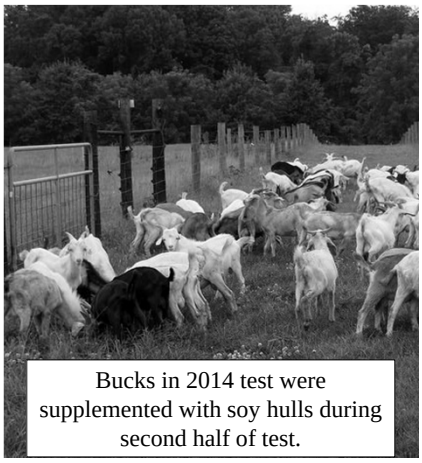
Nutritional management

- Sheep/goats in better body condition and higher plane of nutrition are more resilient
- Extra protein (by-pass, above NRC) in late pregnancy reduced fecal egg counts in periparturient ewes
- Many pastures are usually deficient in <u>energy</u>



Bucks in 2014 test were supplemented with soy hulls during second half of test.

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Pasture and grazing management

- Safe (clean) pastures
- Low risk pastures
- Evasive grazing
- Strip grazing
- Short-duration grazing
- Rotational grazing
- Management-intensive grazing
- Multi-species grazing
- Composting manure before spreading on fields.
- Browsing
- Alternative forages
  - Tanniferous forages
  - Annuals
  - Legumes, forbs, herbs
- Minimum grazing height
- Delayed grazing
- Night penning
- Zero grazing (dry lot feeding)

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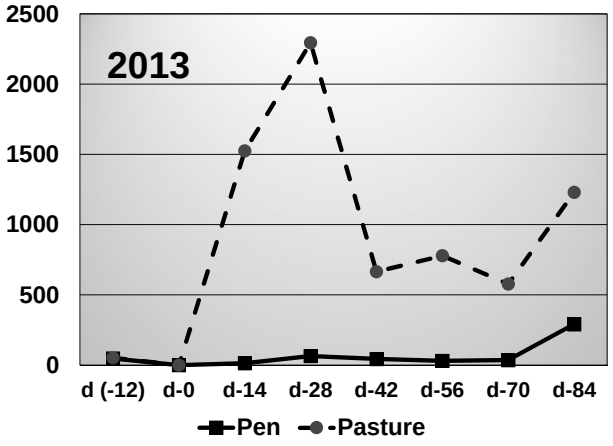
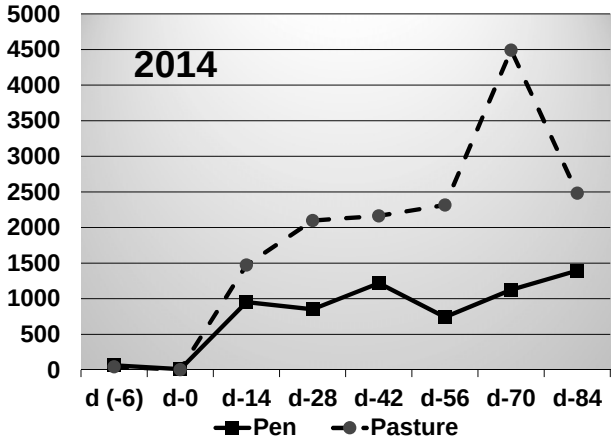
Western Maryland Research & Education Center
Pen vs. pasture studies
Avg. fecal egg counts, epg





No pen goats required deworming; pasture goats received 28 (2013) and 5 treatments (2014)

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Genetic selection

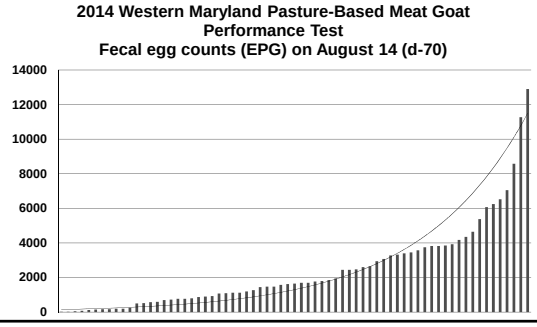
- There are documented differences in breeds with regards to parasite resistance.
- There is as much genetic variation within a breed as between breeds.
- Fecal egg counts are not evenly dispersed in a herd.

One of the more resistant bucks in the 2014 test.

Approximately 20-30% of the herd's responsible for 70-80% of the pasture contamination.

Note: Some recent research from West Virginia indicates Texel sheep may have some resistance.

FECs are not evenly dispersed



Genetic selection: two traits

RESISTANCE

- Ability of the host to reduce number of parasites that establish, reproduce, or survive in its body.
- Quantified by fecal egg counts (# worm eggs per gram of feces), which are an indirect measure of the worm burden in the animal.

RESILIENCE

- Ability of host to tolerate parasitic infection, i.e. maintain health, thrive, grow, and reproduce.
- Quantified by observation or measurement of clinical signs: packed cell volume (PCV), weight gain/loss, body condition, dag score.
- FAMACHA© scores are an estimate of PCV.

Genetic selection

- Significant (but variable) correlations between FEC and PCV and FEC and FAMACHA© scores.
- Parasite resistance moderately heritable trait in sheep, variable estimates for FEC heritability in goats - no estimates for the US goat population.
- Lincoln University (in Missouri) has embarked on a long term selection study on parasite resistance in meat goats (research herd is ¾ Kiko x ¼ Boer).

Targeted Selective Treatment (TST)

What is it?

- Only treating animals that require treatment or only treating animals that would benefit from treatment.

What does it do?

- Slows drug resistance, b/c
  - Reduces # of treatments
  - Increases refugia
- Identifies resistant and susceptible animals for selection purposes.

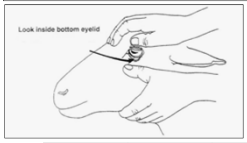
Decision-making tools for TST

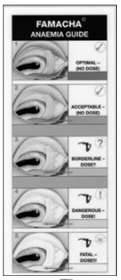
- TST requires practical decision-making tools that farmers/ producers can use.
- The first tool developed was the FAMACHA© system.
- The Five Point Check© is an extension of the FAMACHA© system.

FAMACHA© System

- FAMACHA© system - developed for small-scale sheep farmers in South Africa in response to growing anthelmintic resistance
  - System validated for goats
  - System validated in US for sheep and goats
- System to assess anemia (primary symptom of barber pole worm infection) in sheep/goats and to determine need for deworming individuals
- Named for its originator: Dr. Francois "Faffa" Malan : **Fa**ffa **Ma**lan **Cha**rt

FAMACHA© System





Clinical Category	Eye Lid Color	Packed Cell Volume/PCV	Treatment recommendation
1	Red	≥ 28	No
2	Red-Pink	23-27	No
3	Pink	18-22	?
4	Pink-White	13-17	Yes
5	White	≤ 12	Yes

Decision-making: FAMACHA© score 3

Deworm	Don't deworm
Goats	Sheep
Kids and lambs	Mature animals
Periparturient females	Non periparturient females
Lactating females	Dry females
High parasite challenge	Low parasite challenge
Infrequent monitoring (> 3 weeks)	Frequent monitoring (1-3 weeks)
≥ 5-10% FAMACHA© 4s and 5s	< 5% FAMACHA© 4s and 5s
Downward trend in 1s and reciprocal increase in 2s and 3s	No downward trend in scores
Flock/herd not in good body condition and overall health	Flock/herd in good body condition and overall health
To increase sensitivity of system (probability of identifying anemic animals)	To increase specificity of system (probability of identifying non-anemic animals)

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Tips for using FAMACHA©

- Check at appropriate intervals; varies by season, animals, and risk of infection/reinfection.
- No half scores, use the paler score.
- Be consistent.
- Learn your animals.
- Don't ignore other symptoms and factors.
- Test for anthelmintic resistance.
- Replace card, as necessary.

**If you complete this Journey Farmer training, you will get a FAMACHA card; you can also get training at: http://web.uri.edu/sheepngoat/parasite-control/

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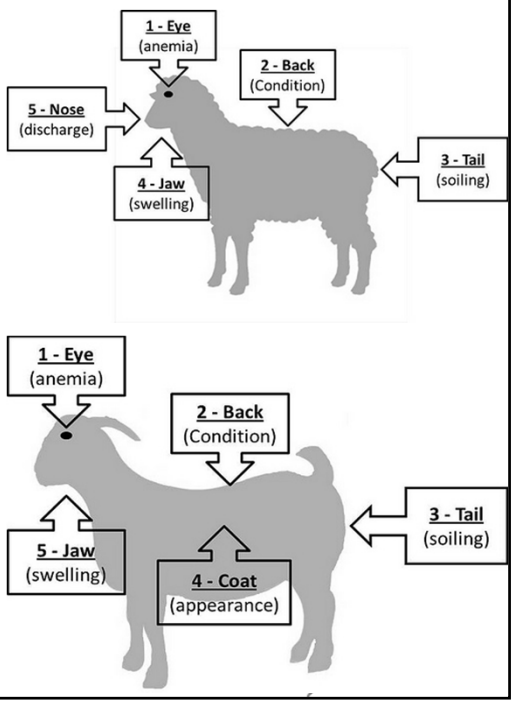
Five Point Check© 5.✓©

- Addresses FAMACHA© limitation - only effective for blood feeding parasites
- Extension of TST - determine need for deworming for all small ruminant internal parasites
- Especially useful for FAMACHA© score 3 deworming decisions
- 5 check points: eye, back, tail, jaw, nose
- Developed for sheep.
  - For goats, can replace nose checkpoint with coat condition.



Check Point	Observation	Possibilities
1. EYE	Anemia 1-5 (FAMACHA© card)	**Barber pole worm (*Haemonchus*)** Liver fluke Hook worms Other worms and causes
2. BACK	Body condition score 1-5 (BCS card)	**Brown stomach worm (*Teladorsagia*)** **Bankrupt worm (*Trichostrongylus*)** Nodular worm Other worms and causes
3. TAIL	Fecal soiling (1-5) Dag score card	**Brown stomach worm (*Teladorsagia*)** **Bankrupt worm (*Trichostrongylus*)** **Coccidia (*Eimeria*)** Nodular worm (Oesophagostomum) Other worms and causes
4. JAW	Soft swelling “Bottle jaw” 1-5	**Barber pole worm (*Haemonchus*)** **Coccidia (*Eimeria*)** Liver fluke Hook worms Other worms and causes
5. NOSE	Discharge 1-5	**Nasal botfly** Lungworms Pneumonia Other causes
5. COAT	Coat condition 1-3	**Barber pole worm (*Haemonchus*)** **Brown stomach worm (*Teladorsagia*)** **Bankrupt worm (*Trichostrongylus*)** **Coccidia (*Eimeria*)** External parasites Other causes

#2 - Back - Body condition score (BCS)

- Many parasites can cause a loss of body condition.
- Poor or declining body condition can also be a sign of age, poor nutrition, or other diseases.
- Animals also vary in their ability to carry and hold body condition.

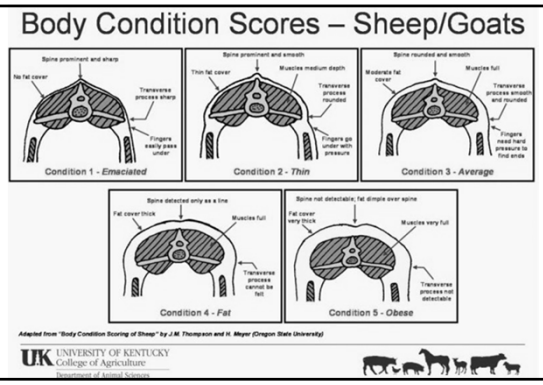


Body condition scoring (BCS)

- Is used to determine how fat or thin an animal is.
- Cannot be determined by simply looking at an animal.
- Is accomplished by feeling for the amount of fat and muscle over the back, ribs, and loin.
- Is one of the most useful management practices.
- Should be done on a regular basis.

Body Condition Score		Spineous process	Rib cage	Loin eye
1	**Very thin**	Easy to see and feel, sharp	Easy to feel and can feel under	No fat covering
2	**Thin**	Easy to feel, but smooth	Smooth, slightly rounded, need to use slight pressure to feel	Smooth, even fat cover
3	**Good condition**	Smooth and rounded	Smooth, even feel	Smooth, even fat cover
4	**Fat**	Can feel with firm pressure, no points can be felt	Individual ribs cannot be felt, but can still feel indent between ribs	Thick fat
5	**Obese**	Smooth, no individual vertebra can be felt	Individual ribs cannot be felt. No separation of ribs felt.	Thick fat covering, may be lumpy and "jiggly"

Source: www.smallstock.info



#3 - Tail - dag score

- The hindquarters of the animal are assessed to determine dag score or degree of fecal soiling.
- Many parasites can cause scours (diarrhea).
- Stress and diet are other causes of diarrhea.


What are dags?

- Dried feces left dangling on the wool on a sheep's rear end.


Dag Score	Description	Action
0	No fecal soiling at all. No indication for treatment/action.	None
1	Very slight soiling on edge of tail/on each side	None
2	Slight soiling on edge of tail/on each side	Usually none
3	Moderate soiling, dag formation	Consider treatment/action
4	Severe soiling, severe dag formation	Treatment recommended
5	Very severe, watering diarrhea extending to hocks.	Treatment essential

Source: University of Pretoria, South Africa

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SIL Dag Score chart

Use this chart for scoring sheep for dags. Note that zero is for "no dags" while 5 is for most daggy. You can use fewer scores but SIL does not recommend using less than a four point scale (zero plus 3 grades of dagginess).

SIL Dag Score Scale

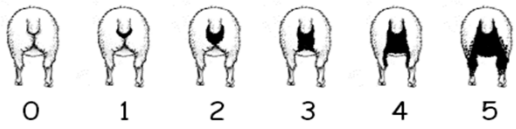
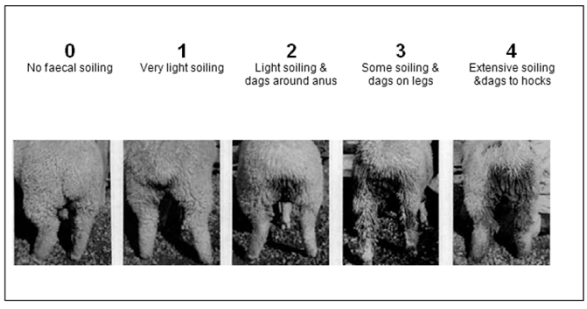
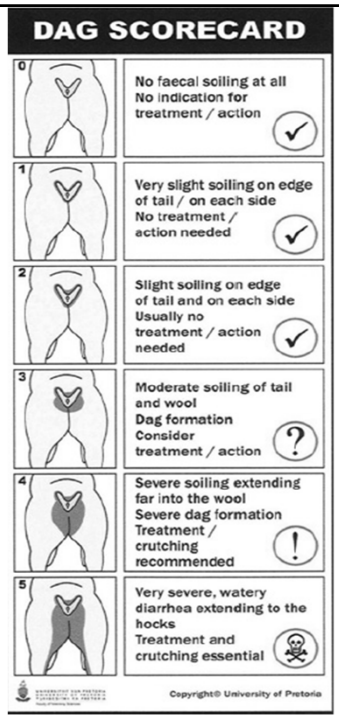


Figure 2.2 Dag Score Reference Guide





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#4 - Bottle jaw

(submandibular subcutaneous edema)

- An accumulation of fluid (swelling) under the lower jaw.
- Usually a result of anemia (blood loss).
- Occurs primarily due to the infestation of barber pole worms (*Haemonchus contortus*) or other blood-feeding parasites.
- Can also be caused by coccidiosis and other parasites.
- Can die without showing bottle jaw.

#5 – Nose (or coat)

Sheep - Nose

- Nasal discharge (for nasal bots)

Goats - Coat condition

- The condition of a goat's hair coat can be indicative of its overall health and thriftiness.
- Diet (nutrition) also has a large effect on coat condition.

Other factors to consider

…especially when deciding whether to deworm FAMACHA 3's

- Fecal consistency
- Fecal egg count
- Weight gain
- Scores of other animals
- Risk of reinfection
- Frequency of FAMACHA© scoring and Five Point Check©

What do to when deworming is not enough or only marginally effective.

- Dose with another class of anthelmintic.
- Give supportive therapy
  - Vitamin B complex
  - Iron or Red cell
  - Nutri-drench
  - Probiotics
  - Electrolytes
  - Proteinaceous feeds
- Remove parasitized animal from pasture (source of reinfection).

For pets: Your vet could do a blood transfusion

Fecal Egg counts (FECs)

- A <u>quantitative</u> measurement that is expressed as eggs per gram of feces (EPG, epg) vs. "positive" or "negative" or +,++, +++ from a simple fecal flotation (which is not very useful!)
- Uses a <u>measured</u> amount of feces and flotation solution.
- An <u>approximation</u> of the worm load an animal is carrying.
- A "<u>snapshot</u>" in time.

FEC data from the Western Maryland Pasture-Based Meat Goat Performance Test

Test ID	FEC d-28	FAMACHA©
303	1650	3
304	1000	3
305	275	3
310	2040	2
334	125	3
335	3000	4
337	1300	3
338	3167	3
355	4650	2
356	6725	2
357	6000	3
358	4900	4
339	120	4
340	4240	3
351	14680	3
352	2125	5
353	33	4
359	867	3
360	200	2
361	1240	3
362	2225	2
363	525	2
367	200	2

Year	Genetic correlation (-1 to 1) between FECs and FAMACHA© scores	
2007	0.29	Intermediate
2008	0.42	Intermediate
2009	0.18	Weak
2010	0.23	Weak
2011	0.14	Weak
Avg. 5 years	0.25	Weak to intermediate

Limitations of fecal egg counts

- Not a highly accurate test, especially at low numbers.
- Parasites vary in their egg producing capacity.
- Immature worms (L4s) suck blood, but do not lay eggs.
- Inhibited larvae do not lay eggs.
- There is a day-to-day variability in counts, even in stable worm populations.
- Eggs are not always evenly distributed in manure.
- Loose stools (diarrhea) may underestimate egg counts.
- Some eggs look the same and cannot be differentiated at the egg stage (e.g. *Haemonchus* vs. *Trichostrongylus*)
- Not all parasites (or strains) are pathogenic.
- There are different procedures for doing fecal egg counts.
- The possibility of human error.

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Three main uses of fecal egg counts

1) Determine anthelmintic (drug) resistance.

2) Monitor pasture contamination.

3) Select animals for their genetic ability to resist worms.

Not a reliable way to diagnose parasitic disease in an <u>individual</u> animal.

What do fecal worm egg counts tell us? http://ohioline.osu.edu/vme-fact/pdf/0027.pdf

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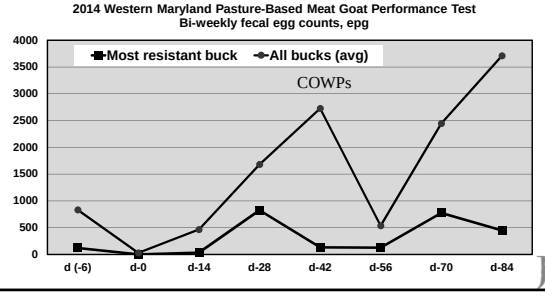
Use fecal egg counts to select goats (especially bucks) that are more resistant to internal parasites.



Doing your own fecal egg counts

What you need

- Compound microscope (10x wide field eyepiece, 10x objective, mechanical stage)
- McMaster slide
- Flotation solution
- Gram scale (optional)
- Cups or vials
- Craft stick or tongue depressors
- Cheese cloth or tea strainer
- Pipettes or syringes

To learn how see: http://web.uri.edu/sheepngoat/video/

Thank you for your attention.

Additional Resources

- www.wormx.info
- www.sheepandgoat.com/#!webinars/cu81
- http://web.uri.edu/sheepngoat/parasite-control/

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

Beginning Farmer Rancher Development Program

Developing the Next Generation of Sustainable Farmers in Georgia Grant

NOTES:

Session 4: Integrated Parasite Management
Learning Exercise/Homework

The following exercise will help to stimulate discussion to help enforce the knowledge you obtained during the session. You will not receive a grade or score.

1. True or False (Circle one) Small ruminant gastrointestinal nematodes (worms) have developed resistance to only one of the classes of anthelmintics (deworming drugs) available in the U.S.

2. How many approved classes/families of dewormers are available for use in sheep and/or goats in the U.S. (Circle one)
    a. One
    b. Two
    c. Three
    d. Four

3. Which dewormers are least likely to be effective in small ruminants for barberpole worm when administered at the appropriate single dose for the species?

    a. Moxidectin (drug in Cydectin)

    b. Albendazole, Fenbendazole, Oxibendazole (Safeguard, Valbazen, Synanthic, etc.)

    c. Ivermectin, Eprinomectin, Doramectin (Ivomec, Eprinex, etc.)

    d. Levamisole, Pyrantel, Morantel (Prohibit, Leva-Med, Goat Care 2X, etc.)

4. What is refugia and what are some methods to help maintain it?

5. What is the ‘worst’ worm for small ruminants in the Southeastern U.S. and what is the main symptom?

6. Farm worm resistance can be directly measured through (circle all that apply):
    a. Sending fecal samples in for a DrenchRite test
    b. Checking to see if FAMACHA scores improve after deworming or not
    c. Checking to see if animals gain weight after deworming
    d. Conducting a fecal egg count reduction test (FECRT)

7. True or False (Circle one). The best use for alternative/natural parasite treatments may be to complement integrated parasite management methods and chemical dewormer use.

8. Which are the animals most susceptible to (most likely to get) worms/internal parasites?
    a. Mature males
    b. Dry (non-lactating) females
    c. Weanlings
    d. Pets
    e. Lactating, high producing females
    f. Really old animals

9. List at least three integrated parasite management methods you can use on your farm.

10. Circle all of the following that should be considered when deciding if/when to deworm <u>individual</u> animals:
    a. FAMACHA eyelid score
    b. Time of the year
    c. Dag score (if have diarrhea/scours, soft stool or normal)
    d. If have bottle jaw or not
    e. Last deworming time/schedule
    f. Nose – Clear or snotty
    g. Hair coat condition - rough looking or not
    h. If you have time
    i. Body condition (level of fatness)
    j. If it is lambing or kidding season
    k. What type of forage is being grazed

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Small Ruminant Production

Meat Production

Marketing

Session Five

Participant Notebook

UGA extension

FVSU extension
Knowledge for Inspiring Lives!

Session 5:
Meat Production and Marketing

Discuss the answers for Session 5 Learning Activity if provided as homework (10 min)

Handouts: The Butcher Stole my Meat; Marketing Live Animals; Ethnic calendar; Maps (counties only, not addresses of facilities); Intern/Mentor Program information

Meat Production (25 min – Dr. Alex Stelzleni)

- Animal grading and selection
- Carcass quality and measurements
- Yield determination

Learning Objectives*:*

- Understand the difference between live weight, hanging weight and retail yield
- Describe how animal age, sex, and farm management practices affect meat quality

How you can use this at home – Determine if you would make any changes on the farm given the information you have learned.

BREAK (if time)

Marketing (35 min – Dr. Alex Stelzleni)

- Market opportunities
  - Live animals
  - Meat/animal products
- Methods and guidelines for marketing red meat products

Learning Objectives*:*

- List opportunities available for marketing live animals and meat
  Activity (30 min) – Meat and Marketing Activity

Ideas for how participants can use this at home – Get more information about/contact the closest livestock sale barns, abattoirs/processing facilities and retail sale sites (farmers' markets for example). Develop a marketing plan for your farm, including more than one market opportunity and determine possible profitability for those markets.

Preparation for Session 6 (next Session):

Body Condition Scoring (8 min – Dr. Niki Whitley, Fort Valley State University)

- Definition of body condition
- How to body condition score

Learning Objectives*:*

- Be able to body condition score goats and/or sheep

OPTIONAL:

Homework Assignment:

View the 2-3 minute video at the following link prior to Session 6:
http://www2.luresext.edu/goats/research/bcshowto.html

Note that this video only shows 'how'/where to score, it does not go over what you would observe at each body condition, so it is more of a supplemental video for the Body Condition Scoring video for the Journeyman Farmer Program.

The butcher kept your meat?

by Dr. Christopher R. Raines, Assistant Professor
Department of Dairy & Animal Science
The Pennsylvania State University

PENNSTATE 1855

No, the butcher probably did not keep your meat. Ever since the first butcher processed a meat animal, the customer has wondered what happened to some of their meat. How could it be that a 1,200 pound steer left you with only 475 pounds of beef? Or that a 250 pound hog generated only 125 pounds of pork? What might seem like a reasonable answer - that the butcher kept your meat - is very unlikely. Take into consideration what happens during the conversion of a market animal into cut and packaged meat, and chances are the math will make more sense. **This brief guide is intended to serve as a general base for meat product return and may not fully account for slight variations that different animals and butcher orders may incur.**

Step 1: Converting an animal into a carcass

Dressing percentage (DP) relates the weight of the carcass to the weight of the live animal and is calculated as: (Carcass Weight ÷ Live Weight) × 100. This can be affected by many things, such as gut fill, fatness, mud on the hide, or shorn versus unshorn. Very fat animals have higher dressing percentages than light very lean animals.

~70%

The average dressing percentage for hogs is about 70-72%.

Example:
Live weight = 245 lbs.
Actual DP = 72%
Carcass wt. = **176 lbs.**

~60%

The average dressing percentage for cattle is about 60-62%.

Example:
Live weight = 1312 lbs.
Actual DP = 60%
Carcass wt. = **787 lbs.**

~50%

The average dressing percentage for sheep is about 50%.

Example:
Live weight = 127 lbs.
Actual DP = 52%
Carcass wt. = **66 lbs.**

Step 2: Making cuts out of a carcass

This is where it starts to get tricky to predict just how much meat the carcass will yield because that depends largely on how you order the meat cut. ***Bone-in or boneless?*** Opting for boneless cuts will reduce your total pounds of meat returned. ***Do you want ground meat with 10% fat or 20% fat?*** Lower fat content ground meat will result in more discarded fat, thus reduced total pounds of product received. ***Was the animal overly fat to begin with?*** If the animal was fat fromthe start, more fat will need to be trimmed away, thus reducing total pounds of meat returned.

Pork

For bone-in pork, expect no more than 75-80% of the carcass weight back as meat. For boneless, 65-70%.

Example:
Carcass wt. = 176 lbs.
Boneless pork = **123 lbs.**

Beef

For bone-in beef, expect no more than 65-70% of the carcass weight back as meat. For boneless, 55-60%.

Example:
Carcass wt. = 787 lbs.
Boneless beef = **472 lbs.**

Lamb

Most lamb cuts are bone-in. Expect no more than 70-75% of carcass weight back as meat.

Example:
Carcass wt. = 66 lbs.
Lamb cuts = **50 lbs.**

Step 3: Aging and further processing (optional)

The longer a whole carcass ages (hangs), the more moisture it loses due to evaporation, thus losing weight. Instead of aging an entire carcass for > 2 weeks, ask if your butcher is willing to age just the middle meats. aged.

Ordering bacon? Cured hams? Smoked sausages? Applying a heat process to meat cuts will also reduce the total yield of meat returned from an animal. Different products have different yields.

For more reading, see: D.M. Wulf, (1999). Did the locker plant steal some of my meat? http://ars.sdstate.edu/MeatSci/May99-1.htm

PENN STATE Meat Science

Session 5
Meats

Alex Stelzleni, PhD
University of Georgia
Meat Science Technology Center

Learning Objectives

- Understand the difference between live weight, hanging weight (hot carcass weight) and retail yield
- Describe how animal age, sex, and management practices affect meat quality

Why is Small Ruminant Production Important?

- Growing US minority populations that consume lamb/goat on a regular basis
  - US = 34% minority population
  - 44% of population for individuals under 18 yrs
  - 47% of population for individuals under 5 yrs
- As long as traditional dietary habits continue, consumption should increase
  - May be restricted to certain times of the year

Photo: Susan Schoenian, Baalands Farm

Runge, AU; US Census

The Meat of the Matter

Producers have the opportunity to market live animals for meat or to market meat directly to consumers!

Important Considerations

- Hot Carcass Weight (HCW) and Dressing Percentage (DP)
  - HCW gives starting weight for sale value
  - DP = (HCW/LW) x 100
    - How much carcass (meat) was in the live animal
    - Considerations – gut fill, age, amount of hair/wool
- Retail vs. Total Yield
  - If selling cuts important to know along with production cost to figure break even (BE) and % profit
  - RY = (Retail cut wt/carcass wt) x 100
  - TY = (Retail cut wt/Live wt) x 100
- Typical Carcass Characteristics/Considerations

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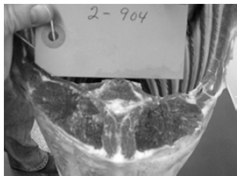
Carcass Characteristics

- Dressing %
  - Lamb and goats, 45-55%
- Fat Cover
  - Minimal - lambs have more
  - 0.1-0.3”
- Carcass wt
  - <50#, depends on time
  - Can lose 5-8% wt overnight
- Loin/rib eye area
  - Goat 1-3 inches^2
  - Lamb 2-4.5 inches^2



Lamb left, Goat right

Photos: Susan Schoenian

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So once we harvest them, what?

Specie	Yield Grade	Quality Grade
Beef	1,2,3,4,5	Prime, Choice, Select, Standard
Lamb	**1,2,3,4,5**	**Prime, Choice, Good, Utility, Cull**
Pork	US 1,2,3,4	Utility
Goat	**None**	**None**

Loveday, UT

Dr. McMillin at LSU developed a grading standard for goats which is used by some sale barns

Lambs

- Yield Grade
  - 0.4+(10*12th rib fat) %BCTRC

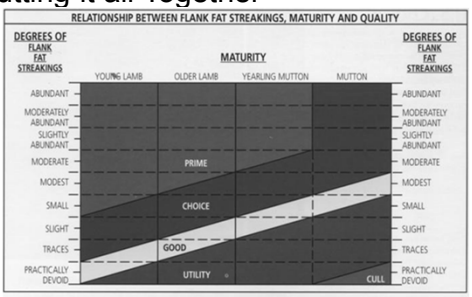
Yield Grade	Expected Yield
Yield Grade 1	47.4 % or more
Yield Grade 2	47.2 – 45.6%
Yield Grade 3	45.4 – 43.8%
Yield Grade 4	43.6 – 42.0%
Yield Grade 5	41.8 % and less

Bottom two photos: Susan Schoenian

Lamb Quality Grade

- *To segregate lamb carcasses into palatability groups based on the expected eating quality of the cooked retail cuts from the lamb carcass*
- What to look for
  - Carcass conformation
  - Maturity (lamb worth more $ than mutton)
  - Fat deposition (Flank)
  - Fat and lean firmness

Putting it all Together



Goat Suggested Grades

Used by some sale barns (with graded sales), can find them at:
www.ams.usda.gov/market-news/goat-reports

Selection 1 Market Kids

- Live goats have a superior meat type conformation; Thickly muscled throughout the body as indicated by
  - −Bulging outside legs
  - −Full (rounded) back strip
  - −Moderately thick outside shoulder

Loveday, UT

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Selection 2 Market Kids

- Live goats have a average meat type conformation; Moderately muscled throughout the body as indicated by a
  - −Slightly thick outside legs
  - −Slightly full (rounded) back strip
  - −Slightly thick to slightly thin outside shoulder

Loveday, UT

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Selection 3 Market Kids

- Live goats have an inferior meat type conformation; Thinly muscled throughout the body as indicated by
  - Legs, back and shoulders are narrow
  - Body has angular, sunken appearance

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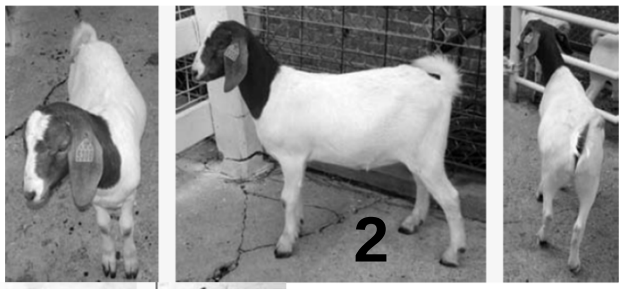
Comparison of Live Goat Selection Grades



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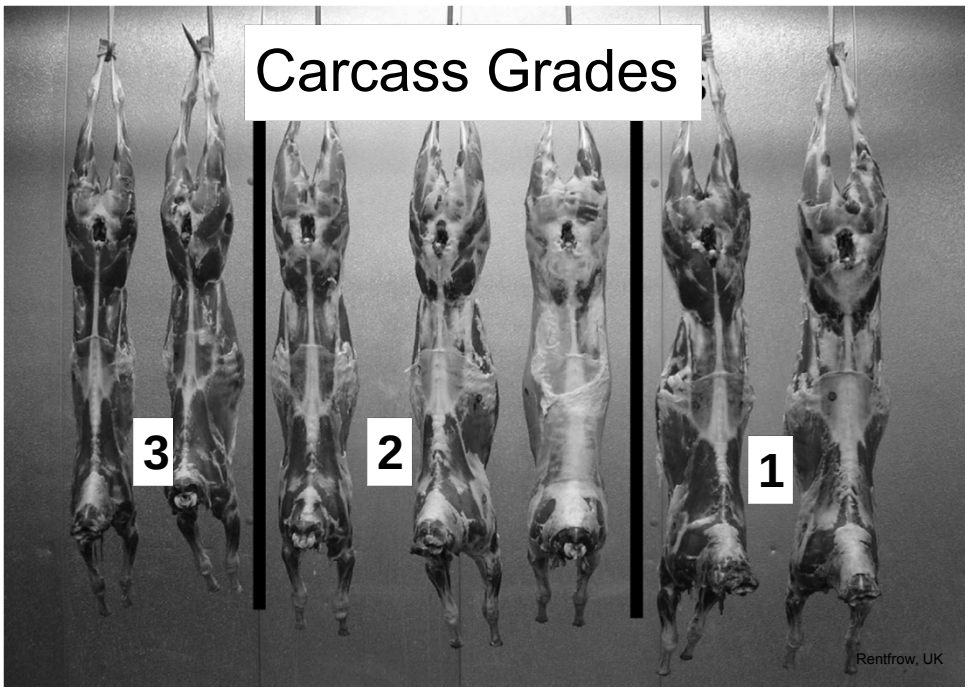

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Fabrication guide to IMPS cuts

IMPS Style	Carcass Weight Range	Recommended Skeletal Cuts	Recommended Muscular Cuts
Platter	15 lb. or less		
Roasting	15-30 lb.		
Barbeque	20-40 lb.		
Food Service	30-40 lb.		
Hotel	40 lb. or more		

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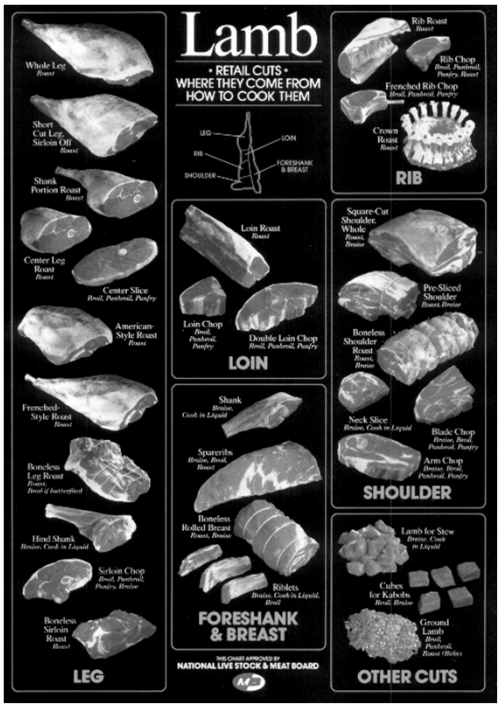
McMillin, LSU

Average Weights and Weight Ranges of IMPS Cuts with Different Goat Carcass Styles

Style	Platter	Roasting		Barbeque		Food Service		Hotel	
Carcass weight lb.	15 or less	15 to 30		20 to 40		30 to 40		40 and above	
Cut name		Average weight	Weight range	Average weight	Weight range	Average weight	Weight range	Average weight	Weight range
Leg		3	2-4	7.5	3.3-10	8.2	1.7-12	11.3	7.6-19
Hind shank						1.4	0.6-6.7	1.6	1.1-2.4
Loin		4	3-6					2.8	1.8-3.8
Back				2	1.2-5	5.8	4-18.8		
Rack (rib)								6.5	4-17.4
Ribs				7.5	4.7-12.6	3.7	2.7-5.6	6.2	3.3-13.6
Shoulder		9.6	7-11.5						
Outside shoulder				3.8	0.9-6.6	6.3	1.1-7.7		
Square shoulder								10.5	6.5-21.2
Fore shank		1	0.5-1.5					2.2	1.3-8.9
Neck		0.8	0.5-1.4	1.2	0.8-1.9	1.5	0.7-2.3	1.7	0.8-3.3



Talk to your processor; not all will process sheep/goats and if they do, they may not be able to create all the cuts you see here.

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% Wholesale Cuts for Lamb and Goat

Primal	Lamb	Goat
Leg	32	32
Loin	12	8
Rack	14	8
Shoulder	24	35
Shank	4	7
Breast	8	9
X Fat	3	1

Adapted from Aaron Renfroe, TX AgriLife

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General impacts on meat quality

- Age
  - Increases yield (muscle) to a point, then fat increases (as long as + nutrition)
  - Meat tenderness decreases with age
- Sex
  - Intact males are leaner (have less fat) and can have tougher meat but may have more muscling/meat than castrated males or females
  - Goat males have a very strong musky smell than can impact meat taste; some consumers are turned off by this (especially Americans)
- Management
  - Animals raised primarily on grass usually have less fat than those fed grain-based feeds (at the same age)
  - Stress can decrease meat tenderness, impact flavor, color, and WHC

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Additional Resources

Goats

- www2.ca.uky.edu/agc/pubs/asc/asc179/asc179.pdf
- www.sheepandgoat.com/#!meat-goat-carcass-evaluation/ce9c

Sheep

- www.sheep101.info/201/lambmarketing.html
- www.sustainagga.org/documents/didthelockerstealmymeat.pdf

Both

- sheepgoatmarketing.info/education/dressingpercentages.php

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

USDA NIFA

Beginning Farmer and Rancher Development Program

Developing the Next Generation of Sustainable Farmers in Georgia Grant

UGA extension

FVSU extension Knowledge for Inspiring Lives!

Georgia Organics

NOTES:

Tips for Marketing Sheep and Goats:
Live Animals

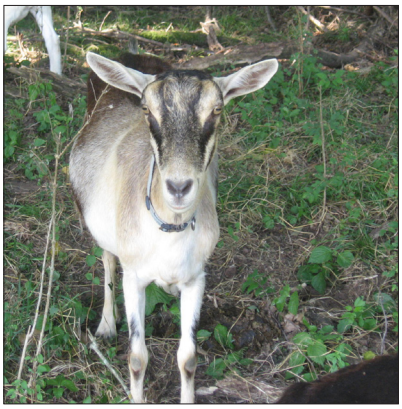


Photo: NCAT

There are many options for marketing sheep and goats. You will have to explore what market options are available in your area and decide what marketing method, or combination of methods, will work best for your farm and farm goals. This tip sheet will explain some of the common market options, address advantages and considerations for each marketing option, and provide further resources.

Market Options	Advantages	Considerations
Sale Barn/Livestock Auction		
This is the traditional livestock marketing venue.	Requires very little effort—you drop your animals off at the sale and receive your check the next week. A marketing option if you don't want to deal directly with customers. A place to sell unproductive or unwanted animals.	You never know the price you will receive for your animals. Your animals may not bring what you think they are worth. You will be charged fees—commission, yardage, tagging fees. This reduces the amount of money you bring home.
On-Farm Sale		
You can sell animals directly from your farm. These can be animals sold for meat or for breeding or show stock.	You set the price. You don't have any fees to pay and you don't have the cost of hauling your animals to a sale. If you have a consistent quality of animals then you can develop a base of repeat customers.	Can be very time-consuming. You have to arrange times for buyers to come to your farm, and you may have buyers come when you haven't arranged a time. You may only be selling one animal at a time. If you are selling breeding stock or show stock, you must only sell high-quality animals for these purposes. It may take some time and marketing effort to establish yourself as a quality breeder.

On-Farm Slaughter

You may have customers interested in slaughtering animals on your farm, usually for religious reasons. If you allow on-farm slaughter, it can be a great service you provide to your customers. On-farm slaughter falls under an exemption to the Federal Meat Inspection Act. States can't disallow on-farm slaughter, but state and local regulations can impose additional requirements. You must check your local regulations before allowing on-farm slaughter.

NCAT

Produced by the National Center for Appropriate Technology • www.ncat.org • 1-800-275-6228 (1-800-ASK-NCAT)
(Parent organization of the ATTRA Project, www.attra.ncat.org)

ATTRA

Market Options	Advantages	Considerations
Pooled Sale		
A pooled sale is where you cooperate with other producers to sell a very large group of uniform animals to a buyer.	Price is generally set ahead of time, so you know what you will be getting for your animals. A way to market a large group of animals at once, with less risk than a sale barn because you know the price you will receive.	Requires cooperation with other producers and a buyer. You must meet the buyer's requirements. The buyer will usually set a target weight of the animal and the number of animals he wants to buy. You may have to pay some fees—commission, trucking. Pooled sales are not available in all areas. You may work with your local producers group to organize such a sale.
Graded Sale		
A graded sale is like a pooled sale in that a buyer is looking to buy a large lot of uniform animals. There will be a USDA grader present to evaluate the animals. Prices will depend on the quality (#1, #2, #3) of the animal.	Price is set ahead of time, so you know what each grade will bring. You will be paid for quality. Heavily muscled animals will bring more per pound. A way to market a large group of animals at once, with less risk than a sale barn because you know the price you will receive.	You may have to pay some fees—commission, tag fees, etc. Graded sales are not available in all areas. You will have to work with other producers, a buyer, and a USDA grader to organize this type of sale.

USDA Selection Grades

USDA Selection Grades are based on the meat type conformation of the goat (how thickly muscled it is).

Selection #1—Goats should have a pronounced bulging to the outside hind leg, a full, rounded backstrip and a moderately thick outside shoulder.

Selection #2—Goats have moderate meat conformation.

Selection #3—Goats have an inferior conformation.

Resources

- **ATTRA - National Sustainable Agriculture Information Service**
  www.attra.ncat.org
- **Maryland Small Ruminant Page—Marketing**
  www.sheepandgoat.com/market.html
- **Sheep & Goat Marketing**
  www.Sheepgoatmarketing.info
- **Marketing Slaughter Goats and Goat Meat—Langston Module**
  www.luresext.edu/goats/training/marketing.pdf

Photo: NCAT

The development of this material was supported through USDA/NIFA/OASDFR
www.outreach.usda.gov/oasdfr

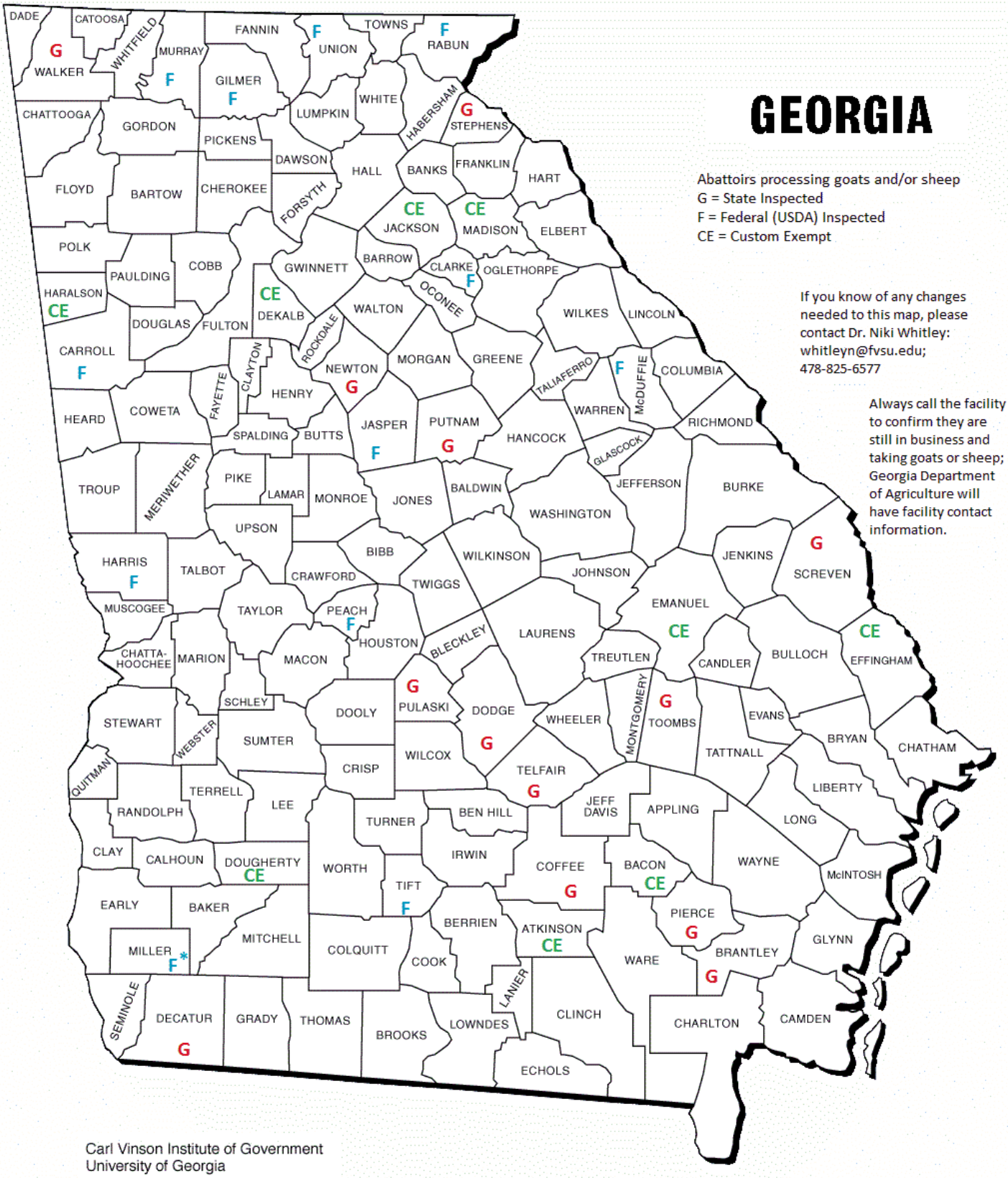
United States Department of Agriculture
National Institute of Food and Agriculture

Tips for Marketing Sheep and Goats: Live Animals

By Margo Hale and Linda Coffey, NCAT
Production: Robyn Metzger
This publication is available on the Internet at www.attra.ncat.org.
IP398 Slot 392 Version 072712

Holiday Calendar for Marketing Sheep and Goats

Holiday	2015	2016	2017	2018	2019
New Years	January 1	January 1	January 1	January 1	January 1
Epiphany	January 6	January 6	January 6	January 6	January 6
Eid ul Adha Festival of Sacrifice	Sept. 23	Sept. 11-14	Sept. 1-4	Aug. 22-25	Aug. 12-15
Islamic New Year	Oct. 14	Oct. 2	Sept. 20	Sept. 12	Sept. 1
Christian Easter	April 5	March 27	April 16	April 1	April 21
Orthodox Easter	April 12	May 1	April 16	April 8	April 28
Passover/Pesach	April 4-11	April 23-30	April 11-18	March 31-April 7	April 20-27
Mawlid al Nabi Birth of the Prophet	Jan. 3 and Dec. 23	Dec. 14	Dec. 1	Nov. 21	Nov. 10
Ramadan Begins Month of Fasting	June 18	June 6	May 27	May 16	May 6
Rosh Hashanah Jewish New Year	Sept. 14-15	Oct. 3-4	Sept. 21-22	Sept. 10-11	Sept. 30-Oct. 1
Thanksgiving	Nov. 26	Nov. 24	Nov. 23	Nov. 22	Nov. 23
Eid al Fitr Ramadan Ends	July 18	July 7-9	June 26-28	July 15-17	June 5-7
Chanukkah	Dec. 21-28	Dec. 12-Jan. 1	Dec. 13-20	Dec. 3-10	Dec. 23-30
Christmas	Dec. 25	Dec. 25	Dec. 25	Dec. 25	Dec. 25



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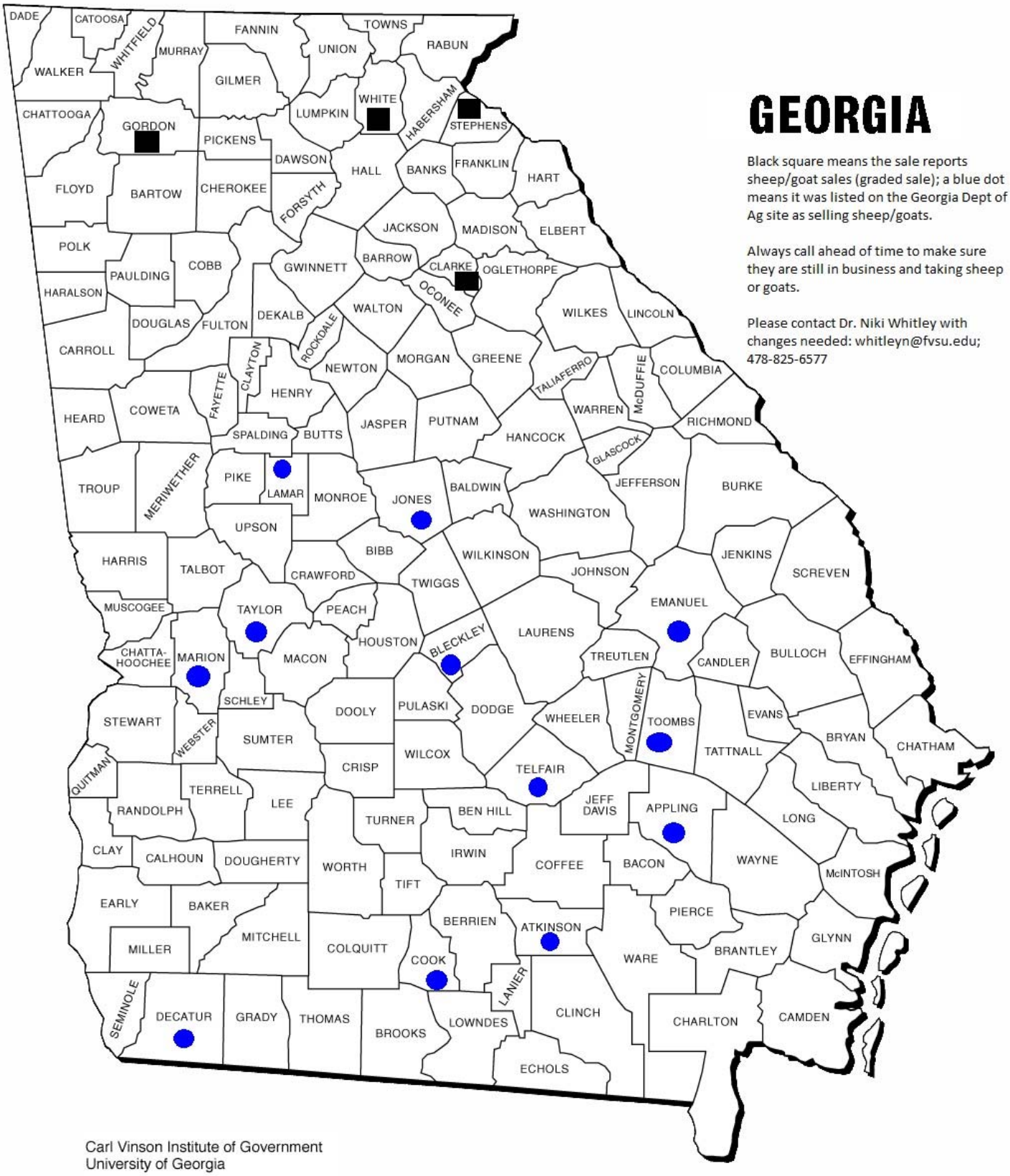

GEORGIA

Black square means the sale reports sheep/goat sales (graded sale); a blue dot means it was listed on the Georgia Dept of Ag site as selling sheep/goats.

Always call ahead of time to make sure they are still in business and taking sheep or goats.

Please contact Dr. Niki Whitley with changes needed: whitleyn@fvsu.edu; 478-825-6577

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Small Ruminant Production

USDA NIFA | FVSU extension Knowledge for Inspiring Lives! | UGA extension

Session 5
Marketing

Alex Stelzleni, PhD
University of Georgia
Meat Science Technology Center

Most photos/some slides: Susan Schoenian, University of Maryland and Baalands Farm

Learning Objectives

- Identify different markets for live animals.
- Understand the requirements for marketing meat products in Georgia.

Lamb(mutton) / Goat Meat Consumption

- Purchasers are usually ethnic
  - ~60% Muslim, Latino/Hispanic, Asian, Caribbean, Italian, Greek, Eastern European
- Different ethnic groups have preference for different types of meat
  - Age, Sex, Cut, Preparation
- May desire Halal or Kosher slaughter

Runge, AU

Photos: Susan Schoenian, Baalands Farm

Major Goat Consumption Holidays

Table 1. Various Holidays and Celebrations Where Goat is Typically Served.

Holiday	*Date*	*Size of Kid*	*Comments*
Easter (Western)	Late March/Early April	20 to 50 pounds	Date varies
Easter (Eastern and Greek)	Mid to Late April	20 to 50 pounds	Date varies
Cinco de Mayo (Hispanic)	May 5	20 to 35 pounds	
Independence Day	July 4	20 to 35 pounds	Older kids accepted
Caribbean Holidays	August	60 pounds	Bucks only
Start of Ramadan (Muslim)	Late August/mid-September	45 to 120 pounds	Less than 12 months old; Date varies
Eid al Fitr (Muslim)	Late September/mid-October	45 to 120 pounds	60 pounds optimum
Eid al Adha (Muslim)	Late November/Early December		Yearlings, blemish free; Date varies
Dassai (Hindu)	Late September/Mid-October		Male goats only; Date varies; Size varies

Jones and Raper, OSU

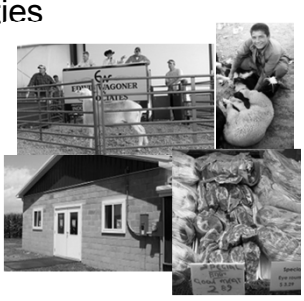
Many ethnicities traditionally consumed goat, but have switched to lamb due to availability, price, assimilation, and other factors

Consumption

- Consumers of goat (chevon/cabrito) or lamb also purchase it for many other celebrations:
  - Christmas
  - Thanksgiving
  - Birthdays
  - Weddings
  - Family reunions
  - Others
    - Superbowl/Game day parties
    - Coming of age parties
    - More

Marketing opportunities

- Can take advantage of these times of high consumer demand through marketing:
  - Sales at livestock auction/sale barns
  - Sales to a harvest/processing facility or other middlemen
  - Farm gate (on-farm) sales of live animals directly to consumers
  - Sales of meat or value added products



Marketing animals through a sale barn
(also called auction or stockyard)

- Not all auctions are equal - consider ones who are experienced with goats/sheep; graded sales usually better.
  - Local
  - Terminal
  - Weekly
  - Special
  - Graded
  - Sponsored

Sale barn Pros/Cons

PROS

- Place of price discovery
- Price competition (usually)
- Prompt, guaranteed payment (P&S Act)
- Unbiased grading (usually)
- Animals are weighed and weights are certified.
- Easy
- Convenient
- Low labor

CONS

- You are a price taker
- Prices not known ahead of time
- Price volatility
- Selling fees can be substantial (commission, insurance, yardage, feed), especially for lighter lambs.
- Stressful to livestock
- Transportation costs
- Shrink

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Tips for sale barn (ethnic) marketing

- Sell livestock prior to major ethnic holidays, at least one week ahead of time.
- Do not castrate males, unless necessary.
- Do not dock lamb tails, unless necessary.
- Do not sell dirty animals with soiled hocks and hindquarters.
- Consider shearing animals that are neither too fat nor too thin.
- When selling suckling lambs/kids, sell them directly off their dams.
- Mark your animals according to how you want them sold.
- Do not bring your animals to the sale barn at the last minute.
- Make sure your animals have feed and water.
- Call the market manager ahead of time. Get to know manager(s).
- Sit through auctions. Get to know buyers.
- Consider selling when reported prices are low.
- Consider breeding out-of-season.
- Pay attention to body condition. Don't sell culls that are too fat or too thin.
- Sell to the auction that offers you the most profit – not necessarily the highest price.

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Abattoir/processor or other middlemen

- Abattoir/processor
- Order buyer/brokers
- Ethnic Stores
- Cooperatives
- Other producers
  - Breeding stock, records needed, pedigrees?

There are buyers in Georgia willing to come to you farm to pick up groups of sheep and goats (usually lots of 40+ animals). The abattoirs/processors buying animals are generally near big cities.

Abattoir/middlemen Pros/Cons

PROS

- Opportunity to negotiate
  - Price
  - Shrink
  - Delivery
  - Contract
- Price known ahead of time
- Low cost method
  - No selling fees
  - No processing costs
- Low labor

CONS

- Payment risk
  [sell to bonded/licensed dealers; require cash payment]
- May not always be the highest price offered; middleman needs to make a profit
- May not always be buying

Farm Gate (direct marketing live animals)

- Different options
  1. Cash-and-carry
  2. Custom slaughter
     Mobile slaughter
  3. On-farm slaughter (where legal)

Farm Gate Pros/Cons

PROS

- Set your own price
- No selling fees
  - Commission
  - Yardage
  - Insurance
  - Feed
- No processing or transportation costs
- Less stress to animal (?)
- Low labor

CONS

- Payment risk
- Someone has to be on the farm to sell, risk of no-shows
- Language and cultural barriers
- Buyer may lack suitable transportation
- You may not know where and how animal is slaughtered

<u>On-farm slaughter</u>

- Not legal in most states, need a place to harvest and for offal disposal
- Comfort (not for everyone)

Sales of Meat/Products

- Direct to consumer
  - Farmers markets
    - Fees, insurance
    - Waiting list?
  - Farm store/off farm
- Retail stores
  - Grocery stores
    - Require liability insurance; may require certifications (i.e. Whole Foods)
    - Want consistent quality and high quantity year round
  - Butchers
- Restaurants
  - Want consistent quality and quantity year round

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Sales of Meat/Products

PROS

- Set your own prices; opportunity for higher net price/animal
- No live animal/sale barn type fees
- Can tell your farm story/interact directly with consumers

CONS

- Finding abattoir/processor who will process small ruminants in the manner/cuts desired
- Cost of processing
- Transportation costs for animals and products
- High labor
- Requires a marketing personality to interact directly with consumers
- Costs may be associated with sales:
  - Farmer's market fees
  - Storage locker fees
  - Labeling costs
  - Audit fees for some certifications/labels
  - Sales tax collection (?)
  - Fees to take credit cards (?)

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General Marketing Tips

- Keep or sell the best (top 10-20%) for breeding stock and sell the rest for consumption
- Sell animals/products for a profit – know your cost of production
  - If cost of production (and marketing) is $125/female/year and your females provide only 1 marketable offspring per year, your break-even price, the minimum price you need to get, is $125 for that kid or lamb.
  - Divide that price by two if they provide you with 2 marketable offspring per year ($75 per kid or lamb).
- Sell for highest "net" price; consider all marketing costs (i.e. fees, transportation) when choosing best option(s)

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General Marketing Tips

- Have a plan for marketing your animals (more than one market?) and schedule breeding for marketing opportunities
- Follow Scrapie Program requirements (free tags/tagger; keep purchase/sales records): www.eradicatescrapie.org
- For sheep, follow rules for the Lamb Checkoff (mandatory fees assessed to seller and first handler): http://lambresourcecenter.com/lamb-checkoff/who-we-are
- **If marketing meat/products, follow state/federal rules and regulations**

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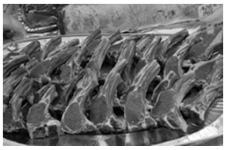
Rules and Regulations for Selling Red Meat in GA

Can I Sell Meat from My Animals?

- It Depends
  - Farmers Exemption, Custom Processing, Inspected, Retail Exempt – Mobile vs Fixed
- Part of Federal MIA
  - Enforced by USDA and GDA (local municipality)
- Laws as we understand them and told to us as a Processing Plant and discussions with inspectors
  - Before doing anything questionable be sure to ask GDA!!!



Types of Plants

- Custom Processor – "Cut and Wrap"
  - Kill, cut, wrap for individual use
  - MUST be marked NOT FOR SALE on each package
  - Meat CAN NOT be sold, donated, traded, bartered
  - Animal owner (end user) pays for kill, processing, storage
  - Oversight from GDA and USDA for records and sanitation
  - Keeps legal records (names, addresses, pounds)

Types of Plants

- State Inspected – GDA, Meat can be sold within state lines
- Federally Inspected (TA) – By USDA or GDA on behalf of USDA, Meat can be sold in US
  - But, need other permits, licenses, approvals to sell
  - Under continuous inspection
  - Owner pays for services and takes meat back for sale (see permits etc. above)
  - Meat must be inspected for direct sale!!!!
  - Plant has high risk potential

agr.georgia.gov

Georgia Department of Agriculture has a list with contact information for all inspected (Custom, State and Federal) facilities in Georgia available upon request. Also, there is a searchable Federally inspected facility directory at: www.fsis.usda.gov/wps/portal/fsis/topics/inspection/mpi-directory

Farmer's Exemption

- Part of Custom Exemption (Curtis Amendment)
- For the farmer, family, non-paying guests ONLY
- Farmer may kill and haul to Custom plant for processing
  - Can do alone if know how (not recommended)
  - Must declare animal was ambulatory (Scrapie, TSE, BSE)
- May take live animal to Custom plant and have killed, processed
- Must be for personal use only
- Plant must keep records, who, how much, how often, animal age

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Custom Exempt

- Producer sells LIVE animal to someone else
  - May deliver to slaughter for new owner (no charge)
- New owner contacts plant
  - Fills cut sheet, pays for kill, processing, picks up
  - Old owner can deliver product as a favor, no charging
- Can't kill then sell sides, quarters … Must sell live animal. Separate transaction for animal vs kill and processing

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Custom Exempt

- Others
  - Producer can sell portions of LIVE ANIMAL, issues with cuts and plant abilities, 2 vs 10 owners
  - Plant keeps records of old owner, new owner(s)
    - If 1 person brings and takes 1 animal/week that is way above personal consumption levels
  - Animal age (cattle, BSE), must be ambulatory
  - Producer cannot sell animal, then kill and cut for another person…operating as processor
    - Ga State Law 26.2.209 prohibits letting others (new owner) from killing and cutting on your land!!!

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Inspected

- As producer you can retain ownership
  - Gives privilege of selling meat and cuts…If you meet other requirements
    - Facilities, Licenses, Permits, Labels
  - Must work with processor on cutting and packaging
  - Must work with processor and USDA/GDA on Label
  - Does <u>not</u> mean you can:
    - Put in trunk of car and sell in mall parking lot or sell out of barn, basement, garage

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How to have it cut?

- Farmers Exemption
  - However you want, or however the Custom plant you use does it
- Custom Exempt
  - As a producer it is out of your hands, you already sold the animal
- Inspected
  - Will vary from plant to plant, must do homework
  - Specialty and new cuts may be desired for ethnic markets, but odds of getting are slight

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Labeling

- Custom
  - No Claims, Generic plant label, Not For Sale
- Inspected
  - Must work with Plant, may not be willing to put special label on product
  - Must be approved by USDA/GDA
  - Must follow Federal Labeling Guidelines
  - All claims must be verified process controlled
  - Label still has plant address and inspection number (why some are iffy about doing this)
  - Label belongs to plant not you

www.tendercutmeats.co.uk

For labeling guidelines - www.fsis.usda.gov

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How to sell cuts?

- Mobile License (Delivery to end user)
  - Farmers markets, parking lots, delivery to Hotel/Restaurant GDA annual basis, $100 GA 40-7-5
- Fixed Location
  - Georgia Food Safety Divisions Licensing GA 40-7-1-19
- Further Processing – cutting, bacon, sausage
  - If fixed location, inspected product, end user only
    - $ Volume and % of total sales (cure/cook MUST be inspected if for use other than household consumer no matter what)
      - 75% end user, 25% or less wholesale &/or less than $76,900
  - If mobile – must be made at inspected facility

Straight from USDA via our GDA Inspector

- FSIS' policy regarding whether the preparation of meat products for sale to other than household consumers by a retail store is exempt from inspection is based on what operation is employed in preparing the product, and where that operation falls under 9 CFR 303.1 (d) (2) (iii) (f). If the retail store engages in the operations of cutting up, slicing, and trimming of carcasses, halves, quarters, or wholesale cuts into retail cuts such as steaks, chops, and roasts, and freezing such cuts; grinding and freezing products made from meat; breaking bulk shipments of products; or wrapping or rewrapping such products in the preparation of retail products for sale to other household consumers, it would be exempt from inspection. 9 CFR 303.1 (d) (2) (iii) (f). The retail store would also have to make no more than 25% of its sales to other than household consumers, and its sales to other than household consumers could not exceed the dollar limits on such sales that FSIS establishes. 9 CFR 303.1 (d) (2) (iii) (b).
- If a retail store cures, cooks, renders, refines livestock fat, or engages in other operations to prepare products for other than household consumers, then those operations are subject to inspection, regardless of the percent of its sales that are to other than household consumers or of the dollar amount of those sales. 9 CFR 303.1 (d) (2) (iii) (f).

Final Considerations

- These are the laws as we understand them
- There are a ton of 'grey areas'
- Be sure to follow due diligence before starting
- Contact GDA – Inspection and Food Safety - with any questions BEFORE doing anything
- Keep and handle as though your young child was eating it, consumer comes first; it only takes one outbreak to shut the system down
- Follow the laws at all times, the consequences are real
- Strongly consider liability insurance!

Additional Resources

GA Dept of Agriculture (GDA)
- www.agr.georgia.gov

USDA – Food Safety Inspection Service
- www.fsis.usda.gov

Inspection Law GDA
- www.agr.georgia.gov/meat-inspection.aspx

Food Safety (Licenses and laws for sales) GDA
- www.agr.georgia.gov/foodsafety.aspx

Marketing webinars:
- www.sheepandgoat.com/#!webinars/cu81

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-70017-22861.

USDA NIFA Beginning Farmer and Rancher Development Program

Developing the Next Generation of Sustainable Farmers in Georgia Grant

UGA extension | FVSU extension Knowledge for Inspiring Lives! | GEORGIA ORGANICS

NOTES:

Meat and Marketing Learning Exercise

The learning objectives for this activity are to be able to estimate hot carcass weight and to understand marketing avenues and break-even prices.

For this activity, you may need a calculator to answer some of the following questions. No score or grade will be assigned.

1. Given that small ruminants dress out with a hot carcass weight that is 45-55% of their live weight (on the lower end of that range if there are more non-meat/bone components like a lot of wool or gut fill), estimate the hot carcass weight of a 120 lb lamb with average wool (use 50% as the dressing percentage).

2. If a doe or ewe averages 1.5 marketable kids or lambs per year and the total cost of production and marketing per female is $115, for marketing live animals:

    a. What is the breakeven price ($/offspring)_____

    b. If the producer usually sells offspring weighing around 50 pounds what is the breakeven price per pound? ($/lb) _____

3. What are three places/ways to market live animals? Rank them in order of most likely (1) to least likely (3) to be used on your farm. Discuss the reasoning behind your ranking.

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Small Ruminant Production

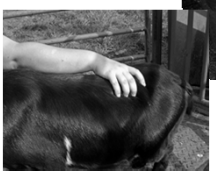
USDA NIFA | FVSU extension Knowledge for Inspiring Lives! | UGA extension

Session 5
Body Condition Scoring

Dr. Niki Whitley
Animal Science Extension Specialist
Fort Valley State University

Learning Objectives

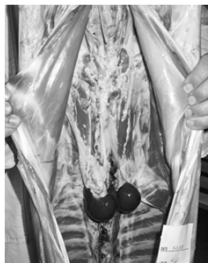
- Be able to body condition score goats and sheep



Photos courtesy of Susan Schoenian, Baalands Farm

How fat?

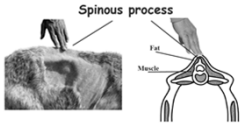
- Ultrasound
- Carcass tests
- **Body Condition Scoring**

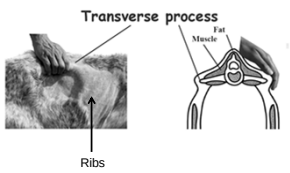


Photos: Susan Schoenian, Baalands Farm

Body Condition Scoring (BCS)

- Must get your hands on them
- At least backbone and ribs
- Goats – sternal fat





www2.luresext.edu/goats/library/field/bcs07.pdf

Body Condition Scoring Overview

Score	Spinous process	Rib Cage	Loin
BCS 1 Emaciated (Very thin)	Easy to see and feel, sharp	Easy to feel each rib	Little muscle, no fat covering
BCS 2 Thin	**Easy to feel, but smooth**	**Smooth, slightly rounded, can feel ribs with slight pressure**	**Has muscle, thin fat cover**
BCS 3 Good Condition	**Smooth and rounded**	**Smooth, even feel**	**Muscle is full, moderate fat cover**
BCS 4 Fat	**Can feel with firm pressure, no points felt**	**Individual ribs not felt, can feel indention between ribs**	**Muscle full, thick fat cover**
BCS 5 Obese	Smooth, no points, may slightly dip in	Individual ribs not be felt. No separation of ribs felt	Muscle full, very thick fat covering

Adapted from a presentation by Scott Sell, Clemson University

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BCS 1 – Emaciated (very thin)

- Very thin, weak animal; individual backbone points and ribs easy to see and feel; fingers fall into spaces between the ribs easily
- Can easily grasp the top and sides of the spine; saw-tooth appearance of backbone; very little muscle and no fat felt along backbone, dip between top and side of backbone (over the loin)

Photo: Susan Schoenian, Baalands Farm

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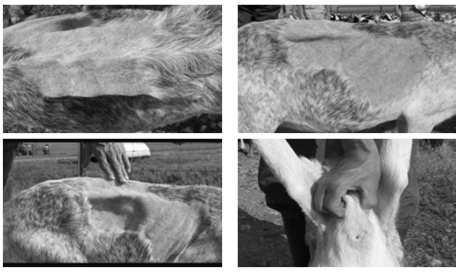
BCS 1



- Sternal fat can be easily grasped between thumb and fingers and moved from side to side.

www2.luresext.edu/goats/research/BCS_factsheet.pdf

BCS 2 Description

- Backbone is visible; some ribs can be seen/all can be felt and fingers can still go between ribs
- Can grasp backbone between the thumb and forefinger and still grasp side of backbone but points on the side are harder to see; can feel some muscle, but still a depression over the loin (between top/side of backbone)

Photo: Susan Schoenian, Baalands Farm

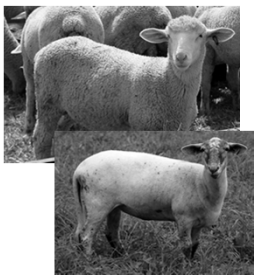
BCS 2

- Sternal fat is wider and thicker but can still be grasped and lifted by the thumb and forefinger. The fat layer can still be moved slightly from side to side.

www2.luresext.edu/goats/research/BCS_factsheet.pdf

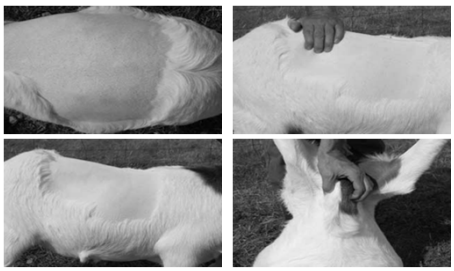
BCS 3

- Backbone not sticking up but can feel a slight dip between points; can barely see ribs and have even layer of fat over then; space between the ribs felt with pressure
- Side of backbone not easily grasped; smooth over the loin from the top to side of backbone; can barely see the outline of the side of the backbone



Photos: Susan Schoenian, Baalands Farm

BCS 3



- Sternal fat is wide and thick. It can still be grasped but has very little movement.

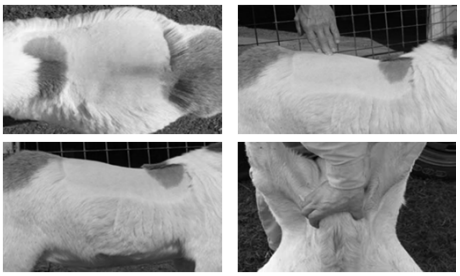
www2.luresext.edu/goats/research/BCS_factsheet.pdf

BCS 4

- Backbone and ribs cannot be seen; cannot grasp the top of the backbone due to muscle and fat; loin is rounded; smooth sided
- Cannot see outline of the side of the backbone; points of the side are smooth and rounded – not individual points felt; muscle and fat thick over loin

Photos: Susan Schoenian, Baalands Farm

BCS 4



- Sternal fat is difficult to grasp because of its width and depth. It cannot be moved from side to side.

www2.luresext.edu/goats/research/BCS_factsheet.pdf

BCS 5

- Backbone is buried in fat so cannot feel; ribs not visible or felt and covered with excessive fat
- Thick muscle and fat over the loin, making a bulge so that there is a dip over the backbone; side of backbone cannot be found and is impossible to grasp

Photo: Susan Shoenian, Baalands Farm

BCS 5

- The sternal fat now extends and covers the sternum and cannot be grasped.

www2.luresext.edu/goats/research/BCS_factsheet.pdf

Goat Body Condition Scoring Review

Score
BCS 1 Emaciated (Very thin)
BCS 2 **Thin**
BCS 3 **Good Condition**
BCS 4 **Fat**
BCS 5 Obese

Stage of Production	Target Body Condition Score
Maintenance	No less than 2
Breeding	At least 3
Early Gestation	At least 3
Late Gestation	More than 3
Lambing/Kidding	3.5
Weaning	No less than 2

Note: Goats fatten faster inside than outside where they are being scored, so some people feel that an extra half a score could be added; if dairy, some feel half to one score could be added (half for dairy sheep, one for dairy goats). Example: BCS 3 for a sheep may be a 3.5 for a goat or dairy sheep or a 4 for a dairy goat.

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References and Additional Resources

- Langston University:
  - www2.luresext.edu/goats/research/BCS_factsheet.pdf
  - www2.luresext.edu/goats/research/bcshowto.html
- University of Arkansas Pine Bluff:
  - www.uaex.edu/publications/pdf/FSA-9610.pdf
- eXtension.org:
  - www.extension.org/pages/19530/goat-body-condition-score#.VexiOBFVikp
- BCS video (sheep): www.agric.wa.gov.au/management-reproduction/condition-scoring-sheep
- Sheep 101:
  - www.sheep101.info/201/feedingewes.html

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NOTES:

Additional Resources Page

Session 5: Meat

Market lamb meat cuts and direct marketing:
http://extension.psu.edu/courses/sheep/marketing/marketing-meat-animals-directly-to-consumers (has worksheets)
http://slideplayer.com/slide/7998915/

Meat processors:
http://articles.extension.org/pages/23875/find-a-meat-processor-near-you-or-list-your-plant

Tips for marketing sheep and goat products (free PDF downloads):
Meat: https://attra.ncat.org/attra-pub/summaries/summary.php?pub=409
Dairy: https://attra.ncat.org/attra-pub/summaries/summary.php?pub=410
Fiber: https://attra.ncat.org/attra-pub/summaries/summary.php?pub=428
Vegetation Control: https://attra.ncat.org/attra-pub/summaries/summary.php?pub=408

Session 5: Marketing

Marketing sheep and goats:
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=411
http://sheepgoatmarketing.info/marketing_dir.php?col=categories
https://www.ams.usda.gov/market-news/goat-reports

Ethnic calendars:
http://sheepgoatmarketing.info/calendar.php
http://extension.psu.edu/courses/sheep/marketing/marketing-meat-animals-directly-to-consumers

Marketing meat goats:
www2.luresext.edu/goats/training/marketing.pdf
http://www.uaex.edu/publications/pdf/fsa-3094.pdf
http://articles.extension.org/pages/62566/marketing-meat-goats-the-basic-system

Marketing sheep:
www.sheep101.info/201/lambmarketing.html
www.makingmorefromsheep.com/market-focussed-lamb-and-sheepmeat-production/index.htm

Tips for selling:
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=440

Social media tools:
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=412

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Small Ruminant Production

Hands On: Body Scoring,
FAMACHA©, Foot Trimming,
Castrating, Giving Shots

Session Six

Participant Notebook

UGA extension

FVSU extension
Knowledge for Inspiring Lives!

Session 6: Hands-on Demonstration: Body Condition Scoring, FAMACHA©, Deworming, Foot Trimming, Castrating and Giving Shots

Handout – Basics of Hoof Care

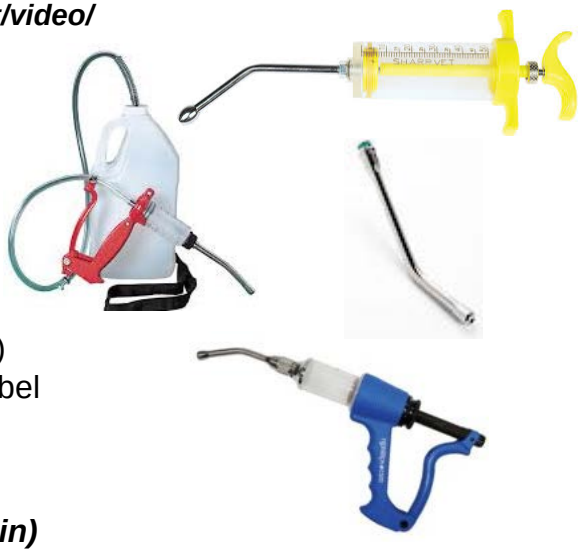
Body Condition Scoring (45 min)

- Practice body condition scoring live animals

*****FAMACHA/ Five Point Check and De-worming (45 min – Trained instructor)***

- Always use card
- Conduct in sunlight
- Score both eyes; score quickly to avoid eye irritation; use highest score
- Five point check:
    - FAMACHA©,
    - Body condition score,
    - Dag score/soiling on rear
    - Bottle jaw/swelling under chin
    - Replace nose score with coat condition
- **Can get a FAMACHA certificate and card if attended/participated in FAMACHA and "Integrated Parasite Management I and II" and a trained instructor teaches the FAMACHA hands on section to sign certificates

FAMACHA© video available at: web.uri.edu/sheepngoat/video/



Deworming (with FAMACHA/5 Point Check)

- Use correct equipment (see examples right)
- Can search:
    - Drenching syringe
    - Backpack drencher
    - Drench gun
    - Drench nozzle (to fit on luer lock syringe)
- Make sure store dewormers according to the label
- Deworm back of the mouth, top of the tongue

Foot Trimming, Castrating and Giving Shots (90 min)

- Trim hoof parallel to hair line
- Trim regularly as needed to avoid foot scald and perhaps hoof rot
- Castrate if market wants it or your resources require it (if not room to separate male offspring)
    - Separate males/females by 3-4 months of age, especially if during breeding season
    - Some markets like intact males (with testicles)

- Surgical castration vs banding
  - Make sure covered for tetanus prior to castration (vaccination for CDT is up-to-date)
  - If you have a problem with tetanus on your farm:
    - Make sure vaccination for CDT is up-to-date and consider using tetanus antitoxin prior to castration as well
    - Surgical may be better than banding
- Shots: intramuscular and subcutaneous
  - How to give
  - Sites to use
  - Store and use vaccinations/medicines correctly

Foot trimming videos online:

- www.youtube.com/watch?v=Ya17IujktZM
- www.youtube.com/watch?v=6ffU_cBjlsk

***Learning Objectives**:*

- Demonstrate use of FAMACHA and the Five Point Check to select animals for deworming
- List the two most common castration methods

Wrap Up (20 min)

- Online knowledge evaluation
  - Can take as many times as want (put name in each time though)
  - Must get a 70% to pass and receive a certificate
  - If cannot do online, ask your host/facilitator for directions for paper copy
- Ask your county agent about other upcoming programs in your area

Goat and Sheep Production – Basics of Hoof Care
Draft Fact Sheet

Developed by Dr. Niki Whitley, Fort Valley State University

Hoof care is an important part of goat and sheep production. When trimming hooves, the bottom of the hoof should be trimmed flat and at the same angle as the top of the hoof at the hairline; the toe often needs trimming more than the heel. Both halves of the hoof should be the same length; the inside between the two toes should be trimmed. Avoid causing the hoof to bleed by trimming a little at a time and stop if you see pink. Below are some tips about hoof health and hoof care.

- Hooves require regular trimming (highly variable – from 2 weeks to up to 12 weeks or more); some animals naturally need trimming more than others
- Living conditions can change how often trimming is needed.
    - Animals in rocky pastures may need it less
    - Obese animals or animals fed a lot may need it more
    - Concrete blocks or shelters with slanted sides covered with asphalt roof shingle or metal concrete lathe for animals to climb may reduce the need for trimming as often
- Look out for the following possible hoof issues
    - Hoof scald or rot – avoid buying it!
        - Common in both sheep and goat industries nationwide
        - Caused by a bacteria that does not like oxygen and spreads in wet, muddy soils; keeping feet trimmed and dry helps prevent
        - Symptoms include lameness and rotten-smelling feet; with foot rot, there can be pus, sores and maggots; those with scald may just have moist, red areas between the toes
        - Treatment: foot baths (zinc sulfate or others), trim feet, antibiotics (see a vet)
    - Founder or laminitis
        - Laminitis is swelling under the hard walls of the hoof, causing pain and lameness
        - Like with horses, hoof wall can get thick and overgrown (founder)
        - Possible causes include sudden or major changes in the diet (i.e. too much grain) or bad bacterial infections
    - Hoof abscesses
        - Caused by an injury allowing bacteria into the hoof
        - Symptoms include lameness from pain and swelling at hair line just above the hoof/pus leaking out
        - Trim/treat infected area; antibiotics may help
    - Granuloma
        - Round, red swellings of scare tissue caused by injury
        - Symptoms are lameness and hooves that grow oddly because of the granuloma inside
    - Shelly hoof
        - Caused by issues with the white line (where the soft and hard part of the hoof meet); these parts separate and a pocket of air forms
        - Symptom: usually only see pockets dirt between the hard and soft part of the hoof that you trim out to avoid infection like foot/hoof scald or rot

Video resource link: http://www.extension.org/pages/30650/goat-basic-hoof-care

For more information, contact your local County Extension Office or Fort Valley State University Cooperative Extension program (478-825-6296).

NOTES: