Table of Contents

2011 VA-NC Shepherds' Symposium
Presented By
Virginia Sheep Producers Association

Page Number

"Managing Parasites – Keys to Success"
Dr. Anne Zajac, DVM 1

"Selected Tools for Internal Parasite Management in Sheep"
Dr. Will Getz 19

"Trying to Get the Job Done with COWP"
Dr. Will Getz 26

"National Issues Impacting Sheep Producers"
Dr. Will Getz 30

"Out-of-Season Breeding Using the Eazi-Breed CIDR-G in Ewes"
Dr. Keith Inskeep 36

"Expansion Decisions for the Part-Time Sheep Producer"
Mr. Tom Stanley and Dr. Scott Greiner 56

"Working With Your Local Livestock Market"
Mr. Mike Carpenter 59

"Successful Wool Marketing – Our Story"
Ms. Kathy Donovan and Ms. Patti Price 60

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Virginia Tech
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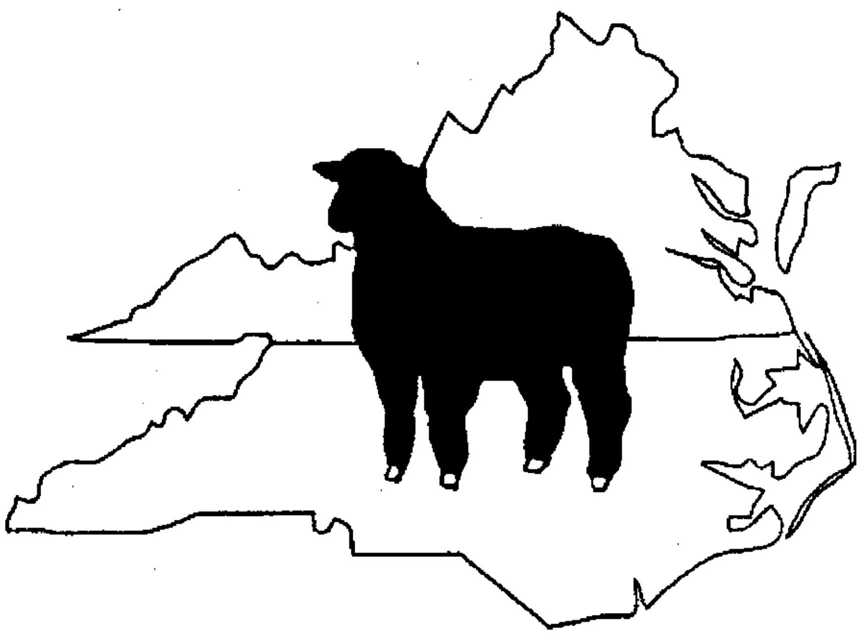
Proceedings

2011

VIRGINIA-NORTH CAROLINA SHEPHERDS' SYMPOSIUM



January 14-15, 2011

AUGUSTA COUNTY GOVERNMENT CENTER
18 GOVERNMENT CENTER LANE
VERONA, VIRGINIA

Friday, January 14

PM *Augusta County Government Center*

4:00 **Virginia Sheep Industry Board Meeting (Open to the public)**

6:00 **Virginia Sheep Producers Association Board Meeting (Open to the public)**

Saturday, January 15

AM *Augusta County Government Center*

8:30 **Registration and Commercial Exhibits**

9:30 **"Implications of the Chesapeake Bay TMDL-What Livestock Producers Need to Know"**
Mr. Dale Gardner, Chesapeake Agricultural Program Coordinator, Water Stewardship, Inc.

10:00 **"Managing Parasites – Keys to Success"**
Dr. Anne Zajac, DVM,VA-MD Regional College of Veterinary Medicine

Break

10:45 **"Experiences With Parasite Control in Sheep and Goats"**
Dr. Will Getz, Extension Specialist, Fort Valley State University

11:30 **Virginia Sheep Producers Association Annual Business Meeting**

PM

12:15 **Lunch** – *will be provided*

"National Issues Impacting Sheep Producers"
Dr. Will Getz, Extension Specialist, Fort Valley State University

"Impact of Your American Lamb Checkoff"
Mr. Leo Tammi, Director, American Lamb Board, Mt. Sidney, VA

2:00 **"Successful Utilization of the New Sheep CIDR"**
Dr. Keith Inskeep, Division of Animal & Veterinary Sciences, WV University

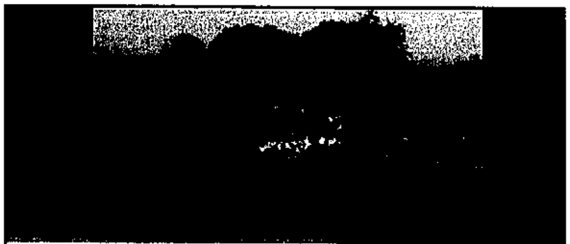
2:00 **Concurrent Youth Session**

Break

2:45 **Economics & Marketing Session**
"Should I Expand? – Key Production and Marketing Factors:
Dr. Scott Greiner, Extension Specialist, Virginia Tech
Mr. Tom Stanley, VCE Farm Business ManagementAgent

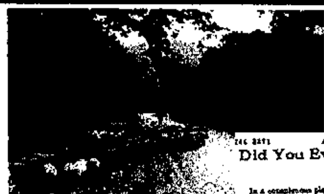
"Working With Your Local Livestock Market"
Mr. Mike Carpenter, VDACS

"Successful Wool Marketing – Our Story"
Kathy Donovan & Patti Price, Loudoun Valley Sheep Producers Association

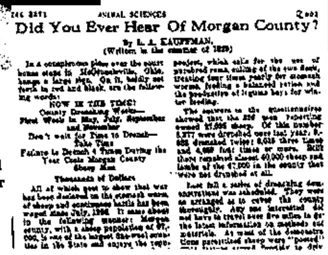


Anne Zajac, DVM PhD
Virginia Tech
Blacksburg VA

VIRGINIA-MARYLAND



Band of sheep crossing Shenandoah National Forest, Va., E.S. Shipp, photographer, Aug. 1925



ANIMAL SCIENCES

Did You Ever Hear Of Morgan County?

By L. A. KAUFFMAN.

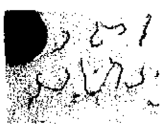
Worms are not a new problem!

In the 1920's drenches included carbon tetrachloride and copper sulfate/nicotine

---

Stomach and Intestinal Worms

- Gastrointestinal nematodes most important health problem for small ruminant producers in eastern U.S.
- Most important is barber pole worm, *Haemonchus contortus*
  - Abomasal parasite
  - Extraordinary in ability to exploit environments, management practices
    - Typically a warm weather worm but survives everywhere
    - In summer predominant even in Vermont



Stomach and Intestinal Worms

- Haemonchus contortus
  - Blood sucking parasite
    - Anemia and bottle jaw
    - Not diarrhea
    - Subclinical losses possible
  - Related worms can contribute to problems
    - May cause diarrhea

Life as a Worm

- All common worms have same life cycle
  - Eggs passed in manure
  - 2 molts to infective stage in feces
    - Takes about 5-7 days, more when cooler
  - Larvae move onto grass
  - Sheep and goats infected when grazing
    - 200 females produce up to 1 million eggs/day

Life as a Worm

- How do worms survive the winter?
  - On pasture as eggs, larvae
    - Only some species can make it through the winter
    - Survival of *Haemonchus* poor in cold weather
    - As larvae in the host in a dormant state (arrested or hypobiotic)
      - No disease, no eggs in feces

Managing Parasites—Keys to Success

- Parasite losses are a management disease
- We have ways of controlling parasites
- Each producer has to decide how high a priority parasite control is and which keys work best for him/him

Most Popular Key—Drugs

- Victory for Science!
- Since 1960's have have had fantastic drugs for treatment of sheep and goat GI nematodes
  - Highly effective against adults and larvae (>95%)
  - Safe
  - nonprescription
  - CHEAP

Anthelmintics

- Modern dewormers in 3 groups
- A worm population resistant to 1 drug in a group, resistant to all in group
- May seem that one drug in a group continues to work but that is only temporary

Benzimidazoles	Macrolides Avermectin Milbemycin	Nicotinics
fenbendazole (Safeguard)	ivermectin-A (Ivomec etc.)	levamisole (Prohibit)
albendazole (Valbazen)	eprinomectin-A (Eprinex)	Pyrantel (Strongid)
oxfendazole	doramectin-A (Dectomax_	morantel (Rumatel, Goat Care, Positive Pellet)
oxibendazole	moxidectin-M (Cydectin)	

What happened?

- GI worms greater problem in small ruminants than 20 years ago
- Resistance--A heritable change in a parasite population produced by drug use so that the drug no longer works as well as it did
  - 1964 first reports of resistance to TBZ
  - 1981 field resistance to levamisole
  - 1988 resistance to ivermectin

Virginia Goat Farm--1995

- Reduction in fecal egg counts following treatment
  - Fenbendazole: 50% (C.I. -36%, 81%)
  - Levamisole: 0.75% (C.I. -83%, 43%)
  - Ivermectin (1996): 75% (C.I. 14%, 93%)
- Widespread in sheep and goats in eastern US

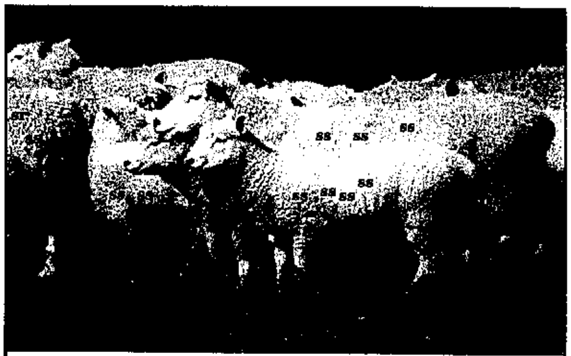
Zajac and Gipson, 2000, Vet Parasitology

Anthelmintic Resistance

- Difficult to detect in early stages—WHY?
- Each worm inherits genetic material from parents determining resistance (R) or susceptibility (S) to a drug
- Random mutation gives rise to R alleles

SS

SR



Resistant worms must mate to produce offspring
Gradual increase in resistant population

DRUG RESISTANCE

- What does it look like to producer? (fictional example—could develop faster or slower)

Year 1
98% effective

Year 4
88% effective

Year 5
70% effective

Year 6
50% effective

Year 7
30% effective

By the time resistance is typically detected, so many worms are resistant that withholding drug does lead to return of susceptibility

Year 8
15% effective

Why did resistance in small ruminants develop so rapidly?

- Highly pathogenic parasites like *Haemonchus* cause serious disease and death
- Convenience and availability of drugs
- Misguided recommendations from specialists and the pharmaceutical industry!

Where Did We Go Wrong?

- Recommended frequent treatments to prevent any clinical disease
- Recommended treating all animals in herd/flock
  - Convenient
  - Prevented subclinical loss of production
- Result is a control program based on the most susceptible animals

Where Do Worm Problems Occur

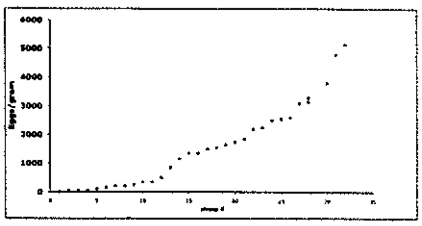
- Animals with temporary low immunity
  - Young--before immunity develops
  - Stressed
    - Lactation
    - Disease
    - Poor nutrition
- ANIMALS WITH INHERITED HIGH SUSCEPTIBILITY

Individual Susceptibility

- Under normal conditions, most animals control their parasites
- Parasite populations overdispersed (aggregated)
- Much of an individual animal's susceptibility is heritable (0.2-0.4)

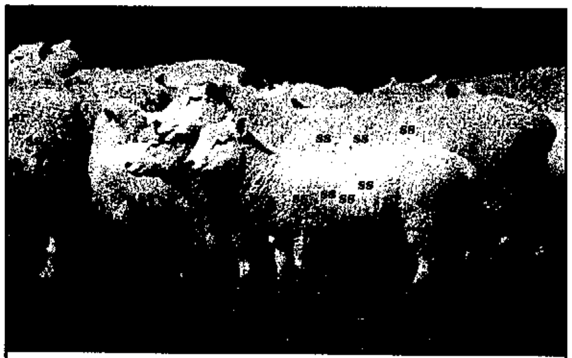
Strongylid Parasite Population—Fecal Egg Counts

Sheep—Pembroke VA



Where Did We Go Wrong?

- Recommended frequent treatments to prevent any clinical disease
- Recommended treating all animals in herd/flock
- Only the most susceptible animals require treatment
- Recommendations decreased REFUGIA, allowed rapid accumulation of resistant parasites



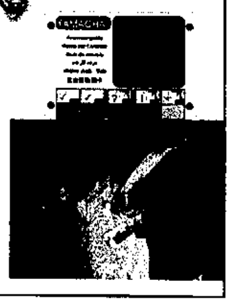
The refugia is the portion of the parasite population that is not exposed (=unselected) when a drug is administered.

Refugia

- Refugia is now understood to be most important factor in slowing rate of resistance
- Other common recommendations that effectively reduce refugia
  - Treating and moving to clean pastures
  - Treating when there aren't many worms on pasture (drought, end of winter)

Use Drugs Wisely

- Rational drug use to minimize rate of development of resistance
  - Selective deworming programs
    - By groups (ex. lambs vs dry ewes)
    - FAMACHA practical way to evaluate individuals



Use drugs wisely

- Use the correct dose
  - Dose for the heaviest animal in each category
  - Weight tapes only accurate for dairy goats
- Don't use out of date products
- Place drenches in the back of the mouth
  - Don't bypass the rumen
- When animals added, deworm with 2 or 3 drugs from different groups, quarantine

Use drugs wisely

- Restrict feed intake for 24 hours prior to treatment (BZ and ivermectin)
  - Withholding feed decreases digesta flow rate leading to an increase in drug efficacy
  - Never in late pregnancy
- Repeat dose in 12 hours (BZ)
- Can substantially improve efficacy (temporarily) if resistance is present and help slow resistance if not yet present

Other Antiparasitic Compounds

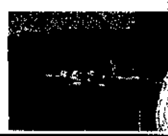
- New drugs
  - Amino acetonitrile
    - Monepantel—Zolvix
  - Different class of drugs but will select for resistant worms just as quickly
- Copper boluses
  - Beneficial effects of copper oxide wires on *Haemonchus*

Use Drugs Wisely

- Test for Resistance
  - Fecal egg count reduction test
    - Work with vet
    - Can you do it yourself?
      - Need to invest in good microscope
      - Must do egg counts
        - Will always find eggs, numbers important
  - Drenchrite test
    - University of Georgia
    - More convenient for producer

Other important keys to success

- Management to reduce exposure of vulnerable animals
  - Limit exposure to larvae
    - Change reproductive cycle
    - Limited or no pasture exposure
    - Rotation with parasites in mind!



Other important keys to success

- Increase herd/flock resistance to parasites
  - Individuals
    - Monitor with fecal egg counts, FAMACHA scores
      - Positive selection difficult with small groups
    - New test in New Zealand measuring salivary IgA
    - No genetic markers

Resistance is Here, What Next?

- Increase herd/flock resistance to parasites
  - Breeds
    - Hair sheep
      - Kathadins most practical, but probably not most resistant
        - Not much published experimental data
    - Goats—less clear cut

Other Keys to Success

- Good nutrition
  - Parasites take advantage of animals in poor condition
  - Energy, protein, vitamins and minerals all important in producing adequate immune response
  - Some studies have shown beneficial affect of feeding extra protein to growing animals
  - Lactating animals can be more vulnerable to parasites, need good diet

Other Keys to Success

- Phytotherapy
  - Intense interest in naturally occuring antiparasitic compounds in plants
    - Forages
    - Medicinal plants
  - Most research with plants with condensed tannins
    - Promising results with sericea lespedeza

Plant Extracts as Dewormers

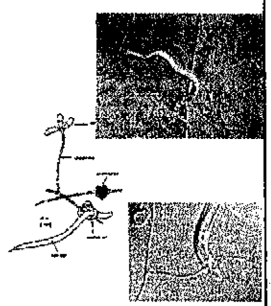
- Large numbers of plant extracts have been tested in the lab and show anthelmintic effects
- Fewer show effects in vivo and results inconsistent

Downside of plant anthelmintics and herbal dewormers

- Difficult to compare studies and establish protocols
  - Active ingredients vary with age of plant, local environmental conditions
  - Extracts prepared in different ways by different investigators
  - Pharmaceutical companies have no/little interest in investing in products
    - Who will pay for the research to establish best use?

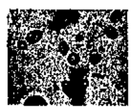
Looking into the future

- Vaccine
  - Not anytime soon
- Predatory fungus
  - Reduces number of larvae in manure
  - Not anytime soon
- Good management will always be the key!



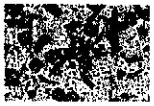
Other Common/Important Parasites

- Coccidia
  - Protozoan parasites
  - Infect all small ruminants but host specific
  - Sometimes cause diarrhea in young animals, usually under conditions of stress
  - Not affected by dewormers



Other Common/Important Parasites

- Tapeworms
  - Common in young animals
  - Owners see segments, but worms usually don't cause problems
  - Treatment usually with drenches like Valbazen, Safeguard



Other Common/Important Parasites

- Meningeal Worm (brain worm)
  - *Parelaphostrongylus tenuis*--Parasite of white tailed deer
  - Transmitted by snail/slug intermediate host
  - Small ruminant infection, MAY cause signs clinical signs
    - Range from transient lameness, gait abnormalities to paralysis
    - Llamas/alpacas more susceptible than sheep/goats?
  - Treatment difficult, camelid owners use routine macrolide treatments, can contribute to resistance in GI worms

Managing Internal Parasites in Sheep and Goats

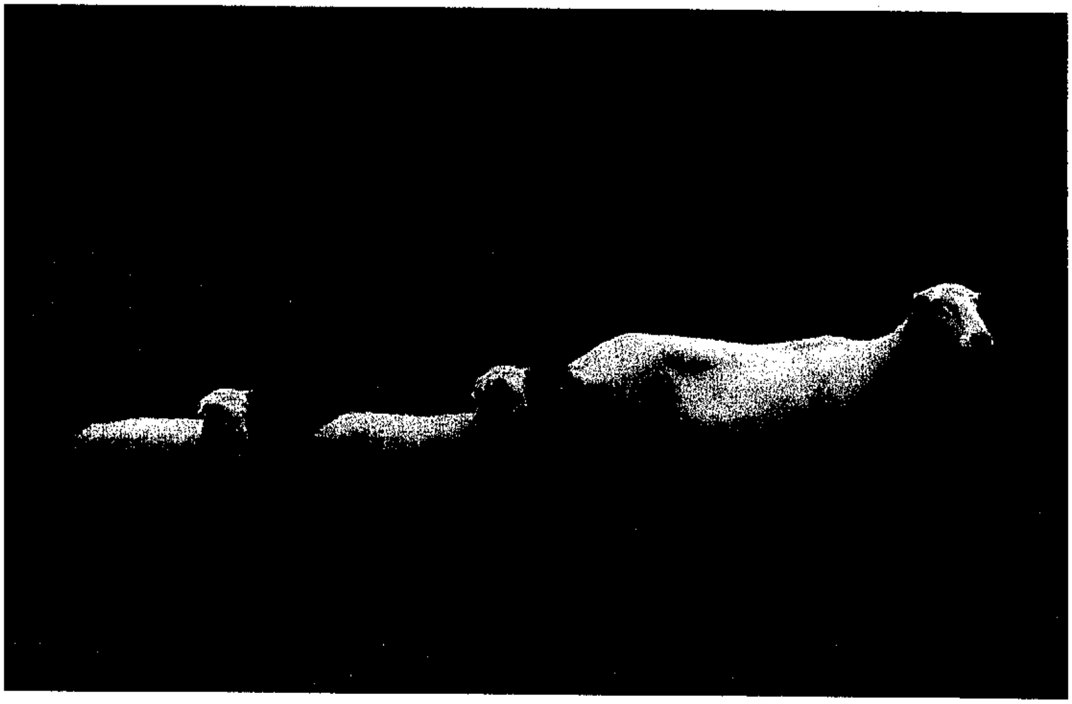
A Publication of ATTRA - National Sustainable Agriculture Information Service • 1-800-346-9140 • www.attra.ncat.org

By Margo Hale
NCAT Agriculture Specialist

Internal parasite management, especially of *Haemonchus contortus* (barberpole worm, stomach worm), is a primary concern for the majority of sheep and goat producers. These parasites have become more difficult to manage because of developed resistance to nearly all available dewormers. This publication discusses new techniques to manage parasites and to prolong the efficacy of dewormers. New management tools that remain under investigation are also discussed. A list of resources follows the narrative.

Contents

Introduction 1
Parasite Primer 2
Parasitism 2
Resistance to Dewormers 3
Pasture Management... 4
New Techniques 5
Other Techniques........... 6
Conclusion 7
Resources 7
References 8



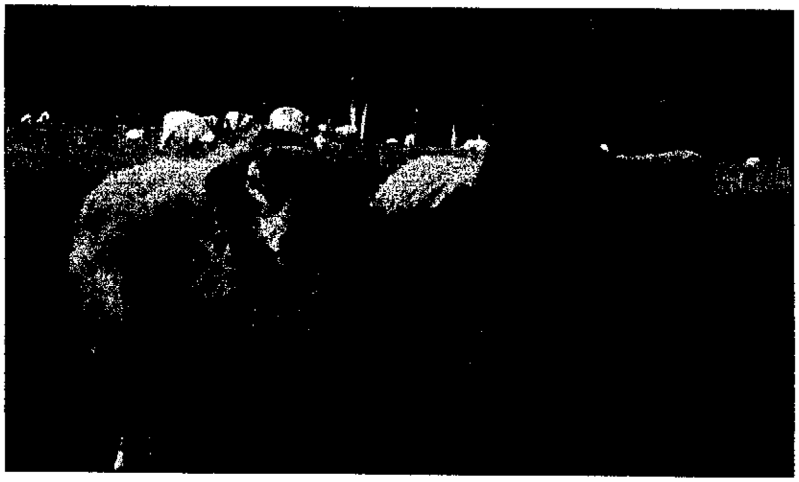
Owners of this Katahdin ewe and her lambs are able to manage internal parasites using sustainable techniques. NCAT photo by Margo Hale.

ATTRA—National Sustainable Agriculture Information Service is managed by the National Center for Appropriate Technology (NCAT) and is funded under a grant from the United States Department of Agriculture's Rural Business-Cooperative Service. Visit the NCAT Web site (www.ncat.org/agri.html) for more information on our sustainable agriculture projects.

Introduction

The management of internal parasites, primarily *Haemonchus contortus* (barberpole worm), is considered by many to be the biggest production concern for small ruminants. "There are many important diseases of sheep and goats," notes University of Georgia researcher Ray Kaplan, DVM, PhD, "but none are as ubiquitous or present as direct a threat to the health of goats as internal parasites." (Kaplan, 2004a). The cost of internal parasite infection includes treatment expense, reduced animal weight gains, and even animal death.

These parasites are difficult to manage because on some farms they have developed resistance to all available commercial dewormers. (Zajac, Gipson, 2000) Resistance to dewormers is now seen worldwide (Kaplan, 2004b). Producers can no longer rely on drugs alone to control internal parasites. Rather, an integrated approach that relies on sustainable methods to manage internal parasites should be employed.



Most animals in a flock are not visibly affected by parasites and do not need to be treated with dewormers. Photo by Linda Coffey.

Parasite Primer

Internal parasites (worms) exist by feeding off of their host. Some types do this directly, by attaching to the wall of the digestive system and feeding on the host's blood. These types of parasites cause anemia in the host, as well as other symptoms. Haemonchus contortus (barberpole worm) is one example of this type. Others live off the nutrients eaten by the host; these cause weight loss but not anemia.

Mature parasites breed inside the host and "lay eggs," which pass through the host and are shed in the feces. After the eggs pass out of the host, they hatch into larvae. Warm, humid conditions encourage hatching. The larvae need moisture to develop and move. They migrate out of the feces and up blades of grass (usually 1 to 2 inches). When an animal (sheep or goat) grazes, they may take in parasite larvae along with the grass blade. An animal can also pick up parasite larvae by eating from a feed trough that is contaminated by manure.

Internal parasite numbers:

- Increase with number of host animals
- Increase during warm, humid weather
- Increase when pastures are grazed too short
- Decrease during hot, dry weather
- Decrease if a non-host animal (cattle or horses) graze the same pasture
- Decrease with pasture rest time, as the larvae naturally die off

Parasite numbers increase over time when conditions are favorable (warm, wet). Internal parasites get out of control and cause damage when their numbers grow beyond what the animal can tolerate. In order to manage internal parasites, it is important to understand the parasite cycle and factors that encourage their production.

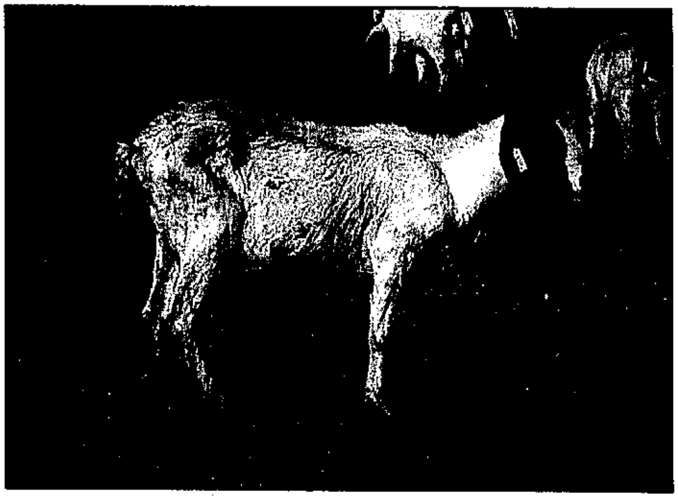
Parasitism

Animals raised in confinement or on pasture-based systems will almost certainly be exposed to internal parasites at some point in their lives. Dry environments, such as arid rangelands, will pose less of a threat for parasite infections. Warm, humid climates are ideal for worms, and therefore animals will have more problems with internal parasites in these climates.

Sheep and goats should be managed so that parasitism is not evident. Sheep and goats will always host some level of parasite burden. Certain signs of parasitism are seen when the parasite load becomes excessive or when the animal's immunity can no longer overcome the adverse effects of the parasitism. (Scarfe, 1993) Young animals and those with weakened immune systems due to other diseases are most affected by internal parasitism. A combination of treatment and management is necessary to control parasitism so that it will not cause economic loss to the producer. (Scarfe, 1993)

While it is ideal to manage animals so there are no visible effects of parasitism, some will nonetheless succumb to the burden of internal parasites. Learn to recognize the signs of internal parasite infections and offer early treatment.

Due to lowered immunity, young stock and pregnant or lactating animals are more likely to be affected by internal parasites. Photo by Linda Coffey.



Loss of condition and rough hair coat indicate parasitism.
Photo courtesy of Jean-Marie Luginbuhl.

Bottle jaw is a sign of parasitism.
Photo courtesy of Jean-Marie Luginbuhl.

Signs of Parasitism

- Loss of condition
- Rough hair coat
- Scours, diarrhea
- Bottle jaw
- Pale mucous membranes (eyelids, gums), indicating anemia
- Death

Resistance to Dewormers

Producers were once instructed to deworm all of their animals every three to six months. Many producers dewormed even more often, as often as every four weeks in humid climates. It is now known that this practice is not sustainable.

Drug resistance is the ability of worms in a population to survive drug treatments that are generally effective against the same species and stage of infection at the same dose rate. (Kaplan, 2004b) Over-use of dewormers has led to resistance, and available dewormers are now ineffective. In an article from 1993, David Scarfe predicted the development of drug resistance.

> Suppressive deworming is probably the most effective means of keeping parasite numbers lowered for a period of time. However, this method will also eventually lead to resistance to the anthelminthics(s) used much more rapidly than if other strategies of control are utilized. One point to consider here is alternating the use of different drugs.
>
> It is considered by this author, and several expert parasitologists, that rapid rotation of different drugs is ill-advised as this will lead to resistance of multiple drugs – something that the small ruminant industries certainly do not need. (Scarfe, 1993)

Scarfe recognized the unsustainable practices that were being used long before parasites were resistant to dewormers in the U.S.

Some farms still have dewormers that continue to work, while others have no effective dewormers. This is a problem because no new dewormersc for sheep and goats are currently under development. (Kaplan, 2004b)

Development of Resistance to Dewormers

Internal parasites, especially *H. contortus*, have developed drug resistance. Drug treatment gets rid of the worms that are susceptible to that particular drug; resistant parasites survive and pass on "resistant" genes.

Overview of Available Dewormers for Sheep and Goats

Several types of dewormers are available for use in sheep and goats. Many are not approved for use in sheep and goats, however, so work with a veterinarian to ensure proper "off-label" use. The different classes of dewormers have different modes to kill worms. The level of resistance depends on the class of dewormer and how often the drug was used on a particular farm.

Drug Class	Common Names/ Brands	Effectiveness
Benzimidazoles	Albendazole (Valbazen®), Fenbendazole (Safeguard®)	High prevalence of resistance
Avermectin/ Milbemycins	Ivermectin (Ivomec®) Moxidectin (Cydectin®)	Ivermectin— least effective of all available drugs Moxidectin—resistance becoming common where used frequently
Imidazothiazoles/ Tetrahydropyrimidine	Levamisole (Tramisol®), Pyrantel (Strongid®), Morantel (Rumatel®)	Low to moderate prevalence of resistance

Related ATTRA Publications

Integrated Parasite Management for Livestock

Goats: Sustainable Production Overview

Meat Goats: Sustainable Production

Dairy Goats: Sustainable Production

Sustainable Sheep Production

Dairy Sheep

Small Ruminant Sustainability Checksheet

Worms that are not treated are called "refugia." The concept of refugia has been largely overlooked in the past. Having some worms in refugia (not treated) insures that a level of genes remain sensitive to dewormers. (Kaplan, n.d.) A surviving population of untreated worms dilutes the frequency of resistant genes. Consequently, when a dewormer is required, it will be effective because the worms will be susceptible to treatment. (Kaplan, n.d.)

When fewer numbers of animals receive treatment, the refugia population remains large. The more refugia, the better. Sustainable techniques, such as FAMACHA®, fight drug resistance by increasing refugia.

In contrast, several practices accelerate drug resistance. They include frequent deworming (more than three times a year), underdosing (often caused by miscalculation of body weight), treating and moving to clean pasture, and treating all animals, regardless of need. These practices lead to resistance because they decrease the number of worms susceptible to dewormers (refugia).

Since no dewormer is 100 percent effective 100 percent of the time, worms that survive a dose of dewormer are resistant to that dewormer. Frequent deworming increases the rate resistance develops.

Each time animals are dewormed, the susceptible worms are killed. The strong ones survive and lead to a population of very resistant worms. Underdosing causes larger numbers of stronger worms to survive. The weakest, most susceptible worms are killed. But because of the weak dose, more of the stronger worms will be able to survive and reproduce, creating a population of stronger worms. Once an animal has been treated, only resistant worms remain. If the animals are moved to a clean pasture they deposit only resistant worms on the pasture. There are no susceptible worms to dilute the worm population. Treating all animals regardless of need ignores the importance of refugia and will lead, in time, to a population of worms unkillable by dewormers.

Pasture Management

Numerous techniques can be used to control parasitism. Pasture management should be a primary tool to control internal parasites. Sheep and goats ingest infective parasite larvae from pasture. The rate at which they are ingested can be controlled through pasture management.

Eating higher off the ground reduces the number of parasite larvae consumed. Photo by Margo Hale.

Most worm larvae crawl up the plant only one to two inches from the ground. Preventing animals from grazing below that point decreases the number of worm larvae ingested. Animals that eat closer to the ground tend to have more problems with internal parasites. It is important to monitor animals and the pasture. Allowing animals to graze pastures too short results in more parasites consumed and reduced feed intake, therefore harming the animal in two ways. It also inhibits pasture regrowth.

Larvae migrate no more than 12 inches from a manure pile. Livestock not forced to eat close to their own manure will consume fewer larvae. Providing areas where animals can browse (eat brush, small trees, etc.) and eat higher off of the ground helps to control parasite problems.

Decreasing the stocking rate decreases the number of worms spread on a pasture. The more animals you have on one pasture, the more densely the worms are deposited. Animals on densely stocked pastures are more likely to have parasite problems. Grazing sheep and goats with cattle, or in a rotation with cattle, can also reduce internal parasite problems. Cattle do not share the same internal parasites as sheep and goats. Cattle consume sheep and goat parasite larvae, which helps "clean" the pasture for the small ruminants.

Sheep grazing at Maple Gorge Farm in Prairie Grove, Arkansas. Photo by Margo Hale.

Certain forages have also been shown to control parasite problems. Tannin-rich forages, such as sericea lespedeza, have been shown to help reduce internal parasite egg counts. (Min and Hart, 2003; Shaik et al., 2004) Other plants, including plantain, chicory, and wormwood, also have an anthelmintic effect, although wormwood also produces toxic compounds. Providing tannin-rich forages and diverse pastures can help animals battle internal parasites.

High levels of tannins in forages such as sericea lespedeza reduce worm burdens. Photo courtesy of Jean-Marie Luginbuhl.

New Techniques

FAMACHA©

FAMACHA® is a system for classifying animals into categories based upon level of anemia. (Kaplan, n.d.) It was developed in South Africa and has been validated in the U.S. (Kaplan et al, 2004)

This system identifies anemic animals on a 1 to 5 scale by examining the eyelids of sheep and goats (see photo next page). The system treats only animals that are anemic (a sign of parasitism). This reduces the use of dewormers, slows the development of resistant worms, and saves the producer money. Most importantly, it also allows the producer to select animals that are healthier. By breeding the healthiest animals and culling the weaker individuals, the flock or herd becomes stronger over time. FAMACHA® is only effective for

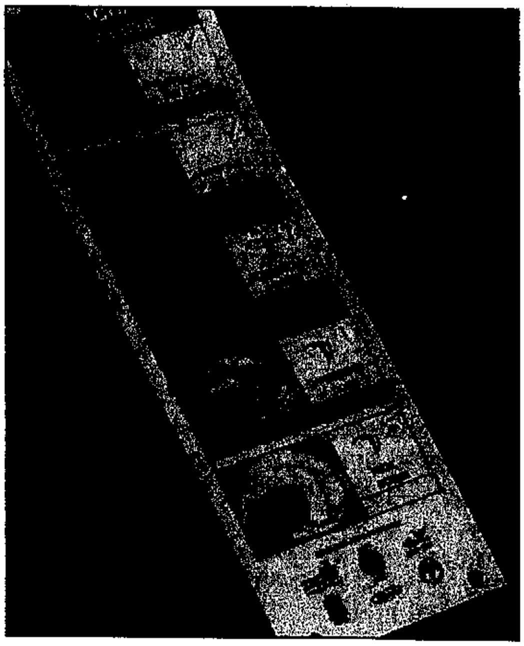
FAMACHA System Saves Money and Reduces Stress

On Maple Gorge Farm, in Prairie Grove, Arkansas, busy schedules prevented the farmers from monitoring parasites. By late summer, the sheep had been grazing for months with no treatment. The farmers noticed a young lamb with bottle jaw and feared they had a huge problem on their hands.

They considered not bringing the animals in for treatment because they were low on dewormer. They knew they wouldn't have enough to treat all of the animals. Then they remembered the FAMACHA© system that they had recently been trained in. Using the FAMACHA© system, they decided to sort off, identify and treat only the 4s and 5s (anemic animals), and a few 3s that were thin.

To their surprise, only 9 of the 65 sheep actually needed treatment. Identification numbers and FAMACHA© scores were recorded. They decided any ewe scoring a 4 or 5 would not be kept in the flock.

This whole process took less than an hour. Treating only the animals in need reduced stress for the animals and farmers, and also saved money. After using the FAMACHA© system and seeing how easy it was and the impact it had on their flock, the farmers at Maple Gorge Farm are believers in the system.



Demonstration of the FAMACHA© technique. Photo by Margo Hale.

the treatment of *H. contortus*. Producers must be trained by a veterinarian or other trained animal health professional in order to use FAMACHA©. (Kaplan, n.d.) However, this technique is simple to learn and quick and easy to use. For more information on FAMACHA©, see *Other Resources*, page 8.

Other Techniques

Selecting Resistant Animals

Several other techniques can be used to help manage internal parasites. There are several breeds of sheep and goats that show resistance to parasites. There is something in their genetic makeup that causes them to host a smaller parasite load. Breeds such as Gulf Coast Native, St. Croix, Katahdin, and Barbados Blackbelly show an increased resistance to parasite loads. Spanish, Myotonic, and Kiko goat breeds have also shown a tolerance to parasites. Resistance will vary within breeds as well. Some animals, regardless of breed, will be more resistant to parasites than others. Having parasite-resistant animals will decrease the need for dewormers.

Sheep breeds such as Gulf Coast Native show resistance to parasites. Photo by Linda Coffey.

Within any breed, certain animals are more tolerant of parasite loads than others. These resilient animals can host a large parasite burden, yet show few signs of parasitism. Some animals will carry a heavier parasite load than others. Research shows that 20 to 30 percent of the animals carry 70 to 80 percent of the worms. (Kaplan, n.d.) Producers should cull animals that are always "wormy," and select for animals that have a natural resistance or tolerance to a slight parasite burden. The FAMACHA© system will help you identify those more tolerant animals.

Copper Wire Particles

Recent research has been performed on the use of copper wire particles to control internal parasites. Studies show that copper wire particle boluses administered to lambs decrease parasite loads. (Burke et al., 2004) However, higher doses may increase the risk for copper toxicity in sheep. Copper wire particle treatments do not appear to be effective in mature sheep (Burke et al., 2005), but may work in mature goats. (Chartier et al., 2000)

Smart Drenching

Smart Drenching refers to the ways producers can use dewormers (drenches) more selectively and effectively.
—Southern Consortium for Small Ruminant Parasite Control, SCSRPC, n.d.

Used in conjunction with FAMACHA©, Smart Drenching helps slow the development of parasite resistance. The components of Smart Drenching are:

1. Find out which dewormers work by performing a fecal egg count reduction test or a DrenchRite larval developmental assay.
2. Weigh each animal prior to deworming. Double the cattle/sheep dose when deworming goats for all dewormers, except Levamisole, which should be dosed at 1.5 times the cattle/sheep dose in goats.
3. Deliver the dewormer over the tongue in the back of the throat with a drench tip or drench gun.
4. Withhold feed 12 to 24 hours prior to drenching with benzimidazoles, ivermectin, doramectrin, and Moxidectin, if possible.
5. Benzimidazole efficacy is greatly enhanced by repeating the drench 12 hours after the first dose. Albendazole should not be used during early pregnancy (during buck/ram exposure and up to 30 days after their removal).
6. Simultaneously use two classes of dewormers if resistance is suspected.
7. Drench only the animals that need treatment. (SCSRPC, n.d.)

Research is still underway on this technique, especially for long-term studies to determine the copper levels that are toxic to sheep.

Nematode-Trapping Fungus

Another tool currently being researched is the use of nematode-trapping fungus. This fungus traps parasite larva in the feces, interrupting its life cycle. Research has shown that it is "effective in significantly reducing development of L3 and appears to be an effective tool for biocontrol of parasitic nematodes in goats" (Terrill et al., 2004). The use of these fungi is still being researched.

Conclusion

Control of internal parasites in sheep and goats can be a daunting task. Previous control methods are no longer viable, so new techniques must be used Techniques such as increased pasture management, Smart Drenching, FAMACHA®, and selecting parasite-resistant animals can help to manage internal parasites. These techniques reduce dependence on dewormers and lead to a more sustainable parasite management program. New techniques, such as copper wire particles and nematode-trapping fungus, are being researched and developed. These developments may increase the tools available to battle internal parasites of small ruminants.

Resources

The following publications are available from ATTRA. These publications are free of cost. Copies can be requested by calling 800-346-9140 or at our website: *www.attra.ncat.org*.

- Goats: Sustainable Production Overview
- Meat Goats: Sustainable Production
- Dairy Goats: Sustainable Production
- Sustainable Sheep Production
- Dairy Sheep
- Small Ruminant Sustainability Checksheet
- Small Ruminant Resources
- Integrated Parasite Management for Livestock
- Predator Control for Sustainable and Organic Livestock Production
- Multispecies Grazing
- Matching Livestock and Forage Resources
- Rotational Grazing
- Pastures: Sustainable Management

Other Resources

Southern Consortium for Small Ruminant Parasite Control, *www.scsrpc.org*

Association of Small Ruminant Practitioners
1910 Lyda Avenue, Bowling Green, KY 42104-5809
Phone: 270-793-0781, *http://aasrp.org*

Management of Barber Pole Worm in Sheep and Goats in the Southern U.S.
www.attra.org/downloads/goat_barber_pole.pdf

Maryland Small Ruminant Page
www.sheepandgoat.com

FAMACHA® Information
www.vet.utk.edu/departments/LACS/pdf/FAMACHA.pdf
www.scsrpc.org/SCSPRC/FAMACHA/famacha.htm

Langston University, Oklahoma:

- E. (Kika) de la Garza Institute for Goat Research *www.luresext.edu/goats/index.htm*
- Information about Internal & External Parasites of Goats, *www.luresext.edu/goats/training/parasites.html*

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Managing Internal Parasites in Sheep and Goats
By Margo Hale
NCAT Agriculture Specialist

Paul Driscoll, Editor
Karen Van Epen, Production
This publication is available on the Web at:
www.attra.ncat.org/attra-pub/parasitesheep.html
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Selected Tools for Internal Parasite Management in Sheep

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Professor and Extension Specialist
Georgia Small Ruminant Research and Extension Center
Fort Valley State University

Southern Consortium for Small Ruminant Parasite Control
A Research Group

INTRODUCTION

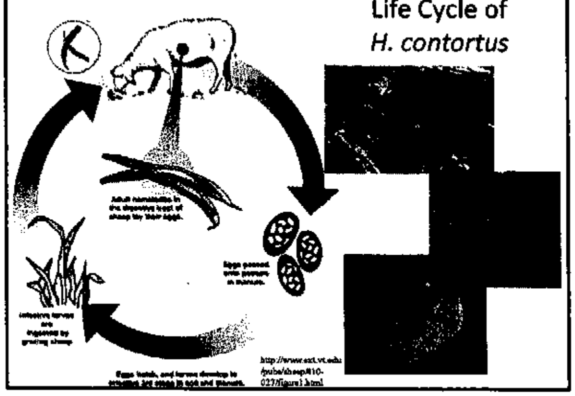
GASTROINTESTINAL NEMATODES

- *Trichostrongylus colubriformis*
- *Cooperia* spp
- *Ostertagia circumcincta*
- *Haemonchus contortus*

Haemonchus contortus
(Barber Pole Worm)

- Sheep, goats, deer, exotic ruminants
- Blood-sucking parasite
  - highly pathogenic
  - causes severe anemia
  - causes low blood protein -- "bottle jaw"
- Most important parasite in sheep/goats raised in warm/wet (moist) environments such as in the southern US A.

Life Cycle of *H. contortus*

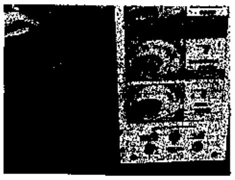


CONTROL MEASURES: Anthelmintics

- Multiple anthelmintic resistance in small ruminant GIN is a major problem in Australia, New Zealand, South Africa, South America, Great Britain, USA
- Cost of anthelmintics
- Concerns over drug residues in meat and milk products
- Environmental concerns

CONTROL MEASURES: Strategic deworming

- Smart drenching
- FAMACHA



ALTERNATIVE CONTROL MEASURES

- Vaccines
- Genetic resistance/tolerance
- Copper oxide wire particles
- Nematode-trapping fungi
- Use of forages/plants

HERBAL MEDICINE

- Plant compounds with *in vitro* and *in vivo* activity against *Haemonchus contortus*
  - Alkaloids
  - Triterpenoids
  - Benzyl isothiocyanate
  - Allicin
  - Oleanolic acid
  - Condensed tannins

HERBAL MEDICINE, cont.

- Condensed tannin (CT) – containing plants and forages
  - Grazed, or cut and fed green
  - Dried, fed as hay
  - CT extracts

BENEFICAL EFFECTS OF CONDENSED TANNINS

- Increased net absorption of (dietary) essential amino acids (EAAs) = protein.
- Increased wool growth and growth rate
- Increased live weight gain
- Higher ovulation rate
- Higher milk yield
- Reduced bloat
- Apparent reduced detrimental effects of internal parasites

CONDENSED TANNINS IN FORAGES

- Vary in concentration
  - Alfalfa (none)
  - Birdsfoot trefoil (2-3 %)
  - Big trefoil (4-5 %)
  - Sericea lespedeza (6-7 %)
  - Canary clover (14%)
- Vary in reactivity
  - Birdsfoot trefoil CT (low reactivity)
  - Sericea lespedeza CT (high reactivity)

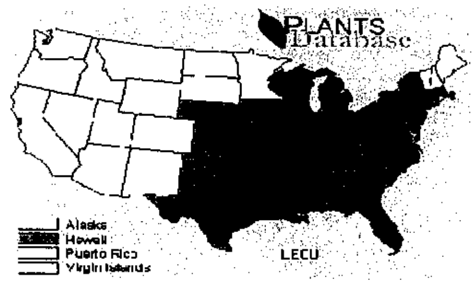
CT-CONTAINING FORAGES

- Cool season legumes
  - Sulla
  - Birdsfoot trefoil
  - Big trefoil
  - Sainfoin
- Warm-season legumes
  - Sericea lespedeza

Sericea lespedeza

- Perennial warm-season legume
- High in condensed tannins
- Tolerant to low pH (4.5)
- Grows well on infertile soils

Sericea lespedeza Distribution



Forms of Sericea Lespedeza used in Experimental Studies

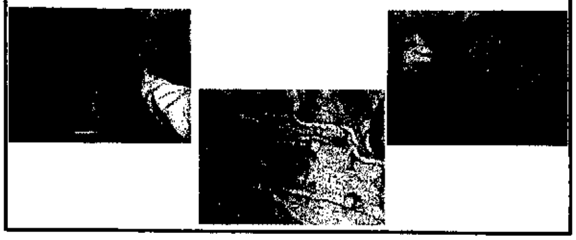
- Hay – long stem and ground
- Pellets
- Grazed forage

MATERIALS AND METHODS in EXPERIMENTS

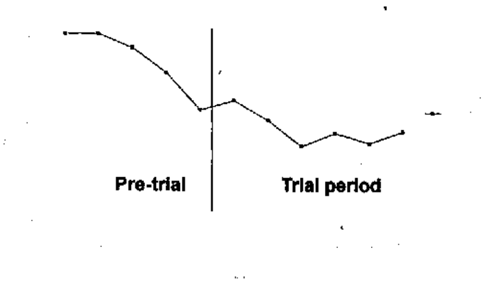
- Samples collected every week or every two weeks
- Fecal samples analyzed for EPG
- Blood sample - PCV

Procedures, cont.

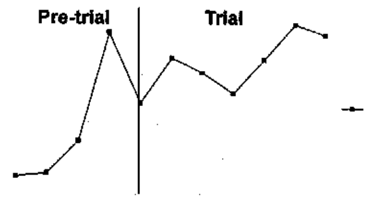
- At the end of each trial animals are slaughtered and worms collected from abomasum and intestines



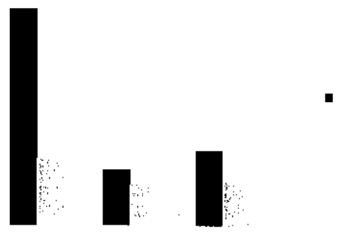
PCV



FEC



Effects on Adult Worm Species

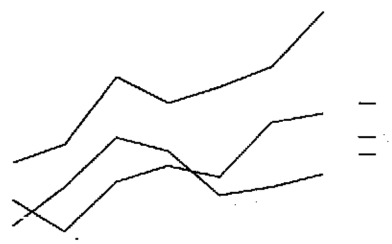


Conclusions

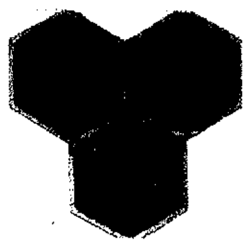
- Feeding SL hay to goats (Terrill et al.) and lambs (Miller et al.) decreased FEC & improved PCV compared to BG hay
- % *Haemonchus* larvae & % larva recovered were lower in lambs and goats fed SL hay
- Feeding SL hay reduced total worm count in both abomasum and small intestine of small ruminants.

Effects on Fecal Egg Counts

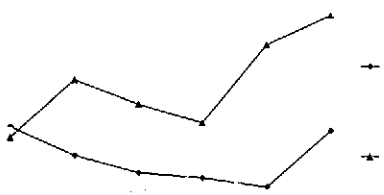
Effects on PCV



Ground and Pelleted Hay Effects



FEC



PCV

Adult nematodes

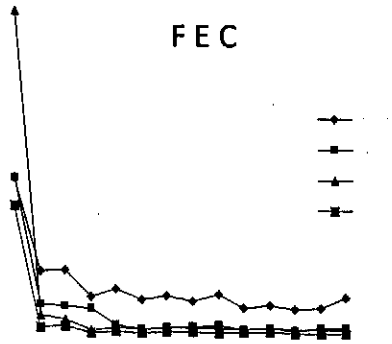
CONCLUSIONS

- Pelleting does not reduce the efficacy of sericea lespedeza hay against parasitic nematodes
- Further research is needed to evaluate CT forage as a component of an integrated parasite control program for small ruminants

Growth Rate

- Bermuda grass – non infected
- Bermuda grass – infected w/ larvae
- Sericea lespedeza – non infected
- Sericea lespedeza – infected w/ larvae

F E C



Blood Urea Nitrogen levels

Growth rate of growing goats

Conclusions

- Sericea lespedeza hay reduced parasitic infection levels and increased animal performance (ADG) of growing goats
- Condensed tannins in SL increased protein utilization efficiency in the animal

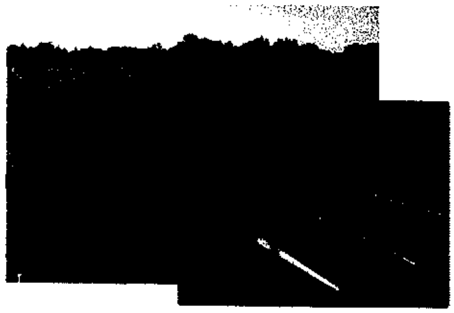
Future Research with Sericea Lespedeza for Parasite Control

- Grazing trials with sheep and goats
  - Pure stands
  - In combination with other forages
  - SL as deworming paddock
- Research with SL as dried feed
  - Leaf meal, pellets
  - Ingredient in complete feeds
  - Pasture supplement
  - Component of TMR for feedlot, confinement feeding

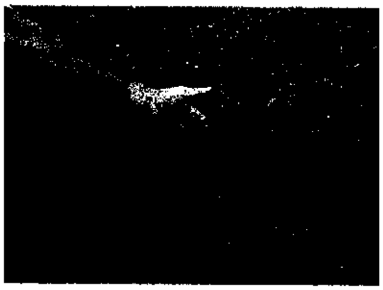
CT Forage/Browse Species

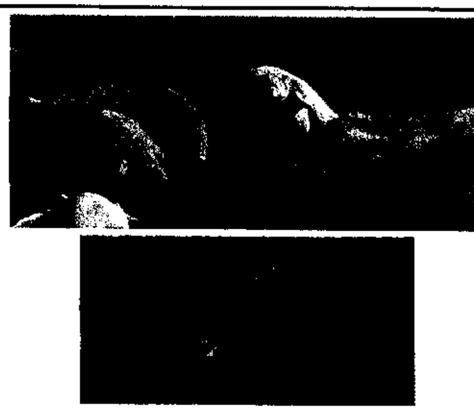
- *Lespedeza*
- *Desmodium*
- *Desmanthus*
- *Neptunia*
- *Acacia*
- *Leucaena*
- *Calliandra*
- *Crotalaria (Sunn hemp)*

Wrong Image of the Crop



Better Image and Correct Grazing Maturity





Trying to Get the Job Done with COWP

Copper wire particles

- Lambs and Kids
  - Studied under natural infection.
  - History of grazing on same pastures, but different times.
  - Grazed same area during study.
  - Kids – Spanish breed
  - Lambs - Wool and hair ancestry
  - Wethers

The Truth about Copper? Why Sheep Ewenique?

- Complicated and Complex
- Variable
- Unpredictable

WHAT IS COPPER?

- Nutrient
- Dietary Essential Trace or Micromineral
- Needed in Small Amounts for Essential Functions
- Generally Acquired through Feedstuffs
- Both Deficiency and Excess are Concerns

FURTHER POINTS IN UNDERSTANDING CU

Dietary essential

- Amount is a key
- Chemical form determines bioavailability.
- Liver is the primary storage tissue for Cu.
- Stress factors have a major role in release.
- Most Cu absorbed in preintestinal area.

Forms of Copper

- Copper sulfate ($CuSO_4$)
- Copper lysine (CuLys)
- Copper proteinate (chelation of Cu with amino acids)
- Copper oxide (CuO)

Key Points on Copper Homeostasis

- Normal levels of Cu in blood plasma are
  - 0.8 - 1.5mg Cu/L.
- Copper absorption is more important than its concentration in the feed.
- Copper requirement in sheep is 7 - 11 mg/kg (ppm) dry matter.

Homeostasis, cont.

- In sheep, copper absorption is relatively poor (1.4 - 12.8%) but influenced by ...
  - Type of diet, including forage type.
  - Level of Mo, S, Fe ... and to a degree Ca, Zn.
  - Protein level of the forage or feed.
  - Age of animal
    - Young animals (lambs) may absorb up to 90% of dietary copper

COPPER ABSORPTION LEVELS FOR SHEEP (NRC, 2007)

	Absorption Coefficient
Lamb, preweaning	
5 kg (~ 11 pounds)	0.90
10 kg (~ 22 pounds)	0.53
20 kg (~ 44 pounds)	0.20
Lamb, postweaning (pasture)	0.045
Lamb, postweaning (feedlot)	0.06
Ewe, gestation	0.06
Ewe, lactation	0.045

COPPER TOXOCOSIS IN SHEEP

> Phase I – Prehaemolytic. Copper accumulates in the liver to exceed 1,000 mg Cu/kg. Can last for a few weeks to more than a year.

> Phase II - Haemolytic crisis. Copper is released from the liver in lysosomes and blood copper value rises. Followed by haemoglobinuria, haemoglobinaemia, and jaundice. Lasts from hours to days.

>Death – may be "sudden"

TOXICOSIS, CONT.

> Variables include:
  > Breed and perhaps genetic type.
  > Environmental stresses

> NRC (2007) suggests maximum tolerable Cu concentration for sheep is 15 mg/kg dry matter when dietary Mo and S are at normal levels.

Why Copper Oxide Does not Kill Sheep?

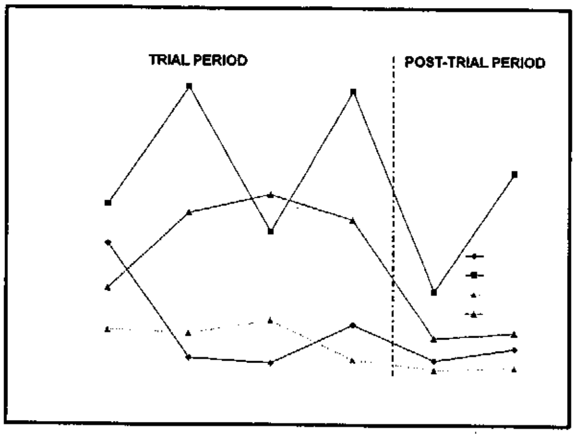
- Bioavailability very low.
- Form has an influence - particles vs powder.
- Duration of exposure may be short.
- Resides in one location so not multiple sites for absorption.

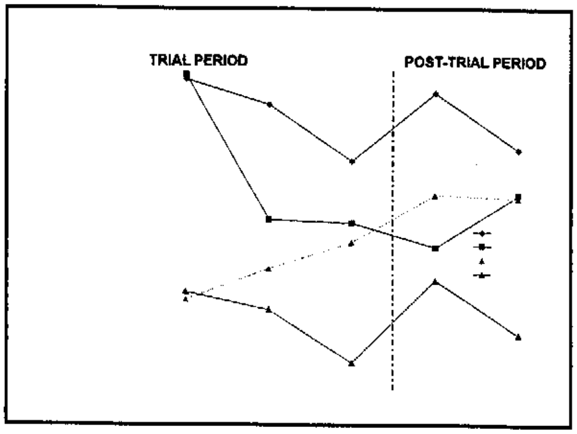
PROTOCOL FOR COPPER OXIDE IN INTERNAL PARASITE MANAGEMENT

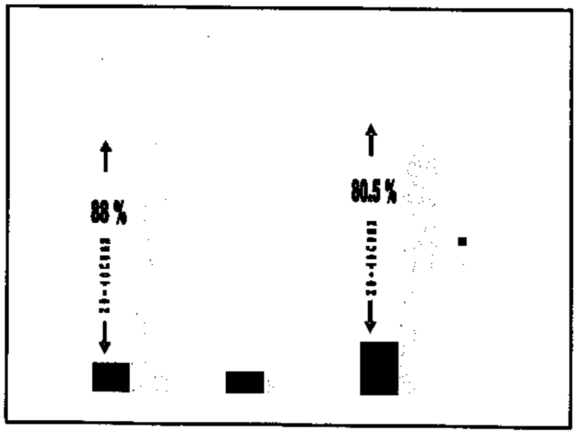
- Role in control of *H. contortus* which reside in abomasum.
- Bolus containing 0.5 g copper wire particles.
- Administer bolus up to need up to 2- 4g.
- Most effective in younger animals and during seasons when challenge is greatest.
- See www.SCSRPC.org reference for details.

What is the Truth Then?

- Copper is essential for sheep body functions.
- Level of consumption is usually adequate from forages (Soil influences level in plants)
- Supplemental copper may be toxic
  - Absorbed and accumulated in the liver.
  - Release triggered primarily by stress events.
- Certain supplemental forms can be used for H. contortus control w/o toxic outcome.
- Bioavailability is a key.







Small Ruminant Species Differences re COWP

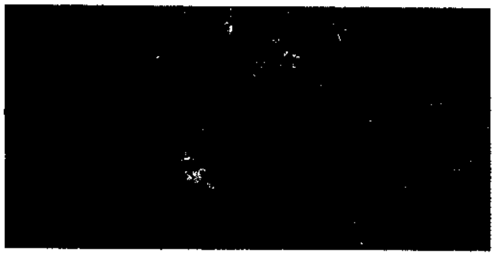
- Indication that COWP useful short-term intervention.
- Indications of differences between lambs and kids
  - Level of response
  - Timing of response
  - Duration of response

SL, COWP, and Sheep

- Animals (sheep) highly susceptible to GIN infection will have high FEC regardless of (SL) grazing treatment.
- In experiments these animals i.d. via FAMACHA and treated w/COWP.
- When removed, SL treatment very visible.
- SL pellets effective w/ moderate infection but may not be so useful under overwhelming …
- Concept of integrated approach being validated.

Summary

- Tools for an integrated approach including -
  - Pasture and grazing management
    - Rotation
    - Stocking rate
  - "Medicinal" plants
    - Condensed tannin-containing
      - Sericea lespedeza and others
  - Novel approaches
    - Copper wire particles, fungi trapping …
  - Anthelmintics
  - Sheep genetics



American Sheep Indu
Association

2010 Sets Historic Record

Structure of ASI as a Federation

- Member state organizations. Each with a Director sitting on ASI Board.
- Regional structure captures member interests and sheep numbers.
- Region II = Mostly southern states.
- Regional Director has seat on Executive Board. Meet 4x per year.
- Member executes ASI actions via representative structure.

ASI Program Structure

- Councils and committees – See Web
  - Lamb council
  - Wool council
  - Production, research and education …. Members selected from volunteers and those w/ special skills or experience
- Taskforces
  - Growing inventory
  - Livestock protection dogs

Some Highlights
2010 All Time High for U.S. Lamb Prices

- Cull ewe market exploded this winter with record prices on slaughter ewes
- Prices for feeder lambs, which fared better than any livestock or poultry sector in 2008/09, strengthened to record highs through Summer 2010
- Lamb meat wholesale prices have never been at this level

Wool Prices Highest Since 1989

- Strong American military purchases plus international wool shortages and U.S. exchange rates combined for substantial price increases
- Some sales matched 100% of Australian wool prices

Lamb Purchase Program

- $2 million lamb program secured by ASI
- Three bids were put out to lamb companies for deliveries to food banks this fall and early winter
- $1.9 million of lamb sold to USDA for delivery through end of year
- Help maintain prices to producers.

LRP-Lamb Insurance New Contact Information

Food and Fiber Risk Managers

"Created By the Industry For the Industry"

Burdell Johnson
Email: bjohnson@fafrm.com
Office: 701-867-9160 – Cell: 701-320-5687
Website: www.fafrm.com

(FFRM is a wholly owned subsidiary of ASI)

Industry Defends Sheep Research Station

- Only rangeland sheep station in the U.S.
- Anti-livestock groups sued to force USDA to do NEPA on research station
- Environmental Analysis still underway in 2010

Livestock Protection Dog Working Group

- Develop public education and guidelines for dogs to ensure continued use of this predator management tool
- Group published a certification program in 2010 for industry comment
- First round of comments brought about program changes
  - Suggested Practices
- ASI board of directors to review

Livestock Protection Dog Working Group

- Videos and interviews with experienced producers across geographically different areas as well as on private/federal land
- USDA Wildlife Services will soon deliver public education brochures and signs

Quantifying the Nontraditional Lamb Market in the United States

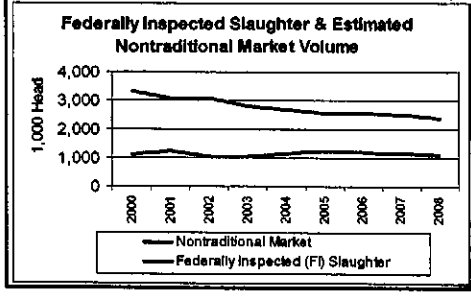
ASI Lamb Council

- Nontraditional lamb marketing research to determine volume, impact and market route of ethnic trade or lambs beyond traditional commercial companies
- Approved by ASI executive board with voluntary funding in cooperation with American Lamb Board

Background

- Discrepancy exists between federally inspected (FI) slaughter numbers and the estimated lamb crop (less 5% for losses)
- Between 2004 and 2008 we estimated this discrepancy at nearly 1.2 million head per year compared to 2.5 million head in FI slaughter

While FI Slaughter has Declined, the Nontraditional Market Held Steady



Top Packers Already Cater to Nontraditional Market

- Volume of lamb channeled into nontraditional markets – defined as ethnic & custom slaughter – by top packers is estimated at nearly 11,000 head/week (566,800 head per annum)
- This equals roughly to 25% of average weekly FI slaughter (44,000 head/wk)

Top Sheep Auctions Channel into Nontraditional Market

- An estimated <u>300,000 head</u> are likely channeled into the ethnic market through San Angelo and New Holland, largest livestock auctions

Producer Survey Found Nearly 1 Million Lambs Channeled Into Nontraditional Markets

- An estimated <u>995,370 lambs</u> sold direct from producer to consumer from the farm.
- This compares to FI lamb and yearling slaughter in 2008 of 2.3 million head.
- National statistics <u>underestimate</u> lamb production in the U.S.

Lamb Consumption Higher for Minority Groups

- Survey targeted sample of ethnic consumers
- Survey included all ethnicities and races EXCEPT the 65% of the population that call themselves both non-Hispanic/Latino and White
- Survey included all consumers that speak a foreign language at home

43% of <u>Targeted Surveyed Ethnic/Minority Consumers</u> Reported Eating Lamb in the Past Year

- In a survey including ALL consumers, survey research indicates about 20% eat lamb
- Minority/ethnic lamb consumers (about 35% of population) consumed an estimated 170 million lbs. in the past year, 58% of the 294 million lbs. of total U.S. lamb supply (including imports)

Super Wash to U.S.

Allows wool products to be machine washed and dried without shrinkage but was not available in United States

- Sheep Venture Company procured loan from NLPA's Sheep Loan Fund to purchase equipment from Italy
- Chargeurs Wool in South Carolina to operate
- Equipment has arrived and is being installed

Raw Wool Marketing

- Certified U.S. Wool Clip Program
  - Important to develop and expand new markets domestically and internationally
- Wool Quality Programs allow for the success of international, product development and military procurement programs
- Military procurement a bright spot in wool

Animal Handling Video

- ASI teaming up with Temple Grandin and Colorado State University
- Designed to help avoid animal welfare issues at slaughter plants
- Will fill sheep handling training video void in U.S.
- Will be produced in English and Spanish

Goat Committee

- ASI Goat Committee elected the interim board of directors to the American Goat Federation in 2009
- The Federation is finalizing membership recruitment and benefits in 2010
- A shared goal with ASI is eventually a chance to cost share some activities that benefit both species, such as predator management

Goat Committee, cont.

- Eleven-member interim board elected by goat committee
- American Goat Federation
  - www.americangoatfederation.org
- "To speak with a united voice for all elements of the U. S. goat industry"
- Three initial areas of focus
  - Research and education
  - Marketing and product development
  - Policy and legislation
- Membership drive began with Founding Member incentive through December 2011.
- Official board elections scheduled for January 2012.

Mandatory Price Reporting

- Secured a 5-year extension to be effective October 1, 2010
- Continues policy that requires domestic processors and importers to report purchase price
- ASI led the coalition of livestock and meat industry organizations for past year to reauthorize this important program.

CIDR Approved

- Controlled Intravaginal Drug Release for induction of estrus in ewes during seasonal anestrus
- ASI has worked with FDA/CVM through the NRSP-7 process for over 12 years on the background research and approval
- Nov. 2009 Pfizer made CIDR available in the U.S.

ASI Survey

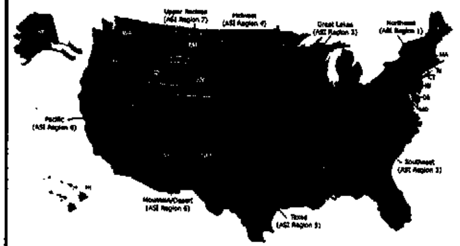
- Administered winter 2009
- Outstanding response rate of 24%

ASI Survey Results

- Summary data:
  - 60% of respondents are 51 years old or older
  - 64% commercial; 22% seedstock; 10% club lamb; 4% feeders; and 0.4% dairy
  - 53% of agriculture operation revenue from sheep
  - Percent of lambs born per ewe exposed averages 159%

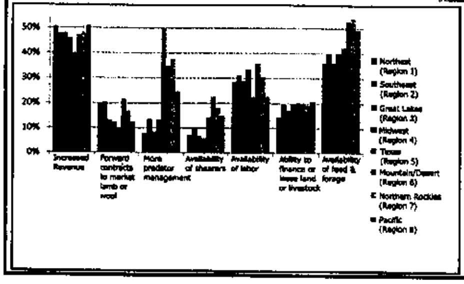
ASI Survey Results

Percentage of producers who see operation as expanding



Survey Results

Most popular items to help expand sheep operation



Survey Results

Percentage of producers by region impacted by predators

National Sheep Industry Improvement Center

- New authorization with $1 million in funding in the 2008 Farm Bill
- Rules have been published and Center now valid
- Nominations were due from ASI to USDA by Sept. 24
- Awaiting Secretary's announcement of Board Members

Genetics Workshop

- Genetic Stakeholders Committee sponsored Genetic workshop in Ohio in July
- 100+ producers attended

Genetics Directory

- Developed at request of Wool Council
- Resource for producers to locate genetics to improve flock wool quality
- Includes information on
  - wool quality program
  - certified shearers
  - wool buyers/warehouses
  - testing labs

Re-build the Sheep Inventory Committee

- Committee of 10 dedicated to industry expansion for future of businesses and farms/ranches
  - 'Developing a plan in 2010 encompassing ways to address
    - issues of production
    - sustainability of sheep infrastructure
    - expansion
- Using non traditional lamb market report, ASI producer survey, predator loss reports and industry input

Re-build the Sheep Inventory -- Members

Clint Krebs – Oregon – Chair
Mike Corn – N.M.
Wes Limesand – N.D.
Dominique Minaberrigarai – Calif.
Les Oesterreich – Calif.
John Oswalt – Mich.
Rick Powers – S.C.
Rob Rule – Iowa
Bill Sparrow, Jr. – N.C.
Dennis Stiffler – N.Y.

Re-build the Sheep Inventory -- Projects

- Education subcommittee has submitted an application for a $1 million program to attract new producers to the sheep business
- Projects underway to promote sheep as a profitable addition to farms and ranches
- Finance subcommittee working on credit incentive to expand the ewe flock

OUT-OF-SEASON BREEDING USING THE EAZI-BREED CIDR-G IN EWES

Keith Inskeep, Marlon Knights and Todd Ramboldt
West Virginia University, Morgantown

INTRODUCTION

The sheep industry in the US has been on the decline for many years. Recently, both price and demand for lamb products have risen, but parasites and predators still plague the industry. Increased demand has been associated with a simultaneous increase in the importation of lamb and lamb products. The survival and regrowth of the industry requires that producers increase their production efficiency with the use of improved technologies so that they are better poised to take advantage of the improved consumer demand for lamb products.

For more than 60 years attempts have been made to synchronize the period of sexual receptivity, or estrus, in farm animals. Synchronization of estrus can save labor and is a key component in artificial insemination (AI) programs. AI is not widely used in sheep in the US due to the often low success rate with frozen ram semen and the lack of performance data to identify superior rams. Despite the very low rate of adoption of AI, interest in synchronization of estrus (particularly for out-of-season breeding) remains high among sheep producers. Synchronized breeding leads to synchronized lambing, thus concentrating and reducing the labor requirements at lambing. The more uniform lamb crop facilitates both management and marketing of lambs. Marketing costs are reduced because of fewer weight/age groups to market. Lower lamb mortality can be achieved due to greater observation during the first three days of life when the danger of mortality is highest. In addition, in a West Virginia study that used progesterone and ram introduction to aid out-of-season breeding, lamb mortality to predators was reduced in the fall-born lambs to half that observed in spring-born lambs in the same and similar flocks.

Lamb production has been a seasonal enterprise for most producers. Ewes are typically bred in the fall (when reproductive activity and ovulation rate are greatest) and lamb in the spring. As a result, there are wide monthly fluctuations in both the numbers of lambs available and in the prices received by producers. Seasonal lambing patterns affect prices, as many producers are marketing lambs during the same time period. Further, the inconsistent supply reduces the efficiency of lamb processors and results in periods of low availability to the consumer.

Typically, farmers may expose their ewes to rams during the fall breeding season for the equivalent of two (35 days) or three estrous cycles (51 days). When exposed to rams for the equivalent of three estrous cycles, 90 to 95 percent of ewes lamb within a 60-day period. With synchronization of estrus, a similar percentage of ewes conceive and lamb as with natural, random mating. However, lambing occurs in three shorter and more concentrated lambing periods of about 7, 10 and 10 days, with approximately 10-day intervals between these periods. This is because ewes are bred initially in a short period of two or three days, and those that do not conceive to first service remain synchronized and return to estrus within another short interval of about 5 days, an average of 16 to 17 days after the first breeding. The breeding period can be shortened to about 37 days, because the first service opportunity for all ewes occurs within the first three days.

Ewes of the same breed-type that were bred in a single day usually lamb in a 7-day period and those bred over a 3-day period lamb during a period of ten days or less. Therefore, knowing the average gestation length (about 146 days in most flocks in this region), the producer using synchronized estrus can predict the days when most lambs will be born and can schedule lambing to occur when it is most convenient. In addition, knowing expected lambing dates in advance allows producers to target specific markets.

One technology used routinely by producers outside the US that was approved in October 2009 for use in the US for out-of-season breeding is an intravaginal insert for delivery of progesterone, the CIDR-G developed in New Zealand.

Induction of estrus in ewes during the non-breeding season (spring/summer) to achieve lambing in the fall has been attempted with limited success. Such programs have been aimed at increasing the number of lambings per year (3 every 2 years), taking advantage of seasonally high prices, and (or) making more efficient use of labor and other resources. However, selection for the ability to lamb from breeding in May was effective in increasing the response to introduction of rams was successful in studies by Dr. Dave Notter and his group at Virginia Tech.

STUDIES ON FARMS THAT LED TO APPROVAL OF THE CIDR-G AS AN AID IN OUT-OF-SEASON BREEDING

Among hormonal approaches to synchronizing estrus in ewes, intravaginal delivery devices for progestogens are easiest to use and have generated the most interest in recent years. The CIDR-G (300 mg progesterone) was developed in New Zealand for use during the breeding season with a 12-day treatment. It became of interest to evaluate its effectiveness in ewes during the non-breeding season in the US. It was approved by FDA in 2009, based on studies of its effectiveness when used preceding ram introduction for out-of-season breeding. These studies were carried out by West Virginia University in West Virginia, Pennsylvania and Ohio flocks. Because the release of progesterone from the intravaginal devices decline with time and American ewes are larger than those in New Zealand, it was decided that short-term treatments might be beneficial.

Even when ewes are induced to ovulate and show estrus during the nonbreeding season, ovulation rates and litter sizes (prolificacy) are lower than those observed during the breeding season. The hormone equine chorionic gonadotropin (eCG or PMSG), which has follicle stimulating hormone (FSH) activity in ruminants is widely used in other countries, but no eCG preparation is currently approved for use in livestock in the US. The natural hormone FSH is conditionally approved for use in super-ovulation protocols in cattle, thus it was of interest to evaluate the use of FSH in combination with progesterone pre-treatment and ram introduction for possible future use to increase litter size in ewes mated during the non-breeding season.

Experiment 1. **Tests of an intravaginal insert with and without FSH.** This study was conducted in 1998 with 382 ewes on six farms during the anestrous period (May to July). Eighty-four of these ewes were determined to have high progesterone in blood (thus these ewes had been undergoing estrous cycles) and were removed from the study. The remaining ewes were assigned to one of four groups. One group received progesterone from an intravaginal releasing device for 12 days (P12) alone or with a single injection of FSH (55 mg) on day 11 (P12F). Another group of ewes was assigned to receive the progesterone-containing insert for 5 days with FSH on day 4 (P5F), while the fourth group was exposed to rams only (C). Fertile rams with painted briskets were introduced to ewes at the time of insert removal at a ewe to ram ratio of 15:1. Blood samples were collected throughout the treatment period, ewes were observed for estrus, and pregnancy rates and litter sizes were recorded.

The intravaginal insert did not increase concentrations of progesterone in the blood of the ewe as high as concentrations seen during the luteal phase of the estrous cycle. In ewes treated for 12 days, the concentration of progesterone declined rapidly after the first 4 days, and was not different from that of untreated ewes by day 12. With either progesterone treatment, 74% of ewes showed estrus during the first 5 days after ram introduction compared to 12% in ewes introduced to rams only (Table1). The mean time from introduction of rams to estrus was 42 hours and did not differ with duration of treatment with progesterone.

Table 1. Summary of reproductive performance of anestrous ewes in response to ram introduction (C), or ram introduction + 12-d progesterone pre-treatment (P12), 12-d progesterone pre-treatment + FSH (P12F) or 5-d progesterone pre-treatment +FSH (P5F).

Variable \ Treatment	C	P12	P12F	P5F
N	73	73	71	77
Ewes marked by rams,%	12[a]	77	66[b]	79
Ram introduction to raddle markings, h	56[a]	42	40	43
Pregnancy rate[1],%	3[a]	50	44	48
Conception rate[2],%	10[a]	63	61	56
Pregnancy rate[3] 2nd service period:	50	63	60	61
Ovulation rate[4]	-	1.9 ± 0.1	2.2 ± 0.2	2.2 ± 0.2
Percent ewes lambing:				
(a) From 1st service period,%	0[a]	45	38	42
(b) Both service periods, %	41[a]	66	64	63
Lambing rate[5]:, mean ± SE				
(a) Lambing to 1st service period	-	0.74 ± 0.1	.72 ±.1	0.75 ± .1
(b) Both service periods	0.6 ± 0.1[a]	1.0 ± 0.1	1.1 ± 0.1	1.1 ± 0.1
Prolificacy[6], Mean ± SE:				
(a) Lambing to 1st service period	-	1.6 ± 0.1	1.9 ± 0.1	1.8 ±0.1
(b) Lambing to both service periods	1.5 ± 0.1	1.5 ± 0.1	1.6 ± 0.1	1.8 ± 0.1
Ram Introduction to lambing, days	165 ± 2[a]	152 ± 1	153 ± 1	153 ± 1

[a] (progesterone vs control, P < 0.01), [b] (P12F vs P5F, P < .05) values in same row without common superscript differ.
[1] Number of ewes diagnosed pregnant on d 26 - 31 as a percentage of all ewes in a treatment group.
[2] Number of ewes diagnosed pregnant on d 26 - 31 as a percentage of ewes marked by rams.
[3] Number of ewes pregnant on d 46 – 51 expressed as a percentage of ewes not pregnant on d 26 – 31.
[4] Number of CL observed in ewes diagnosed pregnant on d 26-31.
[5] Lambs born per ewe exposed.
[6] Lambs born per ewe lambing.

The percentages of ewes lambing to the first (42%) and to both first and second service periods (64%) in progesterone-treated ewes were not affected by duration of progesterone treatment. In ewes introduced to rams only, the values were 0 and 41%, respectively (Table 1). Therefore, treatment with progesterone increased the overall proportion of ewes lambing by 23 percentage points.

Ewes lambing to the first service period that were treated with progesterone and given an injection of FSH had a larger litter size (0.2 to 0.3 more lambs born per ewe lambing) than ewes exposed to rams only (Table 1). Ewes treated with progesterone lambed earlier and in a more synchronized pattern (Figure 1). The majority (60 to 70%) of progesterone-treated ewes that lambed did so during the first 8 days of the lambing period. There was no lambing between days 9 and 15, but another period of lambing occurred between day 16 to 25. Ewes introduced to rams lambed continuously between days 14 and 29 of the lambing period.

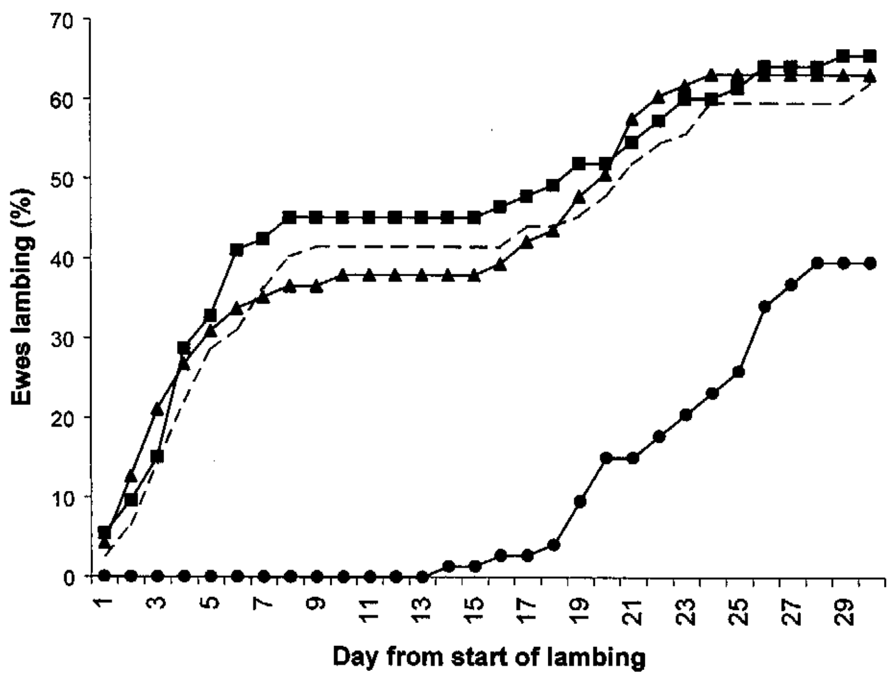


Figure 1. Cumulative percentages of ewes lambing in control ewes (C, —●—), ewes pre-treated with PCL inserts for 12 d without (P12, —■—), or with FSH 24 h before insert removal (P12F, —▲—) and ewes treated with PCL inserts for 5 d with FSH 24 h before insert removal (P5F, – –).

Experiment 2. **Examination of short-term treatment with the CIDR-G.** In experiment 1, treatment for 5 days seemed to be equally effective as treatment for 12 days. Experiment 2 was aimed at testing the efficacy of a 5-day treatment with the CIDR-G device with or without FSH given one day before removal of inserts compared to introduction of rams only. In this study, conducted in 1999, a total of 653 ewes on 7 farms were assigned to be controls (C; introduced to rams only), or to receive the CIDR-G device for 5 days, alone (P5) or in combination with an injection of FSH 1 day before insert removal (P5F).

The results of this study were similar to those obtained in experiment 1 (Table 2). More ewes treated with progesterone (P5 and P5F) were marked by rams during the first 3 days after ram introduction (77 vs 20%), and lambed to the first (46 vs 0%) or both services (63 to 67 vs 45%). Thus an additional 18 to 22% of the ewes treated lambed due to progesterone pre-treatment. Ewes that were treated with FSH and lambed to the first service tended to have a larger litter size than ewes not treated with FSH and control ewes.

In both studies, the response varied among farms and to a limited extent with the face color of the ewe (Table 4). The greatest responses in terms of overall ewes lambing were observed in white-faced ewes (69%) other than North Country Cheviots. Although only a few North Country Cheviot ewes were studied, none of these ewes lambed in response to treatment.

Experiment 3. **Effects of dosage, vehicle, and injection time on the response to FSH.** In a third experiment, conducted during 2000, different dosages of FSH, vehicles for the FSH and times that FSH was injected relative to removal of the intravaginal insert were examined. Although dosages of FSH of 42 or 68 mg increased ovulation rate slightly when given 12 hours before insert removal, numbers of lambs born were not increased in most flocks. Vehicle did not affect the response, but injection of FSH 36 hours before insert removal was ineffective.

Table 2. Summary of reproductive performance of anestrous ewes in response to ram introduction (C), or ram introduction + 5-d CIDR pre-treatment without (P5) or with FSH (P5F).

Variable/Treatment	C	P5	P5F
N	125	257	271
Ewes in estrus[1], %	20	75 [a]	79 [a]
Ovulation rate	-	1.95 ± .1	1.96 ± .1
Conception rate[2], %	0	70 [a]	66[a]
Pregnancy rate, %			
First service period[3]	0	53 [a]	52 [a]
Second service period[4]	57	45	54
Percent ewes lambing, %			
From first service	0	46[a]	46[a]
period	45	63[a]	67[a]
To both service periods			
Lambing rate[5] (mean ± SE)	-	.68 ± .1	.77 ± .1
First service period	.7 ± .1	.96 ± .1[a]	1.07 ± .1[a]
Both periods			
Prolificacy[6] (mean ± SE)	-	1.5 ± .1	1.67 ± .1
	1.52 ± .1	1.47± .1	1.47 ± .1
First service period	1.52 ± .1	1.49 ± .1	1.6 ± .1
Second service period			
Overall			

[a] (P < .001), [b] (P < .05) values in same row without common superscript differ
[1] Number of ewes marked by raddled rams as a percentage of all ewes treated
[2]Number of ewes diagnosed pregnant on d 26 - 31 as a percentage of ewes exhibiting estrus.
[3]Number of ewes diagnosed pregnant on d 26 - 31 as a percentage of all ewes treated.
[4]Number of ewes pregnant on d 46 – 51 expressed as a percentage of ewes not pregnant on d 26 – 31.
[5]Lambs born per ewe exposed.
[6]Lambs born per ewe lambing.

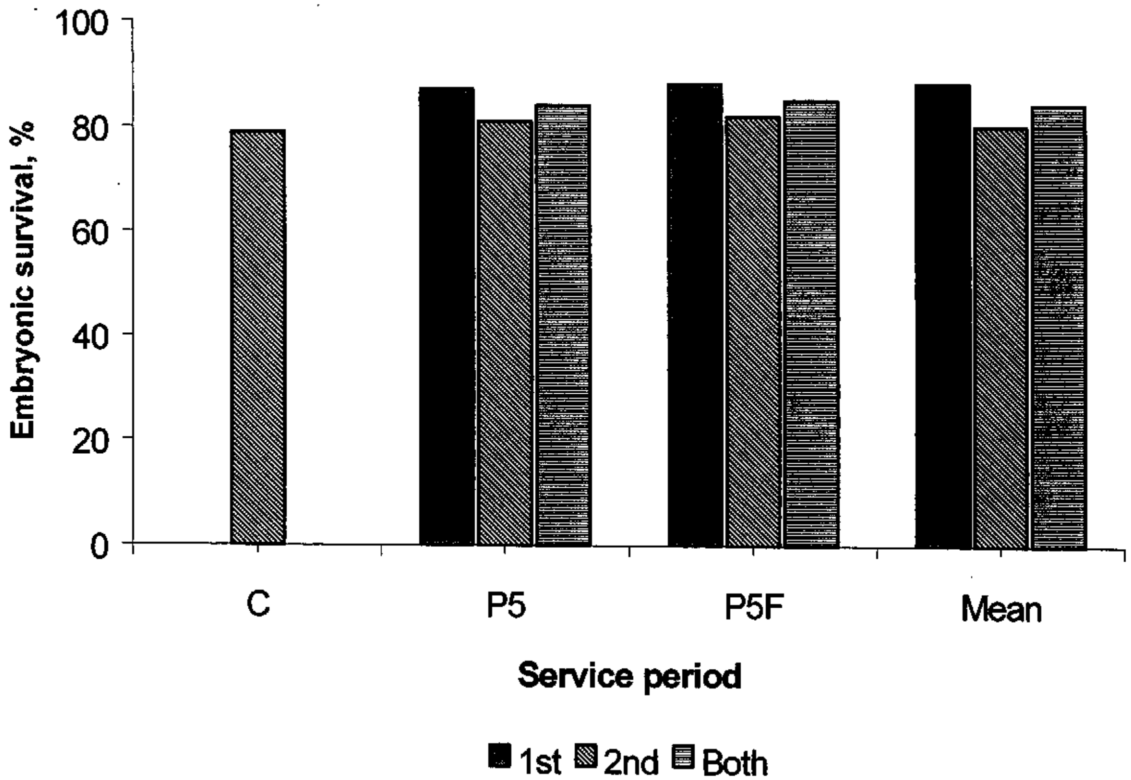


Figure 2. Embryonic survival rate: Percentages of ewes lambing as a percentage of ewes diagnosed pregnant as a result of matings at the first, second, or both service periods after ram introduction, for control ewes (C), ewes pre-treated with CIDR devices for 5 d without (P5), or with FSH 24 h before insert removal (P5F).

Overall, it was concluded that progesterone treatment before ram introduction can be used to induce a synchronized fall lambing in the majority of ewes, which can allow producers to take advantage of seasonally higher lamb prices. Increases in litter size were not sufficient to justify the addition of FSH to the treatment regimen of progesterone and ram introduction.

Lactating Ewes: A Limiting Factor During Anestrus

Lactation has little or no inhibitory effect on the ability of ewes to exhibit reproductive cycles during the breeding season. Estrus accompanied by ovulation occurs about 35 days after parturition in fall-lambing ewes, regardless of whether they are suckling lambs or non-lactating. However during anestrus, lactating ewes usually respond poorly to attempts to induce breeding activity by ram introduction or treatment with progestogens. In recent studies, effects of lactation on response to treatment with progesterone were examined in ewes that were treated in early July. The lambs had been weaned from ewes in one group and ewes in the other group were in the second and third month of lactation. All ewes received CIDR devices for 5 days before introduction of rams.

In experiment 1, 105 weaned ewes and 53 lactating ewes were studied. Half of each group received an additional treatment of 30 micrograms of estradiol benzoate in 1 mL corn oil 24 hours after insert removal and ram introduction. The other half received 1 mL corn oil. Weaned ewes had higher pregnancy rates by ultrasonography at 26 to 30 days after first (59%) or second service (74%) periods than the lactating ewes (38 and 44%, respectively). Thus 81% of the weaned ewes, but only 44% of the lactating ewes lambed. Lambs born per ewe exposed (lambing rate) averaged 1.26 and 0.61, respectively. Lambing rate was higher in ewes treated with estrogen, (1.1) than in ewes receiving corn oil (0.8). In experiment 2, 106 weaned ewes and 44 lactating ewes received either 0, 15 or 30 micrograms of estradiol benzoate 24 hours after insert removal and ram introduction. Again, more weaned (76%) than lactating (27%) ewes were pregnant to first service. More weaned (82%) than lactating (27%)ewes lambed, and lambs born per ewe exposed averaged 1.25 and 0.31, respectively. Treatment with estrogen increased pregnancy rate to first service and ewes lambing in weaned, but not in lactating ewes.

In conclusion, currently available methods are not suitable for induction of breeding out-of-season in lactating ewes. During March or April through July, it is recommended that lambs be weaned for at least 10 days before initiation of treatments to induce a fertile estrus.

Studies on Synchronizing Estrus during the Breeding Season.

Synchronizing estrus during the normal breeding season provides a means for producers to schedule the lambing period, concentrating labor needs into a short time-frame. Estrous synchronization also can help in improving the uniformity of the lamb crop for market.

The use of intravaginal progesterone inserts for a period equivalent to the lifespan of the CL (12 to14 days) has resulted in reduced fertility in some studies. The low amount of progesterone released by a single device was unable to completely maintain a low frequency of release of LH towards the end of the treatment period. A higher frequency of release of LH leads to an earlier increase in estrogen in relation to the time of ovulation. The result is ovulation of an older follicle, in which the egg may have begun to undergo degenerative changes, based upon studies in cattle and two studies in ewes (however, one other study in Ireland did not find decreased fertility in ewes treated with a lower dosage of progesterone).

Experiment 1. **Effect of a CIDR for 5 days with Prostaglandin $F_2\alpha$.** We compared ewes given prostaglandin alone to ewes given a single CIDR-G device for 5 days before injection of $PGF_2\alpha$. The 5-day treatment with CIDR-G plus $PGF_2\alpha$ should synchronize estrus without decreasing fertility, because this treatment should maintain high circulating concentrations of progesterone during the short treatment period. At the same time, it should block ovulation so that ewes will have either no functional CL or CL that are susceptible to $PGF_2\alpha$ (more than 5 days old). Four hundred and sixty (460) ewes on 4 farms were used in this study conducted between late August and December, 1999. Ewes were given a CIDR –G device for 5 days and given an injection of prostaglandin (Lutalyse 20 mg) 18 hours before or at insert removal. A third group of ewes were given a single injection of prostaglandin only.

The results from this experiment are presented in table 3. The estrous response was highest in ewes given a CIDR-G device and $PGF_{2\alpha}$ at insert removal (93%), lowest in ewes given prostaglandin only (72%) and intermediate in ewes treated with CIDR-G devices and given $PGF_{2\alpha}$ 18 h before insert removal.

The conception rate to first service was lower in the ewes given prostaglandin alone (52%) than in the ewes receiving a CIDR-G device and PGF_2⟨ at insert removal (75%), while the conception rate was intermediate in ewes receiving PGF_2⟨ 18 h before insert removal (66%). The overall pregnancy ratefrom the two service periods was 86% and was not different among the 3 treatment groups. The litter size averaged 1.68 and did not differ among groups.

Unexpected Findings: Late Embryonic and Fetal Mortality

During the recent studies in out-of-season breeding, pregnancy was diagnosed by ultrasonography of the reproductive tract of the ewes at 26 to 30 days after first and second service periods. In combination with the data for lambing, the data for pregnancy status at 26 to 30 days allowed us to estimate pregnancy retention. In out-of-season experiment 1, 91% of pregnancies to first service were retained to lambing and 73% of pregnancies resulting from the second service period were retained. Similarly, in out-of-season experiment 2, pregnancy retention rates were 88 and 80%, for first and second service periods, respectively.

These findings stimulated further studies of the numbers of embryos or fetuses present at 25, 45, 65 and 85 days after breeding and numbers of lambs born in both the breeding and non-breeding seasons. In 2000 and 2001, a total of 957 pregnant, non-lactating ewes of mixed breeding on 9 cooperating farms, bred either in early May and June (anestrus, season 1) or in late July, August or September (transition, season 2), were examined by ultrasonography. Late

Table 3 Reproductive performance of ewes in response to 5-day progesterone treatment + $PGF_{2\alpha}$ at insert removal on day 0 or $PGF_{2\alpha}$ alone (Experiment 3).

Treatment Variable	Progesterone + $PGF_{2\alpha}$	$PGF_{2\alpha}$ only
Number of ewes	**519**	**495**
Proportion of ewes with raddle marks[1] (%)	**429/518 (82.8)**	**308/494 (62.3)**
Ewes pregnant to first service (%) [2]	**267/376 (71.0)**	**194/332 (58.4)**
Ewes conceived to the first service (%) [3, a]	**241/315 (76.5)**	**143/210 (68.0)**
Pregnancy rate to second service (%) [4]	**84/102 (82.3)**	**103/135 (76.3)**
Number of ewes lambing: [b]		
(a) From first service period (%)	**259/435 (59.5)**	**191/404 (47.3)**
(b) Both service periods (%)	**369/435 (84.8)**	**324/404 (80.2)**
Lambing rate[5], mean ± SE:		
(a) Lambing to first service period	**408/434 (.94)**	**276/402 (.69)**
(b) Both service periods	**575/434 (1.32)**	**493/402 (1.23)**
Prolificacy[6, c], mean ± SE:		
(a) Lambing to first service period	**1.58 ± 0.60***	**1.45± 0.56**
(b) Both service periods	**1.56± 0.61**	**1.52 ± 0.59**

* $P < 0.05$, ** $P < 0.01$
[1] Two ewes did not have data on occurrence of estrus.
[2] Number of ewes diagnosed pregnant on d 25-45 as a percentage of all ewes in a treatment group, on 5 farms.
[3] Number of ewes diagnosed pregnant on d 25-45 as a percentage of all ewes marked by rams during the first service period, on 5 farms.
[4] Number of ewes lambing expressed as a percentage of ewes diagnosed nonpregnant on d 25-45, for which lambing data were available, on 4 farms.
[5] Lambs born per ewe exposed.
[6] Lambs born per ewe lambing.
[a] Not all pregnant ewes were recorded for raddle marks by rams during days 1 through 3.
[b] Lambing data were not available for one farm (173 ewes) and for 3 ewes on another farm.
[c] Three ewes that lambed did not have data recorded for number of lambs born.

embryonic and fetal mortality was determined from these counts and numbers of lambs born. Breeding season and service period did not affect losses at any stage of pregnancy.

Individual embryos or fetuses were lost from multiple pregnancies, as well as complete losses of either single or multiple pregnancies. In fact, more ewes lost one or more, but not all, embryos/fetuses from day 25 to term than experienced complete loss of a pregnancy (Figure 4). Losses of potential offspring were continuous throughout gestation, with 4.3% of ewes experiencing loss of one or more embryos from day 25 to 45, 5.1% losing one or more fetuses from day 45 to 65, and 10.2% from day 65 to term. Mean losses of embryos or fetuses averaged 3.3% from day 25 to 45, 2.7% from day 45 to 65, 2.3% from day 65 to 85, and 8.5% from day 85 to term.

Treatment with FSH increased the proportion of potential offspring (number of corpora lutea) not represented by lambs born (0.25, 0.55 and 0.71 for 0, 42 and 62 mg of FSH, respectively). Late embryonic or fetal mortality totaled 18.5% from day 25 to term in the current study. Estimated total loss of potential offspring from determination of ovulation rate to lambing was 22.4%. By difference, only approximately 4% of potential offspring were lost from ovulation to day 25 of gestation in those ewes that were pregnant at day 25. Thus fertilization failure and/or early embryonic death were more important in total failures of pregnancy that occurred before day 25 than in later losses. Overall, it is important to realize that ovulation rate is not the only factor limiting litter size in sheep.

CONCLUSIONS:

Treatment of ewes during the anestrous period with progesterone for as little as 5 days before ram introduction can result in synchronized fall lambing in greater than 65% of ewes treated, an improvement of 20 percentage points over ram introduction alone. Treatment with FSH one (1) day before progesterone removal, will sometimes yield a small increase in litter size in ewes bred out-of-season, but only in flocks with naturally low ovulation rates, and FSH increased embryonic and fetal mortality. Therefore, general use of FSH cannot be recommended.

CIDR-G devices are now approved for use in the US sheep industry and marketed in this country, treatment with a CIDR device for 5 days before ram introduction can be used to induce out-of-season breeding. This regimen can allow producers to target lamb markets when prices are highest. Its utilization in the industry could help to ensure a consistent supply of lamb.

Treatment with a CIDR device for 5 days, with $PGF_{2\alpha}$ at device removal, can allow producers to plan lambing dates and concentrate labor at lambing time for ewes bred in season. However this use has not been approved for marketing in the US.

EXPERIENCE WITH USE OF CIDR-G IN 2010

Examples of results with CIDR-G inserts this past year are shown in Appendix Tables 1 and 2.

Authors:
Dr. Keith Inskeep is Professor. Dr. Marlon Knights is an Assistant Professor of Reproductive Physiology. Todd Ramboldt is a Graduate Research Assistant in Reproductive Physiology.

Appendix Table 1. Summary of pregnancy data for a flock of purebred Dorset ewes synchronized out-of-season with a 5-day CIDR-G followed by ram introduction – May and June 2010

Variable	CIDR
Total number of ewes	98
Percent ewes lambing, %	
First service period	54
Second service period	19
Third	4
Total	77
Prolificacy	
First service period	1.73
Second service period	1.82
Third service period	1.3
Overall	1.67
Sex of lamb	
Male	71 or 56%
Female	56 or 44%
Total potential lambs lost, %	19.5
Open at ultrasound, %	11

Appendix Table 2. Hair Sheep Flock - Some Selection for Fall Lambing – June 2010

Variable	Treatment 5-day CIDR+PGF
Total number of ewes	77
Percent ewes lambing	
First service period	47
Second service period	31
Third service period	13
Did not lamb	9
Prolificacy	
First service period	1.61
Second service period	1.38
Third service period	1.20
Overall	1.47
Sex ratio, %	
Male	50
Female	50
Chance for multiples, %	
Overall	
Single	56
Twins	41
Triplets	3
Multiples	44%

EAZI-BREED™
CIDR®
Sheep Insert

NET CONTENTS 20 EAZI-BREED CIDR Sheep Inserts per bag

Each EAZI-BREED CIDR Sheep Insert contains 0.30 grams of progesterone in molded silicone over a flexible nylon spine. Attached to each EAZI-BREED CIDR Sheep Insert is a polyester tail.

Caution: Federal law prohibits extra-label use of this drug to enhance food and/or fiber production in animals.

DRUG FACTS

Active Ingredient: Progesterone, 0.30 grams per EAZI-BREED CIDR Sheep Insert

Use:

- Induction of estrus in ewes (sheep) during seasonal anestrus

WARNINGS:

Human Warning: Avoid contact with skin by wearing latex gloves when handling the inserts. Keep this and all medications out of the reach of children.

Environmental Warning: Store removed EAZI-BREED CIDR Sheep Inserts in a plastic bag or other sealable container until they can be properly disposed in accordance with applicable local, state and Federal regulations.

Residue Warning:
A pre-slaughter withdrawal period is not required when this product is used according to label directions.

Do Not Use:

- in ewes with abnormal, immature or infected genital tracts
- in nulliparous ewe lambs
- an insert more than once. To prevent the potential transmission of venereal and blood borne diseases the EAZI-BREED CIDR Sheep Insert should be disposed after a single use.

T*his product is not approved for estrous synchronization during the breeding season?*

When Using This Product:

- In ewes that respond to treatment the onset of estrus generally occurs within 1 to 3 days after removal of the EAZI-BREED CIDR Sheep Insert.

You May Notice:

- Clear, cloudy or bloody mucus on the outside of EAZI-BREED CIDR Sheep Insert when removed from ewes. The mucus may have an offensive odor. This is a result of mild irritation to the vaginal lining by the presence of the EAZI-BREED CIDR Sheep Insert, and generally clears between the time of removal and breeding. Such irritation does not affect fertility.

Directions:

For induction of estrus in ewes (sheep) during seasonal anestrus:

- Administer one EAZI-BREED CIDR Sheep Insert per ewe for 5 days.
- To optimize response to treatment, ewes should be exposed to mature rams during the 5 day administration period of the EAZI-BREED CIDR Sheep Insert.
- Used (removed) EAZI-BREED CIDR Sheep Inserts still contain some progesterone. Used EAZI-BREED CIDR Sheep Inserts must be stored in a sealable container until disposed. Sealed bag/container with used EAZI-BREED CIDR Sheep Inserts must be properly disposed in accordance with applicable local, state and Federal regulations.
- After insert removal, use standard flock breeding procedures to breed ewes on induced estrus. Make sure to have a sufficient number of rams to adequately breed all ewes in estrus. Breeds of rams may vary in libido in the non-breeding season. Therefore a ewe to ram ratio up to 18:1 is recommended for multi-sire situations. For single sire lots, 12:1 for ram lambs and up to 18:1 for yearling rams are recommended limits.

Insertion:

1. Avoid contact with skin by wearing latex gloves when handling inserts.

2. Only use the specially designed EAZI-BREED CIDR Sheep Insert Applicator for administration.

3. Restrain ewes appropriately (head catch, squeeze chute, gate, etc.) prior to administration.

4. Wash the EAZI-BREED CIDR Sheep Insert Applicator in a non-irritating antiseptic solution, and then lubricate the front portion of the EAZI-BREED CIDR Sheep Insert Applicator with a veterinary obstetrical lubricant.

5. Push the flexible tail end of the EAZI-BREED CIDR Sheep Insert into the EAZI-BREED CIDR Sheep Insert Applicator taking care to assure the tail is extending upward through the slot of the EAZI-BREED CIDR Sheep Insert Applicator and is pointed toward the handle.

6. Fold the wings of the EAZI-BREED CIDR Sheep Insert to make it longer and continue to advance the EAZI-BREED CIDR Sheep Insert into the applicator until it is fully seated. When fully seated only the tips of the wings should protrude (one half inch) from the end of the EAZI-BREED CIDR Sheep Insert Applicator (see Figure 1 below).

7. Lubricate the protruding tips of the wings of the EAZI-BREED CIDR Sheep Insert with veterinary obstetrical lubricant.

8. Clean the exterior of the vulva.

9. Open the lips of the vulva and gently place the loaded EAZI-BREED CIDR Sheep Insert Applicator through the vulva. The slot in the EAZI-BREED CIDR Sheep Insert Applicator should face upwards (see Figure 2 below).

10. Once the loaded EAZI-BREED CIDR Sheep Insert Applicator is past the vulva slope the EAZI-BREED CIDR Sheep Insert Applicator slightly upwards (35 - 45° angle) by lowering the handle, and then forward, without forcing, until the EAZI-BREED CIDR Sheep Insert Applicator is fully inserted or resistance is felt (see Figure 3 below).

11. Squeeze the finger grips within the handle of the EAZI-BREED CIDR Sheep Insert Applicator to deposit the EAZI-BREED CIDR Sheep Insert in the anterior vagina (see Figure 4 below) and then pull the EAZI-BREED CIDR Sheep Insert Applicator backwards to remove it from the vagina.

12. With the EAZI-BREED CIDR Sheep Insert correctly placed, with the wings open in the anterior portion of the vagina, the tail of the EAZI-BREED CIDR sheep Insert should be visible, pointing downward from the vulva of the ewe. Tails of EAZI-BREED CIDR Sheep Inserts that protrude more than 2.5 inches from the vulva may be clipped to minimize removal by other sheep.

Removal:

1. Remove EAZI-BREED CIDR Sheep Inserts by pulling, gently but firmly, on the protruding polyester tail.

2. EAZI-BREED CIDR Sheep Inserts may reverse direction within the vagina; therefore, if the polyester tail of the insert is not visible on the day of removal, check the vagina to determine if an insert is present.

EXPANSION DECISIONS FOR THE PART-TIME SHEEP PRODUCER

Tom Stanley, Virginia Cooperative Extension- Farm Business Management

Scott Greiner, Extension Sheep Specialist, Virginia Tech

Prices for market lambs in the fall of 2010 reached historic highs. Total numbers of sheep in the U.S. have been in decline for some 50 years while the population of ethnic minorities that prefer fresh lamb has been on the rise. In particular, immigrants from Africa and southern Asia have traditions and beliefs about how lamb should be prepared and consumed that result in their need for fresh domestically-produced lamb, mutton, and chevon (goat meat).

Most of the sheep and goats in the Mid Atlantic region are held in small flocks of under 70 ewes. These are part-time enterprises that fulfill lifestyle goals as well as providing supplemental income. The historically high prices received for lambs has prompted many people to consider either expanding existing flocks or starting new flocks of sheep.

There are a wide range of issues that warrant consideration when planning to expand an existing sheep flock. Labor requirement, feed requirements, animal performance, and financing costs are the categories that perhaps come closest to encompassing all the challenges that must be addressed to successfully expand a sheep production enterprise. This paper attempts to illustrate how changes in these four categories of expenses can change in the course of a flock expansion and describe how net income may be affected.

Table 1 summarizes the results of an enterprise budget analysis for a spring-lambing ewe flock that currently has 25 ewes and relies of stockpiled fescue for much of its winter forage supply. The columns show the changes in net income when the flock size is doubled to 50 ewes and one of the categories of labor requirements, feed requirements, animal performance, or financing cost is changed. **The analysis summarized in Table 1 looks at each of these changes in isolation, holding the other factors constant in order to illustrate the relative magnitude of impact of a particular change. In reality, there are numerous interactions that would likely result in several of these factors changing simultaneously if the 25-ewe flock expanded to 50.** For example, if the number of days hay must be fed increases, it is highly likely that the labor requirement would increase as well.

The enterprise budget used for this analysis is adapted and customized from the Farm Business Management Enterprise budget for sheep production available from Virginia Cooperative Extension at: http://www.pubs.ext.vt.edu/category/enterprise-budgets.html.

Columns 1 and 2 serve to provide a baseline of the potential impact on net income of an expansion from 25 to 50 ewes. If the flock could be expanded from 25 to 50 ewes without increasing labor required or changing the factors in the other columns, the 50 ewe flock very nearly reaches the goal of returning $10 per hour for the shepherd's time and paying 5% interest on expenses and the flock's value.

Column 3 illustrates how changes in labor efficiency impact income relative to the time the sheep require. Feeding and handling facilities, pasture management and supplemental feeding systems all impact labor efficiency. Moving from 25 ewes to 50 ewes could demand significantly more labor if basic facilities needs are not met.

Table 1. Economic Impact of Various Factors During Sheep Flock Expansion From 25 to 50 Ewes

	1	2	3	4	5	6
Item Changed (underlined in its respective column)	Current existing flock of 25 ewes	No change except add 25 ewes	Increased Labor/Week	Increase days of Hay feeding	Decrease Animal Health/Performance	Finance $5,000 over 5 years
No. Ewes	25	50	50	50	50	50
% Death Loss	10	10	10	10	15	10
% Unthrifty Lambs	10	10	10	10	20	10
Days of Hay Feeding	63	63	63	122	63	63
Labor = Hrs per Week	6	6	10	6	6	6
Interest/Finance Charge	$369	$768	$768	$823	$768	$1,987
Income Relative to Goal*	-$1,402	-$278	-$2,358	-$1,425	-$1,229	-$1,498
NET CASH INCOME	**$1,868**	**$3,172**	**$3,172**	**$2,080**	**$2,216**	**$1,953**
CASH INCOME per HOUR (includes interest on expenses and the flock value)	$5.99	$10.17	$6.10	$6.67	$7.10	$6.26

*Enterprise Budget lists labor at $10 per hour and 5% interest on all expenses and the value of the ewes. The 'Goal' being to capture sufficient revenue to cover all cash expenses,5% interest on total cash expenses and the value of the breeding flock inventory, and $10 for each hour of labor.

Column 4 and 5 illustrate changes in income if an expansion from 25 to 50 ewes necessitated significant changes in feed requirement or animal performance. Expanding flock size can lead to shortfalls in available pasture or increased internal parasite loads both of which reduce income.

Column 6 attempts to illustrate a circumstance where the income from the additional sheep must finance some aspect of the expansion (animals, equipment, facility improvements etc.). In this example, $5,000 is amortized over 5 years at a 7% interest rate and the entire loan payment (principle and interest) is assigned to the cash expenses. Normally, only interest on the loan would be assigned to expenses but here, the intention is to illustrate how much cash the shepherd realizes for her efforts. Keep in mind, once the loan is paid, then income in this example will go up by $1,219 and the operation will still enjoy the benefit of the asset.

To reiterate, the reality of a flock expansion means that a number of management demands and changes in income and expenses will interact to hopefully result in increased net income. The examples presented here illustrate that feed costs and animal performance are critical elements to manage in the course of an expansion of a sheep or goat flock.

WORKING WITH YOUR LOCAL LIVESTOCK MARKET

Mike Carpenter, VDACS

Suffice it to say that lamb prices have reached a new plateau. Prices did not retreat, and in fact have strengthened since the holiday of Eid-al-Adha. Since the first week of November, prices have been $160-200/cwt. for 60-110 pound lambs. Some wonder if prices will move higher as we enter the low supply period for the year. We might see some spikes above the current levels, but we see some resistance around the $200 level.

Let's discuss some things to help you decide what your best marketing options are. Gathering some information prior to selling can pay dividends. Call your local livestock market to determine buyer activity. Questions to ask are:

- What have lambs been bringing at your sale? (Then check market reports to see if they are comparable.)
- How many lamb buyers are at your sale?
- Do you have any orders for lambs?
- What are your commission charges?

Building a relationship with your local market operator can be beneficial if he knows he will get repeat customers. He is in the business of providing a service – you have to determine if he is doing enough to get your business. If you are satisfied that the market is doing a respectable job, let them know when and how many lambs you plan to sell so they can let their buyers know.

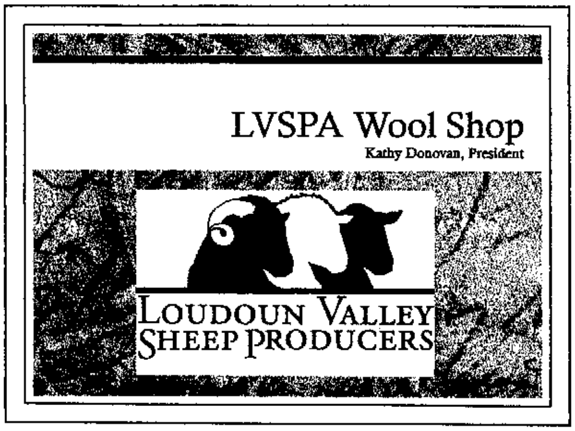
If prices are lower than other locations, you need to figure out if it is worthwhile to haul your lambs to another sale. Factors to consider are:

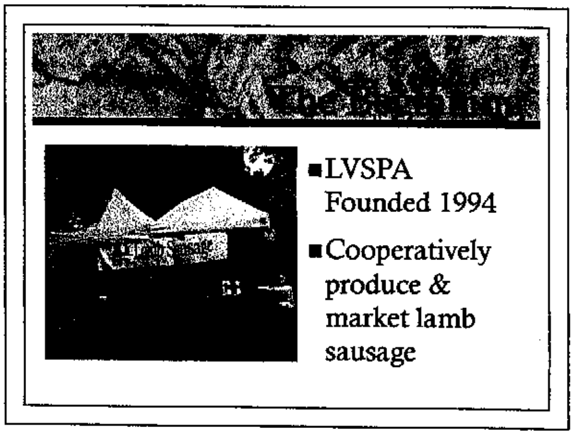
- Trucking.
- Possible additional commissions.
- Shrink.
    - To your local market may be 2-3%.
    - Hauled 200-300 miles and not sold until the next day may be 10%.

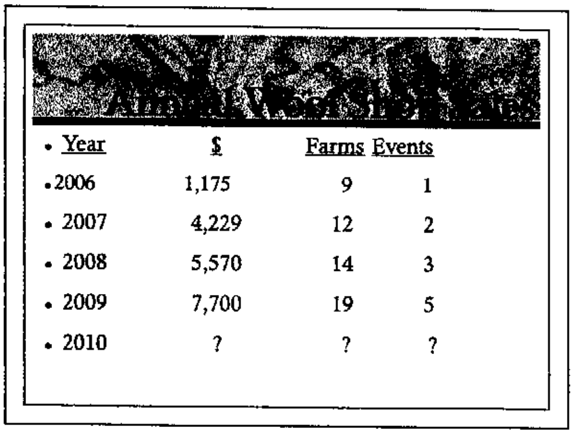
Example:	$7	per head trucking
	<u>$14</u>	shrink cost (8lbs x $1.80)
	$21	additional cost

For 100lb lamb, are they bringing $20/cwt. more at that farther location? For 70lb lamb, it's $30/cwt. to break even. Plug in your own numbers and determine what your net will be.

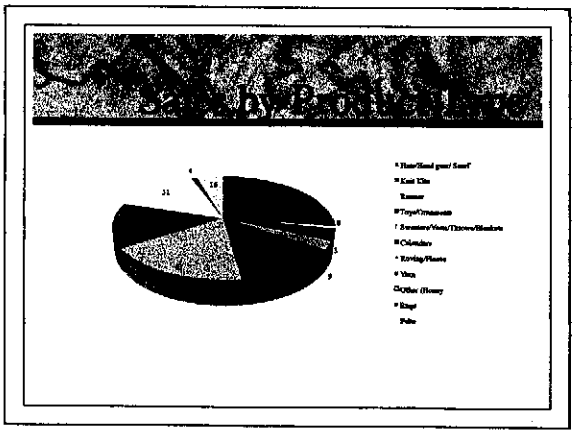
At these high price levels, lower quantity lambs can be discounted $10-20/cwt. Even though feed is high, you can afford some feed to get your lambs in proper condition at $180/cwt.

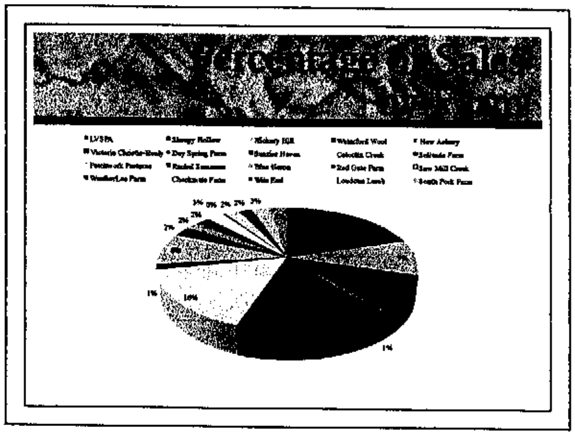






Year	$	Farms	Events
2006	1,175	9	1
2007	4,229	12	2
2008	5,570	14	3
2009	7,700	19	5
2010	?	?	?





Variety of Products from Variety of Breeds of Sheep

Organic
Natural Dyes
Locally Grown
Humane Certification

Promotes our Mission

Sheep Breeds

All Other Products Sold by Farm

- Saves farms expense of setting up their own shop
- Share work load setting up booth and staffing it
- Platform to test new products before big investment

- Create Wool Products
- Pricing Guidance
- Yarn Label & Tag Design
- Packaging for Yarns, Roving, Raw Fleece etc.
- Display Presentation

- Tents, display fixtures, signs, sales books
- LVSPA pays booth fees
- Credit card acceptance
- Accounting and tax management

- Existing Events
  - Bluemont Fair — September
  - Shenandoah Valley Fiber Festival — September
  - Fall Farm Tour — October
  - Leesburg Craft Farm Market — Nov & Dec
- New 2010 Events
  - Master Gardener Symposium — March
  - Fiber Bazaar at Art Center — April
  - Spring Farm Tour — May
  - Montpelier Fiber Festival — October
  - Luray Heritage Festival — October

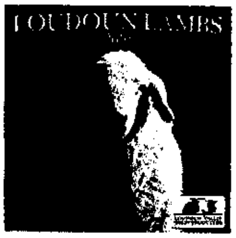
Total Income
for Farms
for 2010 Sales

$ 15,674

• Year	$	Farms	Events
• 2006	1,175	9	1
• 2007	4,229	12	2
• 2008	5,570	14	3
• 2009	7,700	19	4
• 2010	15,674	19	9

Bazaar on 21st Street
Purcellville, Virginia

LVSPA
Products to
Support
Wool Shop
Expenses



2010 LVSPA Calendar

Original LVSPA Knit Patterns

Ashur's Sweater Jacket
Pattern $6.00
Knit Kits use Member's Yarns

- Management of Volunteers
- Key Leader for each event
- Balance the volunteer workload
- Reimburse for travel costs
- Standardize set up / teardown
- Generate Lessons Learned

- Continue to Refine "our" market - Quality products and locations
- Variety of Products – fleece to finished products
- Support wool producers through "knowledge" improvement of staff
- Various of forms of payment accepted (Cash, Check and Credit/Debit Cards)

- Sponsor Education Classes
- LVSPA Website Sales
- Become Independent from LVSPA?
- Expand Farm Membership to State wide or by Region
- Ideas ???

Outstanding Sheep Producer Award Recipients

2009 – Mac Swortzel, Augusta County
2008 – David Shiflett, Augusta County
2007 – Doug Riley, Augusta County
2006 – Mike Carpenter, VDACS
2005 – Jim Wolford, Wythe County
2004 – Martha Mewbourne, Scott County
2004 – David Redwine, Scott County
2003 – Martha Polkey, Loudoun County
2002 – Carlton Truxell, Augusta County
2001 – Corey Childs, Clarke County
2000 – John Sponaugle, Rockingham County
1999 – Bill Stephenson, Page County
1998 – Gary Hornbaker, Clarke County
1997 – Bruce Shiley, Clarke County
1996 - Weldon Dean, Rockingham County
1995 - Bill Wade, Augusta County
1994 - John Henry Smith, Russell County
1993 - Robin Freeman, Chesapeake
1992 - Courtland Spotts, Pulaski County
1991 - Ted Bennett, Halifax County
1990 - Clinton Bell, Tazewell County
1989 - Rex Wightman, Shenandoah County
1988 - Tim Sutphin, Pulaski County
1987 - Zan Stuart, Russell County
1986 - J. W. Riley, Augusta County
1985 - John Bauserman, Fauquier County
1984 - Roy Meek, Pulaski County
1983 - Jonathan May, Rockingham County