WELCOME

We deeply appreciate your attendance at this 23rd Annual Goat Field Day of the E (Kika) de la Garza American Institute for Goat Research of Langston University. The Field Day is one of the most important things we do each year. The primary purpose of the Field Day is for education and extension in areas of greatest interest to clientele of the Institute. Thus, please share your thoughts with us on today's activities and suggestions for the Field Day next year. In addition to extension and education, the Field Day provides an excellent opportunity for the staff of the Institute to meet other people that work with goats. Such interaction helps make our program the most appropriate it can be for the people it serves. The proceedings of the Field Day is a very useful tool for the Institute beyond impact realized from the program today. First, there are reports on Field Day presentations. After this information, there are highlights of research, extension, and international activities of the Institute in the past year. This section is an aid to assess our recent progress, display current activities, and contemplate future directions to be followed. We hope you will take time later to look through this information. This year's general theme "Innovative and Traditional Goat Marketing." I have looked over the articles on these topics in the proceedings, as well as the others, and it looks like we will all learn a great deal of useful new information today. And remember, we attendees also can learn a lot from each other, so let's all make a point of visiting whenever possible. Here is the exciting program planned for today that has developed from your input.

The morning program consists of:

- **Nine Steps to Attract More Customers** *Ms. Ellie Winslow*
- **2008 Feed Market Situation and Outlook** *Dr. Derrell S. Peel and Mr. James Jones*

The afternoon workshops are:

- **Growing Your Rural Business: Attitudes, Marketing Secrets and Methods** *Ms. Ellie Winslow*
- **Livestock Marketing** *Mr. James Jones*
- **Basic Goat Husbandry** *Mr. Jerry Hayes*
- **Basic Herd Health** *Dr. Lionel Dawson*
- **Goat Farm Budgeting** *Mr. Roger Sahs*
- **Nutrition for Health and Production** *Dr. Steve Hart*
- **Introduction to Goat Barbecue Cookery** *Ms. Gladys Young*
- **Internal Parasite Control** *Dr. Dave Sparks*
- **DHI Training** *Ms. Eva Vasquez*
- **Benefits of USDA Programs**
  Mr. Dwight Guy, Mr. Phil Estes, Mr. Robert Dukes, Ms. Sally Vielma
- **Oklahoma Department of Agriculture Services**
  Mr. Justin Whitmore, Mr. Justin Harvey, and Ms. Chris Kirby
- **Body Condition Scoring as a Management Tool** *Mr. Glenn Detweiler*
- **Fitting and Showing for Youth and Adults** *Ms. Kay Garrett*
- **Fun Tent** *Ms. Sheila Stevenson*
- **Poster, Speech, & PowerPoint Contests/Workshops** *Mr. Dennis Howard*

Please let us know your wishes for the 2009 field day, and we will do our best to again provide a quality program with requested and timely topics. On behalf of the staff of E (Kika) de la Garza American Institute for Goat Research, we thank you for your continuing interest and support.

Tilahun Sahlu

Director, E (Kika) de la Garza American Institute for Goat Research

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Keynote Speech

Nine Steps to Attract More Customers

Ms. Ellie Winslow

Beyond the Sidewalk

Ontario, OR

I. Introduction

- A. Enjoying the rural Lifestyle
- B. Generally little business background
- C. Better business on the farm means more enjoyment of the lifestyle
- D. Urban business ideas can be adapted
  1. Defining the extent of your business
     - a. From paying for their feed
     - b. or supporting the family

II. Attracting More Customers

- A. What is the nature of your business
  1. Most people tell me what they raise, grow or produce.
  2. Your income comes from your customers, they are your business
  3. How much time do you spend finding and attracting customers
  4. Make marketing s priority
- B. Tell your customer why he's better off doing business with you
  1. Most people talk in seller ego language
  2. You must translate into buyer ego language
- C. Understand your customer
  1. Know what's important to him
  2. Know what he longs for, his needs, his problems, his frustrations
- D. Have an 'elevator' speech
  1. A short paragraph about what your business does for your customers
  2. Make it so compelling he'll say "Yes, I need that!"

3. Here's mine: "90% of farm and craft businesses fail but you don't have to be one of them! I'll show you how to plan for success, catch more customers, and what to do with them once caught!"

E. Bundle your products and services

1. Quest gives you phone, high speed internet and cable
2. With animals, make it a family group
3. With products, find a grouping that makes sense to your customer
4. With food and produce, provide a package a week of edibles
5. Your customer will be happier and you'll sell more

F. Stay in touch

1. Newsletters
2. Touching base' cards
3. Phone calls and emails

G. You must put yourself out there (shy doesn't cut it)

H. Have a marketing plan

1. Categories are internal events/ external events, media, R & D, Service and Hospitality
2. Who's in charge, what's the deadline, contact info and notes

I. Automate

1. Develop systems and delegate
2. Calendar repealing events (like chamber of commerce)
3. Outsource when budget and time allow

The proper citation for this article is:

Winslow, E. 2008. Nine Steps to Attract More Customers. Pages 1-2 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

2008 Feed Market Situation and Outlook

Dr. Derrell S. Peel and Mr. James Jones

OSU Extension Livestock Marketing Specialist and OSU Area Extension Economist

Summary

Prices for all major U.S. grain and oilseeds will average 50 to 100 percent higher in the 2007/2008 crop year compared to just two years ago. This means that prices for energy and protein feeds, as well as forage crops, will generally be higher than producers have been accustomed to in recent years. Moreover, relative changes in some feed markets means that price relationships between alternative feeds may have changed from historical patterns. Additionally, differing regional impacts have also changed price relationships regionally with significant short run and potential long run regional impacts.

Higher cost for feeds mean that livestock producers must be alert to dynamic feed market conditions and continually evaluate feeding and production alternatives. While all feed prices are expected to be higher, there will be relative feed bargains for producers in various regions and at various times. Producers must evaluate and consider the best use of a wide variety of feed and by-product feed alternatives that will be increasingly available.

U.S. agriculture is operating under a new set of rules. Driven primarily by biofuel demand, competition for agricultural resources is profoundly impacting all agricultural markets, either directly or indirectly. Although it is not yet clear what the permanent impacts will be, agricultural markets will, at a minimum, be in transition for several years.

Corn Markets are the Key

2008 will be a continuation of a massive series of impacts that will reverberate through agricultural markets for several years. 2007 was just the beginning! The sharp rise in corn prices in late 2006 prompted a 20 percent jump in corn plantings in 2007. That acreage increase, combined with good yields, resulted in a record corn crop of about 13.1 billion bushels. Ethanol demand for corn in 2007/2008 crop year, at 3.2 billion bushels, is roughly 50 percent higher than the previous crop year and almost twice the amount of corn used for ethanol just two years ago. This rapidly growing corn demand for industrial use, combined with slight increases in corn used for feed and exports, results in a projected total corn use for the 2007/2008 crop year of 12.69 billion bushels. Because of excellent production in 2007, corn inventories at the end of the crop year (August 31, 2008) are projected at 1.4 billion bushels. For many years, this level of ending stocks would be sufficient to allow corn prices to drop significantly but that is not the case this year. Currently, corn price is over $5.00/bu. in Oklahoma and corn futures for the rest of the crop year suggest that corn prices will be between $5.00 and 6.00/bu. at least until harvest.

There seems to be no relief in sight. New-crop corn futures starting in September are currently approaching $6.00/bu. suggesting Southern Plains corn prices over $5.00/bu. into 2009 The demand driving these price levels appears likely to increase rather than decrease in the coming years. Current ethanol production capacity is about 7.4 billion gallons per year using about 2.64 billion bushels of corn annually. However, if all of the new plants currently under construction are completed in the next 18-24 months, ethanol capacity will expand to roughly 13.4 billion gallons and would use about 4.7 billion bushels of corn per year. A market for this increased ethanol production is ensured by the recently passed Energy Bill that raises renewable fuel standards to 9 billion gallons in 2009 and 15 billion gallons of corn-based ethanol by 2015. The corn market takes no comfort in the 2008 projected ending stocks of 1.4 billion bushels because the current price

levels only hold if the U.S. is able to produce a string of 12-13 billion bushel corn crops in the coming years. In order to do that the corn market must maintain planted acres and have growing conditions that produce record or near-record yields. There are a variety of market and production factors that suggest this will not be an easy feat.

Other Crop Markets will Challenge Corn in 2008

Both current and new-crop corn prices only partly reflect underlying demand and supply conditions; the current ending stock levels suggest that there are adequate corn supplies at this time. The real question is how much corn will be planted and harvested in 2008? Much of the 15 million acre increase in corn acreage in 2007 was facilitated by a nearly 12 million acre decrease in soybeans. Such a decrease in soybean production was possible with minimal market impacts because the current crop year started with record 2006 soybean ending stocks, the result of three large soybean crops in 2004-2006.

2008 soybean ending stocks are projected to be only one-third of 2007 levels. Thus, it is imperative for more acres to return to soybeans in 2008. The market is attempting to ensure that with new-crop soybean futures prices currently trading over $13.00/bu. In other words, corn, soybeans and other crops are in a bidding war for U.S. cropland in 2008. Additionally, there are several production reasons that suggest corn will not be able to maintain 2007 planted acreage. Many of the increased corn acres in 2007 were acres that followed corn in 2006 rather than the more typical 1:1 corn to soybean crop rotation. Planting corn in a 2:1 corn to soybean rotation increases fertilizer needs and increase the odds for disease and pest problems.

Energy versus Protein Feeds

Ethanol production removes the starch from corn and the resulting co-products have considerable feed value, especially for ruminants. The net effect of ethanol production is to reduce the initial volume by two-thirds and return a product that is approximately three times more concentrated with protein. Pound for pound (dry basis), distillers grain has nearly as much energy (from the oil and fiber) as corn and all the protein of the original volume of corn in one-third of the pounds. The result is less total pounds of feed and relatively more protein compared to energy. This does not mean that protein is cheap but it does mean that corn is being driven by the energy value and the result is a relative increase in protein supplies.

Food Gains and Feed Grains

Early in 2007 it appeared that corn prices would likely set a floor for wheat price in the U.S., which happens occasionally when food grain prices drop to feed grain price levels. 2007 was unusual, however, in that it was the sharp rise in feed grain prices up to food grain price levels that appeared to lead to the potential for wheat to be priced and used to a greater degree as a feed grain. However, the poor U.S. wheat crop, combined with strong global demand and tight world stocks, caused wheat prices to rise to record levels for reasons largely unrelated to ethanol production.

Record average wheat prices are expected in 2008 and there appears to be little chance that food grain prices will drop to feed grain price levels in the coming year. Nevertheless, record high wheat prices further enhance, at least indirectly, the bidding war for crop acreage in 2008. Although wheat and corn are grown in different regions and do not, for the most part, compete directly for cropland, they do compete indirectly in the Great Plains where wheat and grain sorghum are alternatives and in the Delta and parts of the Southeast where spring wheat and soybeans compete. Finally, it should be noted that the current high wheat price is largely a function of global supply conditions and will likely decrease with better crops in the U.S. and in other major wheat production countries. In a year or two, we could easily see food grain prices drop again and be influenced directly by the sharply higher feed grain prices, which are not likely to go away for the foreseeable future.

Grain versus Forage

Forage values are generally higher in the U.S. for a variety of reasons related to both demand and supply. Regional droughts have affected forage and cattle production significantly since 2002. The extreme drought conditions in the Southern Plains in 2005 and 2006 resulted in the U.S. having record low hay supplies on May 1, 2006. Hay production recovered somewhat in 2007 and December 1 hay stocks in the U.S. improved compared to the previous year. However, available supplies of hay, especially good quality alfalfa hay, will be tight in 2008. In 2007, the ratio of corn harvested to planted acres was higher than usual, in large part because fewer corn acres were harvested as silage, a situation likely to be repeated in 2008. There is no doubt that some annual pasture and hay acres will be used for other crop production in 2008 and beyond. All of these things indicate that forage supplies will be relatively tight in the coming year.

Implications

Livestock producers must be aware of changing market conditions for both feed and cattle and be prepared to consider a wider range of production alternatives. It is not business as usual for the foreseeable future and while there are significant challenges and potential threats, there are also new opportunities in the current situation. It is imperative to remain vigilant and to be prepared to adjust to a very dynamic feed market environment.

The proper citation for this article is:

Peel, D. S. and J. Jones. 2008. 2008 Feed Market Situation and Outlook. Pages 3-5 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

Growing Your Rural Business: Attitudes, Marketing Secrets and Methods

Workshop by

Ms. Ellie Winslow

Beyond the Sidewalk

Ontario, OR

I. The Power of Setting Goals

- A. All successful people have some way of goal setting.
- B. A Goal is a dream with a timeline
- C. It must also be measurable by anyone (specificity)
- D. Goal Worksheet
    1. Keep it where you can see it
    2. Find someone who will make you accountable
    3. Its not written in stone, but is a work in progress
    4. You can change your mind and you can do the wheel for multiple goals
    5. Make your daily to-do list from the lists on the wheel
    6. Keep the picture of the outcome in your mind
    7. Remember you are growing an oak tree not a squash
- E. Results seem magic, but its because you're DOING

II. Getting out of your comfort Zone

- A. Setting goals is an activity that puts you out of your comfort zone
- B. As soon as you get serious about goal setting, three things come up.
    1. Considerations—the excuses you give yourself why not to even try
    2. Fears—the feelings that come up that make you uncomfortable
    3. Roadblocks—the things the world throws in your way
    4. Worksheet on Considerations, Fears and Roadblocks
- C. If you know they are coming, it's easier to deal with them.

D. These are the things that have been holding you back, so welcome them and deal with them.

E. The anatomy of fear

1. We make ourselves afraid by imagining bad outcomes

2. Eliminate your discomforts by imagining good outcomes

3. Worksheet on eliminating fears

III. The Secret of Better Marketing

A. Marketing is not about you

B. Marketing is not even about your product (at least not yet)

C. Marketing is about your customer

1. The most interesting thing in the world....

2. Appeal to his emotions

3. Bait your hook with what appeals to the fish

4. Make his life better, feel better, meet his needs, solve his problems

5. Translate from seller ego language to buyer ego language

6. Features are about your product; benefits are why the feature matters

7. Worksheet, features vs. benefits

8. Handout of reasons people buy

IV. Planning

A. Sample Marketing Plan handout

B. Use your own design, but have it where it can be seen daily

C. Decide how many in each category is appropriate and stick to it

D. Automate

1. Plan 10-20 hours per month working on your marketing

2. Put regular events on the calendar

3. Hire help when you can

E. Track how effective your marketing is

V. Advertising in writing is Copywriting

A. Business cards, sales letters, catalogues, sales lists, signs, Fri Mkt ads, magazine ads, flyer, brochures—all are copy writing

B. 80% of selling is in the headline— types of headlines that work—get attention!

1. Direct
2. Indirect
3. News
4. How to
5. Question
6. Command
7. List
8. Testimonial

C. Headline worksheet

D. Rules for the body of the material

1. Write to inform using benefits
2. Use short paragraphs with lots of white space
3. Use simple words not big ones
    a. best not optimum
    b. help not assist
    c. buy not purchase
    d. prove not substantiate
    e. end not terminate
    f. pick not select
    g. best not superior
    h. use not utilize
    i. Bottle not container
    j. get rid of not eliminate
    k. say, tell or show, not indicate
    l. limits not parameters

4. Do not use too many words

    a. Avoid redundant words (free gift)

    b. Too many words dilute your message and message is king!

5. Write to real people, the ‘you orientation” of conversation

6. Prioritize the most important benefits first

7. Do not wander in writing, get to the point.

E. The call to action - closing the sale

1. Now that you’ve told them how their life will improve, what do you want them to do?

2. Tell them what to do!

    a. Which wrapping paper do you want on that?

    b. Send in the coupon

    c. Call today

    d. Where shall I send the paperwork?

3. Worksheet on closing statements (bottom of last worksheet)

4. Worksheet to practice translating poor ads to better ads

VI. Where to find more customers

A. Think creatively

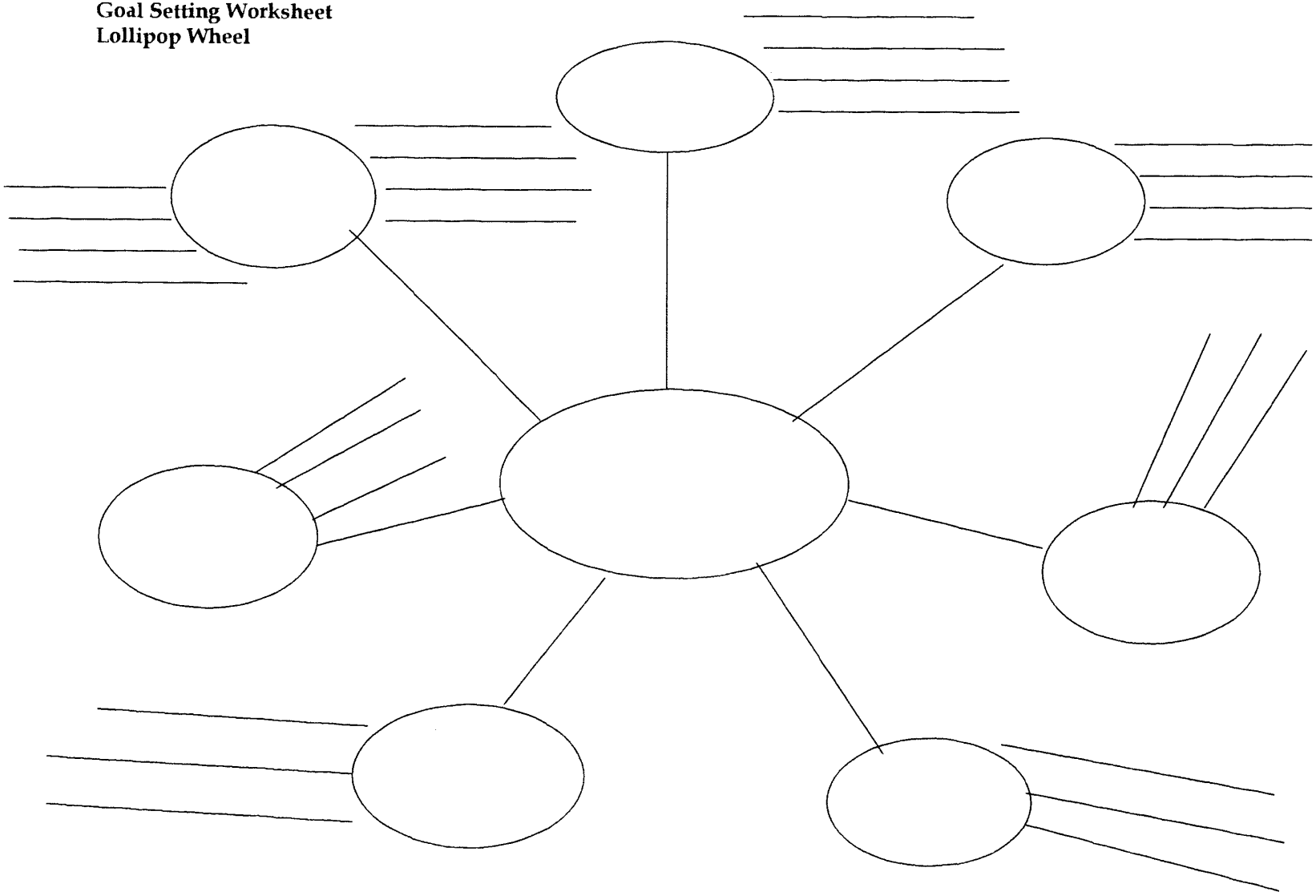
B. Get off the farm and go where your customers congregate and can be; reached

C. Always carry business cards and your brochures or flyers with you.

D. Talk about your business everywhere (Elevator speech)

E. Handout of Places to Market (this is not a complete list by any means)

Goal Setting Worksheet
Lollipop Wheel



Considerations—Fears—Roadblocks

GOAL_____

Considerations: These are the reasons to give up your goal.

I'll have to work twice as hard
I'll have to learn AI and get a tank (I'll have to go talk to retailers)
I'll have to quit my day job or I'll have to get a part time job
I won't have time for golf (TV, movies, internet surfing…)
There's too much competition in Nubians (among artists, with fiber…)

_____

_____

_____

Fears: These are feelings—just part of the process…where you are outside comfort zone

Fear of making a fool of yourself, fear of failure, fear of rejection, fear of hurt feelings, fear of loosing money (your shirt), fear of talking to people, fear of being a success….

_____

_____

_____

Roadblocks: External things that get in the way – These are obstacles the world throws at you

Partner doesn't want to move, Don't have the $$ to expand, No one wants to join your project, Government regulations, Barn is too small (Workspace is too small) Light is wrong, Zoning is wrong, Truck is too small, etc.

_____

_____

_____

_____

Eliminating Fears Exercise

Getting out of our comfort zones creates discomfort and makes us uneasy.

I'm afraid:
I might fail.
I might have to learn a new skill.
I might lose money.
I might get my feelings hurt
I might screw up

We are uncomfortable because we imagine the worst outcome.

To overcome those feeling of discomfort, turn it around: Imagine a positive outcome.

I might succeed.
I might love to learn something new.
I might make money.
I might NOT get my feelings hurt.
I might not screw up!

Write down one thing you want to do that make you uncomfortable

I want to _____ and I make myself

uncomfortable by imagining _____

_____.

Now turn it around:

I want to _____ and I reassure myself by

imagining (this good outcome)_____

_____

Features versus Benefits

FEATURE (Facts--can you point at it, measure it, touch it?) how do you put it into buyer ego language?)	**BENEFIT** (Does it address an emotional or non tangible need,

Emotional Reasons People Buy

Physical	Emotional	Intellectual	Spiritual
Exhilaration	Well-being	Learning	Fulfillment
Pleasure	Personal growth	Knowledge	Peace
Comfort	Recognition	Appreciation	Freedom
Convenience	Personal identity	Rarity	Trust
Independence	Caring	Excellence	Integrity
Security	Relationships	Control	Spiritual growth
Survival	Status	Quality	Spiritual expression
	Self-expression	Choice	Creative expression
	Self-esteem	Reliability	Aesthetic connection
	Belonging	Efficiency	Social conscience
	Happiness	Satisfaction	
	Harmony	Performance	

22 Reasons why someone might buy what you're selling

To be liked
To be appreciated
To be right
To feel important
To make money
To save money
To save time
To make work easier
To be secure
To be attractive
To be sexy
To be distinct
To be happy
To have fun
To gain knowledge
To be healthy
To gratify curiosity
For convenience
Out of fear
Out of greed
Out of guilt
To be comfortable

MARKETING PLAN

INTERNAL EVENTS	EXTERNAL EVENTS	MEDIA ADVERTISING	R & D	SERVICE-OUTREACH	HOSPITALITY
Things you do at your business: Give a tour of your business 4H group meeting Customer picks up products Neighborhood get - together Put on a workshop Teach a class Invite professionals to visit Free give-away	**Things you do away from your business:** Give a presentation Take flyers around Deliver products Go to a show Attend a craft fair Put on a conference Sponsor an event Saturday Market Sales calls on prospective outlets Samples given out	**Getting the word out:** Newspaper ad Radio spot Niche publication Posters Flyers Fax bomb Phone calls Thank you notes Press release Business Sign Sign on auto or truck Brochures Direct mail	**Anything that helps with new products or innovations** Attend a conference Take a class Acquire new catalogs of supplies Brain storming Buy new equipment Research Get samples Try new recipes Read books	**Service to the community:** These things are about visibility but not a direct sales event. They are about how you and your business and your products can meet the needs of others: Sponsor a service or award Serve meals at an event Belong to a service group Volunteer	**Expressing appreciation for those who help you produce:** This could be family or employees. Get creative about small ways to reward good productivity, good customer service or good attitudes. Flowers Incentives Awards Time off

Decide how many of each type of promotional event over a unit of time, is appropriate for your business and desire for more business. A minimum effort gets a minimum response. A beginning business needs more than an established business. Start with efforts that are manageable and delegate effectively.

MARKETING WORKSHEETS				
EVENT	**WHO'S IN CHARGE**	**DEADLINE**	**CONTACT #'s**	**NOTES**
INTERNAL				
EXTERNAL				
MEDIA—Ads, Posters, Web, News Release, Handouts Flyers	**WHO'S IN CHARGE**	**DEADLINE**	**CONTACT #'s**	**NOTES**

Research & development -- EVENTS, projects	WHO'S IN CHARGE	DEADLINE	CONTACT #'s	NOTES
SERVICE.--OUTREACH	**WHO'S IN CHARGE**	**DEADLINE**	**CONTACT #'s**	**NOTES**
HOSPITALITY—what you do for family or employees	**WHO'S IN CHARGE**	**DEADLINE**	**CONTACT #'s**	**NOTES**

THE SALESMAN AT THE KEYBOARD

(Principles of copywriting)

Get attention—Headlines-Kinds of headlines that work—80% of selling

1. Direct
2. Indirect
3. News
4. How To

** 5. Question

6. Command
7. Reasons why or ways to…
8. Testimonials

Write to inform--more benefits--Rules for making your written material easy to read

1. Use short Sentences
2. Use short paragraphs
3. Use simple words
4. Write to people—the 'you' orientation
5. Prioritize your selling points
6. Be clear, be concise

The Call to action—closing the sale

Would you approve this now? When will you send the check?
Can we add you to our Board this month? When will I hear your decision?
Call me today and we'll set an appointment

Write your own

_____

_____

_____

Converting and Translating Poor ads Exercise

we are starting our fall semen collection tour. we collect, evaluate, freeze, and store goat semen. we also do a.i.work.

_____

_____

_____

have a look at the rams, this is our selection with most parasite resistance, large ribeyes, good shedding.

_____

_____

_____

Here is our current sales list. We've added a couple of does. These goats really need to go soon.

_____

_____

"We are offering a select grouping of females. Every female comes with an original breeding plus 2 breedbacks to our award winning and quality bloodlines herdsires. We also offer half price upgrade breedings. 60 days of free agisting, discounts for transport and full mentoring and tax advice from a CPA for first time buyers. Guaranteed female cria program available."

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_____

_____

PLACES TO MARKET

Your Business Beyond the Sidewalk

Signs:

1. On your place of business—Make sure it is readable, short, clear and eye-catching.
2. On telephone poles (fence posts)—particularly effective for events and for directing customers to your place.
3. In others' places of business—If your products compliment other businesses, they may be open to having your sign or products in their place of business.
4. Bulletin boards—many public places have bulletin boards where anyone can post. Be sure your notice or sign is really great and well attached.
5. On a Booth—your portable retail space at shows, markets and events needs a superb sign to advertise what you have for sale.
6. On your fence/gate—for those with fences or gates across the driveway, it's a great place for an eye-catching sign.

Handouts:

1. Brochures—Describe what your products provide for the customer. They should be clear, error free, and address the benefits more than information about you.
2. Flyers—for getting the word out, well done flyers can increase awareness when they are interesting, clear and short.
3. Coupons—can entice customers who are 'on the fence' to buy sooner and more than they might otherwise. They should be professional looking.
4. Business Cards—a superb marketing opportunity. Have one or two clear and interesting words about your products or business.
5. Direct Mail—A well-written direct mail letter can let old or new customers know why they should buy from you.

Presentations:

1. At club meetings—Many types of clubs and organizations are looking for members of the community to introduce themselves especially if you can provide some interesting information that helps them in some way.
2. To a business owner—You may have a product to solve a need of his/hers or you may be trying to acquire a wholesale account.
3. In schools—if your children go to school, there will be opportunities to take either your products or your baby animals to show the children. It's also a marketing opportunity
4. At service clubs—They have weekly lunch meetings and usually have a speaker. Figure out how your business can entertain them or provide them with information about history, industry or some other subject they're interested in as it relates to you.
5. Church Events—see if your church needs speakers or if you can provide information or entertainment at events. Tie what you do to principles of living ethically.

Retail Space:

1. In a store—How you arrange your signs and merchandise in any retail space has the potential to be either good or bad advertising
2. At a roadside stand—near your home or in a more commercial area.
3. At a Farmer's Market—they allow a remarkable variety of both food and craft items.
4. In your place of business /home/farm/garage—where ever you sell your stuff, how you arrange it is part of your advertising.

Web sites:

1. Your own—as any marketing, your web site needs to be about your customer, easy to get around in and in harmony with the products and customers you have.
2. Someone else's—same rules apply if you have space on someone else's web site.

Ads:

1. Newspaper—can be pretty expensive for display ads, but check out the classifieds for line ads.
2. Thrifty Nickel type free newspapers—very reasonable advertising rates if it reaches your target customer.
3. Niche magazines—for specialty items find the magazine that caters to your type of customer. Sell doll accessories? Market in doll maker magazines.
4. Newsletters—Every professional and many casual organizations produce a newsletter on some regular schedule. Most will allow some advertising, particularly if your product is of interest to their readers.
5. Email lists—Many have one day per week when it is acceptable to send an ad to all the members of the list. Good ads get more sales.
6. Signature on emails—is an opportunity to say something about your business and give contact information.

Indirect:

1. Write an article—if you are an expert on any subject, there is a publication somewhere that would love to have you write an article for them. It's also acceptable to write a few lines about yourself as the author. Both what your article says and your introduction can be good PR.
2. Volunteer –giving back to your community is always satisfying on many levels and it gets you known more widely, too.
3. Donate to causes—more PR
4. Sponsor an event or publication—Sponsors usually get some publicity and that can be good for your business

Public Events:

1. Livestock Shows--If you have animals at a show, it's an opportunity to have a display (and sign, handouts, free samples, etc.) that promotes your business
2. Community gatherings—depending on what the event is, you may be able to display something or talk about your business.
3. Craft shows—Craft shows are a viable market for many of the products made in homes beyond the sidewalk. Assessing each one for the type of clientele and products is important.
4. Trade Shows—If you make enough product to depend on wholesale accounts, trade shows might be where you will find new customers.
5. Auctions—Selling meat animals at an auction becomes your advertising byhow your animals look and sell. Get a reputation for superior stock and the customers will line up. Come to the Farm Auction handles many products and there's always E-Bay.
6. Parades—Can you make a float or have an entry in the parade?
7. School events—fairs, festivals, plays, talent events, picnics—any school event is an opportunity to get your name, business and product involved.
8. County Fairs—Whether it's in the displays or the competitions or in the showmanship—any of the above can be a way to showcase what you produce.
9. Create a competition - invite all the cheese makers (any product) to a local competition

Word of Mouth:

1. Have satisfied customers—bend over backward to make your customers satisfied with your products, animals and service.
2. Always talk to anyone around you about your "product"—never miss an opportunity to tell people what you do, make or produce and why it's the best!

Go where Your Potential Customers hang out:

1. Find contacts who have contacts that you'd like to have and ask them for help.
2. Go where your prospects shop, visit, congregate, socialize.
3. Find what they read and be a presence there (articles, ads, promotions)
4. Get out of your office and barn and think creatively!
5. Take baby animals to the story time at the public library when they're reading about your species.

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Meat Goat Herd Health Procedures and Prevention

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Introduction

The goal of a herd health program is to improve the goat herd's productivity through general husbandry, nutrition, parasite control, vaccination, and environmental management. An understanding of various management practices and common diseases on the farm is necessary to accomplish this goal. An effective herd health program is an essential part of a successful goat management program. Good feeding and breeding will not result in maximum production if goats are not kept in good health. Conversely, good nutrition and herd management will greatly reduce the complexity and cost of the herd health program.

Herd health programs are always described in very general terms and then modified to fit individual herds. The exact makeup of any program depends on the herd size, purpose of having the herd, and the production goals of the owner. For the most part, goats are managed as small groups of five to a hundred animals per herd. There are relatively very few large commercial goat herds with numbers above 500 head in the United States. Large herds may have problems associated with high density of animals and continuous turn over. Small herds tend to have higher nonproductive/productive ratios than do larger herds. This is because small herd owners often keep animals that would normally be culled in large commercial herds. Often, the net result is the maintenance of animals with chronic illnesses that may serve as reservoirs of disease.

Since each herd is different, each owner should work with his/her veterinarian to create an individual herd health plan. Keep good records for each animal regarding medications, vaccinations, dewormers, diseases, breeding, culling etc., and use this information to plan your herd health program. Preventive medicine is usually less expensive than treating the disease as the highest economic returns are realized when disease problems are at a minimum. Many diseases have similar symptoms and a producer should work with a veterinarian familiar with common goat diseases. A veterinarian familiar with goats has the training and experience needed to provide diagnosis and recommend animal health products used in goats to treat these conditions.

General Herd Health Considerations

An obvious key to a successful meat goat operation is having a healthy, productive herd. Herd health can be affected by a number of factors including genetics, environment, nutrition, and management, among others. The purchase of healthy animals and the provision of a healthy environment with proper nutrition, sanitation, biosecurity measures, and preventative health care are necessary in establishing and maintaining a healthy herd. However, goats can be affected by a variety of diseases and no matter how diligently one follows a strict herd health regime, from time to time animals will become ill.

The onus of detecting sick animals or animals undergoing nutritional or other stress falls on the owner or caretaker and can only be accomplished by daily observation. The producer should observe unrestrained animals in order to learn how his animals look and behave in a normal manner. This includes general appearance and movement, normal behavior patterns, fecal consistency, eating behavior, teeth, body parts, etc. Any deviation from a goat's "normal" appearance and behavior should be cause for concern and further

investigation. When an animal does become ill, it is important to identify that particular animal with the aim of trying to determine what course of action should be taken.

When illness does occur consider that it may be a herd health problem rather than an individual animal problem. This is because goats tend to stay close to one another which can promote the spread of any infectious condition. The following steps can assist you in dealing with a potential disease outbreak.

- Isolate any affected animals.
- Determine if the condition is a single occurrence or the start of a bigger problem.
- Check all animals carefully to identify sick ones.
- Contact your veterinarian to limit loss. It is important to have a prior relationship with a veterinarian. If a veterinarian understands your operation he/she can be of help in preventing health problems as well as treating diseases.

If death occurs, submit the goat to your local veterinarian for a post-mortem exam or take appropriate tissues from the animal for diagnosis at a state or other laboratory facility. A post-mortem exam may be more useful in determining the cause of a disease than examining live animals. The results of such an exam may yield an accurate disease diagnosis and allow for proper treatment to begin immediately. It is important to keep the body of a dead animal cool with ice or refrigeration until the examination can be performed. Freezing the carcass will make microscopic evaluation impossible.

Begin with Healthy Animals

To minimize the incidence of disease, it is important that only healthy animals are introduced into the herd. This begins at the time of purchase. Producers should buy only from reputable sources to minimize the chance of buying diseased animals. If animals are purchased at an auction, one can usually expect problems. New purchases should be quarantined for at least 30 days. This allows any diseases that are lingering to express themselves; provides time for new animals to adapt before being exposed to new herd mates; and gives time for the owner to deworm, administer vaccinations, etc., according to his/her established herd health protocol. Depending on the type of operation, testing for any of several disease entities may be advisable. A producer's quarantine protocol along with other procedures to minimize the risk of introducing diseases into the herd should be listed in the farm's biosecurity plan. See the "Biosecurity for Meat Goat Producers" section for more information on potential threats and recommended biosecurity plan components.

If animals are moved across state lines, a certificate of veterinary inspection (health paper) is required. This is a common procedure and should not be difficult to obtain. State requirements vary. To view your state's requirements log on to http://www.aphis.usda.gov/vs/sregs. Be sure to allow plenty of time to obtain the certificate as some states may require testing that may take several days.

Basic Herd Health Equipment and Supplies

It is best to plan ahead and prepare a basic herd health kit before the need to use it arises. Many of the items included will be used in the preventative care conducted as a part of a comprehensive herd health program and, thus, should already be on the farm. The following list is by no means exhaustive and should be used as a guide for a beginning health kit. As you consult with your veterinarian on a herd health program and annual herd health calendar, the items needed to maintain herd health will become apparent.

Basic herd health supplies

General Health Kit

- Thermometer.
- Record book.
- Alcohol.

- Balling gun and(or) capsule forceps for oral dosing of bolus medication.
- Dewormers (anthelmintics).
- Antibacterials/antibiotics (penicillin and tetracycline are most commonly used).
- Biologicals (Tetanus antitoxin, Tetanus toxoid, C. perfringens toxoid, C. perfringens antitoxin.
- Deworming or drench gun.
- Injectables (vitamin A, D, & E, vitamin B complex, BoSe, etc.).
- Syringes and needles of various sizes and gauges.
- Sharp's container for used needles such as an old soda bottle.
- Ear tagger and tags.
- Wound dressing.

Kidding Kit

- Iodine (7% tincture) for dipping navels after they are trimmed. Empty film canisters (2/3 full) are handy to prevent spilling or contaminating the main bottle. Spray bottles and teat dip containers can also be used.
- Betadine Scrub® (Povidone iodine) or Nolvasan Scrub® (Chlorhexidine). Disinfectant soap used to disinfect skin or vulva of goat and hands of people. Squeeze bottles are handy for dispensing.
- Nolvasan® solution. Use diluted to disinfect scissors and other equipment.
- Betadine Solution®. Use diluted to disinfect skin, wounds and tissue.
- Obstetrical sleeves and sterile lubricant.
- Paper towels for washing off doe, and for hands.
- Exam gloves.
- Newspapers for insulation and sanitation.
- Cloth towels to clean off newborn kids.
- Clean bottle (20 oz. soda bottle) and nipple to feed colostrum.
- Red rubber feeding tube (12 to 14 French) or similar flexible plastic tube, with 60 ml catheter tip syringe or funnel to feed colostrum to weak kids.
- Heat lamps, heating pad, or other means to warm chilled kids.
- Body socks or warming box for chilled or weak kids. Frozen colostrum or source of synthetic colostrum.
- Quality milk replacer.

Common Herd Health Procedures

In the normal course of herd health management it will be necessary to perform different herd health procedures. Some of these procedures are performed to collect information on an animal's condition that can be relayed to a veterinarian. Others are needed in the course of disease prevention or treatment. A producer should only attempt those procedures in which they feel comfortable and sufficiently proficient so that no harm can come to the animal. If there is any doubt, consult a veterinarian. The most common procedures done by producers are listed below with a brief explanation of correct methods.

Taking temperature – rectally

The first procedure usually performed on an animal suspected to be ill is to take its temperature. In goats, this is performed rectally. Either a digital or mercury thermometer can be used. Plastic digital thermometers do not break and may be considered as safer to use than a mercury thermometer. A small amount of lubricant may be put on the thermometer and it should be inserted with a twisting motion. A normal goat's temperature should be 103 - 104ºF (39 - 40ºC).

Determining body temperature.

Proper procedure for determining heart rate.

Determining rumen movement.

Checking mucous membranes.

Pulse or heart rate

There are several places on the goat where the pulse or heartbeat can be felt and measured. Heartbeat can be felt by placing one's fingertips between the ribs behind the elbow. Pulse can be measured using the femoral artery on the inside of the rear leg roughly ⅓ of the way down. Pulse may also be detected by placing the index and middle fingers on the artery located below and slightly inside of the jaw roughly two-thirds to the rear of the muzzle. A normal range is 70 to 90 beats per minute.

Respiration

Respiration is detected by watching movement of the flank or chest. A normal range is 12 to 20 per minute.

Rumen movements

Adequate rumen function is essential for a goat's health. One sign of adequate function is regular ruminal movement. This can be detected by placing the hand on the left flank of the animal. If the rumen feels soft and water-filled this should be noted and reported to your veterinarian. Rumen contractions should be easily felt and should occur 1-2 times per minute.

Checking mucous membranes

Paleness of the mucous membranes in the mouth (gums), vagina and prepuce can be an indicator that the animal is in hypovolemic shock, meaning that there is a decrease in the blood volume circulating in the animal. The color of the conjunctiva around the eyes can be an indicator of anemia that could be caused by a heavy internal parasite burden. Roll down the lower eyelid to look at the color. A pale, whitish color indicates anemia. This color can be scored using the FAMACHA system which is described in the section on Parasites of Goats. Remember that irritation of any type causes membranes to turn red. This means that an anemic goat with pinkeye may still have red membranes.

Drenching and dosing

Drenching or dosing an animal entails the oral administration of a liquid. The obvious goal of this procedure is to ensure that the animal swallows the full amount given. Grasp the animal under the jaw to raise its head. Raising the head of the animal will assist in ensuring the liquid is swallowed. A finger or thumb

Drenching.

Proper tubing technique.

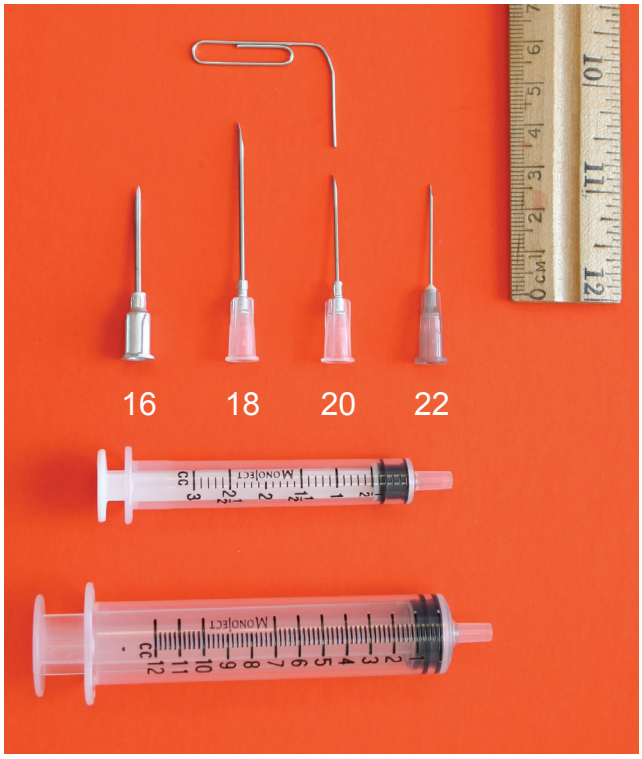
can be put into the mouth where there are no teeth (goats lack canine teeth as do all ruminants) to assist in opening the mouth for the drenching equipment. Generally a bottle with a tube over the end or a drenching gun is used. Liquids should be given slowly to allow time for the animal to swallow. Dewormers must be given using appropriate drenching equipment ensuring that they are given over the back of the tongue and swallowed.

Tubing an animal

In some cases it may be necessary to pass a tube down the mouth directly into the stomach in order to administer a large volume of a liquid. This could also be used to feed a young animal incapable of nursing or to either sample rumen contents or insert rumen contents into an animal having severe digestive problems. The size of the tube passed should be appropriate for the animal's size. Generally, a ½ to ¾ inch (1 to 2 cm) diameter tube should be used for adult goats. A short metal or PVC pipe (speculum) larger in diameter than the tube to be inserted is placed in the mouth to prevent the goat from biting or chewing the plastic tube. Some people prefer to use a "Harp" speculum instead. The hard-sided tube or speculum is inserted into the mouth of the goat and holds their mouth open while you pass the tube. The plastic tube is then passed down the throat and into the stomach. Administer liquids slowly. Have a veterinarian or person trained in this technique instruct you before attempting it the first time.

The procedure for tubing a neonatal kid is similar to that for adult animals with a few distinctions. For kids, one does not need to use a PVC tube or speculum. The size tube used is smaller for baby goats (12 to 14 French or roughly ¼ inch inner diameter). The tube should be flexible without any hard edges to harm the kid's mouth or throat. Hold the kid's mouth open and pass the tube gently over the hump or base of the tongue at the back of the mouth and into the stomach.

There are some precautions to take in tubing an animal to ensure that liquids are not inadvertently administered into the lung. The first precaution is to always hold the goat's head in its normal flexed position. If you extend the head and throat, your tube has a straight shot down the trachea. When doing this, preferably have the goat standing. As the tube is inserted, watch and feel the throat area. The tube needs to enter the esophagus and not the trachea or windpipe. The esophagus is a smooth, flexible tube leading to the stomach and one can feel or see the stomach tube sliding downwards. The trachea is a rigid tube and the stomach tube can neither be seen nor felt from outside the animal. When the tube is in the esophagus, feel the bottom of the neck. You should feel "two tubes." One will be the trachea and the other will be the rigid tube inside the esophagus.



Hypodermic needles and syringes.

Another check can be done while midway down the trachea/esophagus is to suck on the end of the tube. If you are in the esophagus, it will collapse on the tube and you will create a vacuum. Alternatively, blow in the tube and you will see a bolus of air go down the esophagus. If using a stethoscope applied to the goat's rumen on the left side of the body, you will hear air bubbling. Sucking on the tube while it is in the rigid walled trachea will not create a vacuum. One can also check for the smell of rumen fluid to ensure correct

Recommended needle sizes and lengths used in goats			
Age	Gauge	Needle length	
		Intramuscular injection	Subcutaneous injection
< 4 weeks old	20	½ inch	½ inch
4 to 16 weeks	20	⅝ to ¾ inch	½ inch
4 to 6 months	20	1 inch	½ inch
> 6 months	18 to 20	1 inch	½ inch

placement. To ensure proper depth of penetration, place the tube along the outside of the animal stretching from the mouth to the last rib, a point that would be inside the stomach, and put a mark on the tube. Use this as a guide when inserting the tube. Never rely on the goat coughing as a guide to proper tube placement. It is not a reliable test.

Bolus administration - "Balling"

A "balling gun" is used to administration tablets or boluses to an animal. A balling gun has a holder for the tablet in the end and a plunger to expel the tablet into the throat. Large boluses should be lubricated with vegetable or mineral oil for easier swallowing. Pass the balling gun over the hump of the tongue and press the plunger while holding and tilting the goat's head upwards. Ensure the tablet is swallowed by holding the mouth shut. Stroking the throat can also elicit a swallowing reflex.

Be very gentle in placing the balling gun into the mouth and expelling the pill. The tissues of the throat are very delicate and pills and guns have sharp edges. This can result in serious damage to your goat or minimally a goat with a very sore throat that will not eat. Newer model balling guns have soft plastic heads that reduce the potential for injury.

Paste administration

Dewormers, rumen pastes, and the like may come in a tube and are given through the use of an instrument resembling a caulking gun. Hold the animal as described for "balling," insert the end of the tube into the mouth and squeeze the handle the correct number of "clicks" to deliver an appropriate dose. Again, holding the goat's mouth shut will assist in swallowing.

Giving injections

Administering drugs via injection is a common herd health procedure routinely practiced by almost all producers. Following proper guidelines for each type of injection and using proper equipment will ensure that injections are done correctly and inflict minimum stress on an animal. Proper sanitation will ensure that you don't inject bacteria into your goat and cause an infection. Dirty needles and syringes should never be used. Using needles and syringes on multiple animals can transmit disease. After making six to ten injections with a needle it will be dull and should be changed and disposed of properly.

Needle selection

Proper injection technique includes selection of an appropriate size syringe and needle. Syringes should have volume markers that would ensure administration of the correct amount of drug. Needle gauge should be considered as it relates to injection type and thickness or viscosity of drug. In general, 18 to 20 gauge needles (as gauge number increases, needle diameter decreases) are sufficient.

Proper injection sites

Live animals are considered unprocessed food, especially if those goats are intended for slaughter and later used in the food chain. Injection site lesions should be a major product quality concern for goat producers raising goats for meat. Injection-site defects are lesions or scars found in cuts of meat that result from tissue irritation caused by the administration of intramuscular or sometimes subcutaneous injections. In addition to the scarred tissue, tenderness of the meat is also significantly reduced in the affected area surrounding the site. Proper injection sites are described for each type of injection described.

Common injection methods

The three most common injection methods are subcutaneous (SQ, under the skin), intramuscular (IM, in the muscle), and intravenous (IV, into a blood vessel, usually the jugular vein). Subcutaneous injections are the easiest to give and intravenous the most difficult. Whenever a drug or vaccine lists SQ as an option for injection use the SQ route. Only experienced personnel should attempt to give an intravenous injection and professional assistance should be used in most instances. Intravenous injections provide the fastest absorption of a drug by the animal while subcutaneous the slowest.

Subcutaneous injections

To inject subcutaneously, pull up a pinch of skin making a tent. Insert the needle into the tent taking care not to pierce through the other side. Depress the plunger slowly. Injecting with the needle pointing towards the ground will lessen the likelihood of the material leaking out of the hole left by the needle. Massage the injected area. If administering large amounts of a drug, over 3 milliliters (ml or cc), it is best to divide the dose among two or more sites not giving more than 2 or 3 cc per site. The preferred site for SQ injections is the skin just behind the elbow, although they can also be given in the triangular area in front of the shoulders between the top and bottom of the shoulder blade and corner of the jaw. Vaccines often cause swellings or "knots" and a knot behind the elbow indicates an injection site whereas a knot in the neck in front of the shoulder could possibly be confused with a caseous lymphadenitis abscess.

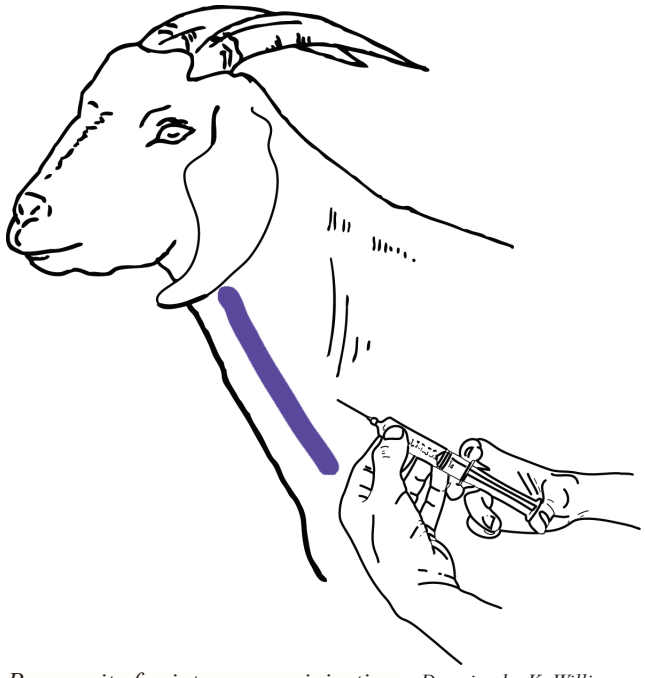
Intramuscular

An intramuscular injection calls for the needle to be inserted into a muscle. Intramuscular injections are commonly given in the triangular area of the neck, in front of the shoulder. Do not give intramuscular injections in the loin or hind leg of goats that are used for meat purposes to prevent injection site blemishes from occurring that lowers the value of the meat. Volume given in the muscle should not be more than 3 ml per site.

After inserting the needle, pull back on the plunger slightly to make sure a blood vessel has not been penetrated. Administer the drug slowly. If a blood vessel has been pierced, the needle can be withdrawn slightly, repositioned, and checked again. Never give an injection near the spine to prevent accidentally causing nerve damage.

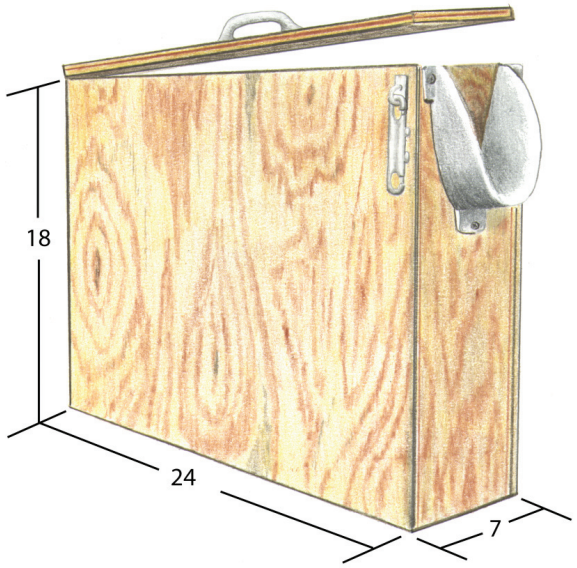
Intravenous

An intravenous injection requires skill to locate a vein, usually the jugular vein in the neck, insert the



Proper site for intravenous injection. *Drawing by K. Williams.*

needle, and ensure that the needle remains in the vessel while the drug is given. Prior to attempting this, it is best to receive training from a veterinarian. Animals may react quickly to drugs given in this fashion due to rapid absorption. Very few drugs need to be given intravenously; however, blood samples often need to be collected and the technique is the same. The easiest approach is to have someone straddle the goat to hold it securely. The holder will elevate the goat's head up and to the side. If you have clippers, clip all of the hair off the bottom third of the neck. Feel for the trachea on the neck and move towards the top of the neck. The area between the trachea and the muscles of the neck is the "jugular groove" and is where the jugular vein lies. Put pressure at the bottom of the groove and you will see the groove swell from your finger up to the jaw of the goat. The vein is now filled with blood. Using an 18 to 20 gauge needle, direct it at an angle of 45 degrees then stab through the skin. Pull back on your syringe and see if there is blood present. If not, adjust the depth (deeper or more shallow) or move up or down the side of the groove until blood is obtained.



Disbudding box (Dimensions in inches).
Drawing by K. Williams.

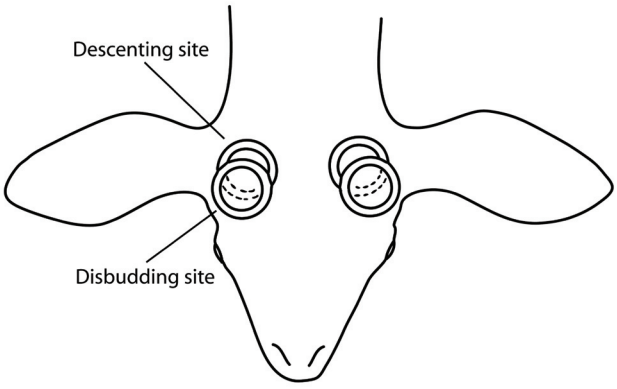
When you are injecting drugs IV, it is important to ensure that all of the drug enters the vein. Give the drug slowly. The jugular vein will take the administered drug straight to the heart and at high concentrations many drugs can cause problems with the heart. IV drugs given around the vein instead of in the vein can cause an irritation or inflammation of the vein.

Minor Surgical Procedures

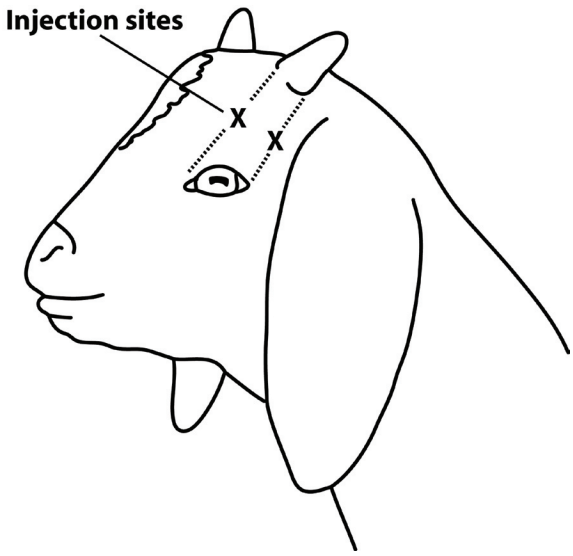
Castration

Males not wanted as replacement bucks should be castrated. Castration can be done by various mean as early as between 2 to 4 weeks of age. There are several methods of castration and the method selected will depend upon the age of the animal. The most common methods are elastrator band, Burdizzo® or other clamp, or surgical methods. General sanitation and vaccination precautions should be followed. Additional information on castration procedures can be found in the Meat Goat Management section.

Some producers may delay castration until bucks are 2 to 3 months of age. This may lessen the incidence of urinary calculi or bladder stones (see the Goat Diseases section) in animals on a high grain or concentrate diet. Also, remember that intact bucks have high levels of testosterone which acts as a growth promotant and stimulates the production of lean muscle mass. Many goat meat consumers that eat young goats do not care if the meat comes from intact or castrated males. There are some ethnic markets that actually prefer meat from mature bucks. Know the market in your area.



Proper placement of disbudding iron.
Drawing by K. Williams.



Injection sites for anesthetics for disbudding.
Drawing by K. Williams.

The point being that if it is not necessary to castrate goats for marketing purposes, then don't. However for breeding purposes realize that some bucks are fertile and ready to breed by 3 months of age and unwanted males should be castrated or separated from fertile females. In most climates photoperiod effects keep this from being a practical problem until kids are 9 to 12 months of age. In general, castration at an early age is the normal practice to reduce shock to the animal. Older animals should receive some type of anesthesia prior to castration and a veterinarian consulted.

Dehorning

Most meat goat producers will elect not to dehorn their goats. If the decision is made to raise goats without horns then kids should be disbudded in the first two weeks of life. Buck kid horns grow faster than doe horns. Some large single buck kids should be disbudded within the first week after birth. Disbudding a buck kid is the true test of proficiency of the person doing the dehorning and many fail, judging by the number of scurs seen on adult bucks. If you try to disbud a buck kid whose horn base is wider than a regular disbudding iron, you will get regrowth of the horn in a crown outside the burned area. If you try to disbud a small kid with a wide calf dehorner, you may get regrowth of the horn from the center of the ring. If one person is doing the job, a disbudding box offers the best and safest restraining device. Approximate dimensions are given the accompanying illustration.

The use of a local anesthetic is commonly advocated; however, the actual technique is not easy and the baby goat will scream while being held in preparation for a ring block or a cornual nerve block. One week old kids are small animals and cannot be given large doses of lidocaine or toxicity will result. A one week old kid should get no more then 1 cc total of lidocaine. One technique used is to dilute the lidocaine with distilled water allowing a larger volume to be injected into the locations shown below. Have a veterinarian administer the anesthetic or train you in the procedure.

Veterinarians typically use systemic anesthetics to anesthetize the goat for dehorning. The commonly used drugs are xylazine (Rompun) and ketamine (Vetalar). These can only be administered by a veterinarian.

The disbudding equipment most commonly used is an electric-heated metal rod with a hollowed-out end. Newer cordless, butane gas powered dehorners are available. Some disbudding irons have problems in maintaining a constant temperature, and it is extremely important to match temperature and time. Underburning of the horn bud will result in scurs while over-burning will lead to brain damage or death. The horn buds can generally be felt in young kids to ensure proper location to burn. After the disbudding iron is hot, apply it firmly over the horn area and rock it around slowly for 3.5 to 4 seconds. Remove the iron and repeat if necessary and do the other side. Evaluate the success of the procedure by its appearance. The goal is to have the area look like "chrome tanned leather." Black color represents burned hair and is indicative of inadequate burning. Clipping the site prior to burning will eliminate the problem of burned hair. Scent glands are located near the base of the horn and descenting could be done at the same time if desired. Inject the kids with 150 IU tetanus antitoxin. Although the risk of tetanus after disbudding is not great, it is a good practice to administer tetanus antitoxin.

An alternate disbudding method is the use of a caustic paste. The hair around the horn bud should be clipped and the paste applied. A ring of petroleum jelly around the horn bud may help prevent the paste from burning other skin tissue. Caustic paste sounds more benign than burning horn tissue; however, the paste has a bad habit of causing chemical burns on other parts of the goat or on his/her pen mates. To use caustic paste, make sure the kid is kept by itself so that it doesn't rub the chemical on the udder of its mother or the faces of its friends (not practical with most meat goat kids) and that it is kept out of the rain so that rain water doesn't wash the chemical into the goat's eyes.

Lancing abscesses

Goats get a variety of swellings or "knots" at various locations on their bodies. Some of these are cysts (fluid filled structures) and some of these are abscesses (puss filled structures). There is a disease of goats called caseous lymphadenitis (CL) that causes abscesses in the lymph nodes of goats. See the section on Meat Goat Herd Health - Common Diseases for more details.

One way of speeding the healing of an abscessed goat and of containing all of the infectious material from the abscesses is to lance it. This is usually a very simple and safe procedure. The first thing to do is be patient. Wait until the abscess comes to a "head." This is when the abscess is attached to the skin and the hair has begun to come off at the top of the abscess. The center of the abscess will soften. At this point, there are no vital blood vessels or other structures between the puss in the abscess and the outside of the goat.

Since pus is infectious to other animals and humans, wear gloves when performing this procedure. Remove any remaining hair from the region. Scrub the area with disinfectant soap (Betadine Scrub®) and restrain the goat. If this is done correctly it is not a painful procedure for the goat. Take a pinch of skin in the center of the abscess with your gloved hand or a surgical tool (such as a towel clamp) and stab a scalpel or sharp, sterilized knife blade deeply into the abscess and cut out a circle of skin. Just slashing the abscess may allow the cut to seal over before the abscess has healed from the inside out. There will be some white, or greenish white, odorless puss come out of hole created in the abscess. Catch it in a disposable bag and dispose of it where other goats can't get into it. Caseous lymphadenitis is a contagious disease. It is also a zoonotic disease, meaning it can be transmitted to humans, so wear gloves and sanitize your hands and equipment used after this procedure.

After lancing the abscess flush the area with diluted Betadine Solution® (10:1, 10 parts water to 1 part solution) to flush out any residual puss or bacteria. Make sure you keep the goat away from other goats until the lesion has completely healed.

Normal Range for Goat Physiological Parameters

Temperature, rectal	103–104° F (39–40° C)
Heart rate	70–90 beats per minute
Respiration	12–20 per minute
Rumen movements	1–2 per minute
Puberty	4–10 months
Estrous cycle	21 days
Estrus (standing heat)	12–48 hours
Gestation	150 days

Extra-Label Drug Use

There are few drugs for use in goats that have Food and Drug Administration (FDA) approval. Administering any drug not specifically labeled for use in goats or any product, either prescription or over the counter, that is not used as directed on the label is considered "Extra-label" or "off-label" drug use. Only veterinarians

may prescribe or use products “off-label” or “Extra-label” provided they have a valid veterinarian - client - patient relationship (VCPR) with the producer.

The issue of “extra label” use also applies to feed medications not approved for use in goats. While extra-label use of medications in or on animal feed is prohibited, in 2001 the FDA provided guidance on extra-label use of medicated feeds in minor species such as goats. In brief, extra-label use of medicated feed in minor species is limited to treatment of animals whose health is suffering or is threatened or whose death may result from failure to treat. If medicated feed is to be used in a food producing minor species, the product used must be approved for use in a food producing major species. The FDA discourages use of medicated feed in an extra-label manner for improving rates of weight gain, feed efficiency, or other production purposes.

Most goat producers are unaware that they do NOT have “extra-label” drug use privileges. Only veterinarians who have established a VCPR with a particular client may prescribe or use drugs in an extra-label manner on that client’s animals if the animal health is threatened and suffering or death may result from failure to treat. To establish a VCPR, the veterinarian should have visited the farm, and have a thorough knowledge of the management of these animals, or has recently seen the animal to be treated. Once a VCPR has been established, the veterinarian may use drugs in an extra-label manner provided that the client has agreed to follow his or her recommendations.

Three conditions of extra-label drug use:

1. The veterinarian has examined the animal(s) in question recently and has made a diagnosis and a determination that products with proper labeling will not work in this instance.
2. The client has been instructed by the veterinarian in the proper use and administration of the product, a withdrawal period has been determined, and the client is willing to follow the instructions given by the veterinarian.
3. The veterinarian is available to respond to any adverse reaction or follow up examination and treatment that may occur to the animal due to the administration of the drug or failure of the drug to work.

FDA criteria for Using Pharmaceuticals Extra-Label

The FDA has also established five criteria that must be met before any drug may be used in a food-producing animal in a manner different from that product’s label.

1. The veterinarian must first examine the animal and assumes responsibility for making clinical decisions regarding the health and treatment of the animal within the guidelines of a VCPR. Often a goat owner will not have the animal examined by a veterinarian, but will telephone a veterinarian, who may never have visited the farm, with a list of symptoms and ask for a recommended treatment. This does not qualify as VCPR!
2. The second criterion requires that the veterinarian determine there is no marketed drug specifically labeled to treat the diagnosed condition, or that the recommended dosage on the label for that product is clinically ineffective. Since there are few drugs labeled for use in goats, it is not difficult to determine whether or not there is a legally licensed product available.
3. The third criterion requires that the individual animals to be treated are clearly identified, and that accurate records be maintained regarding the treatment of those specific individuals. If there is no permanent identification such as an ear tag, notch, or tattoo, the owner must make some effort to identify the treated animals with a visible temporary mark by using temporary tags or paint. If possible, these animals should be isolated. Records on animals and treatment must be kept for future reference to avoid any drug residues in the meat or milk.
4. The fourth criterion requires that a significantly extended time period be assigned for drug withdrawal prior to marketing meat or milk from treated animals. The owner must keep accurate records of

the treatment, namely the person treating this animal, date, route of administration, product used and a proper withdrawal period. Proper withdrawal period can be obtained from your veterinarian. Veterinarians can access drug information at the Food Animal Residue Avoidance Databank, http://www.farad/org.

5. Many goat owners casually treat their animals and do not keep proper records of animals treated, drugs used, or proper withdrawal period for that product. If no information is available to establish a withdrawal time, then the treated animal or animal products such as milk and meat are permanently barred from the human food chain. This is to prevent illegal drug residues in products for human consumption. Although there are no drug residue test kits marketed specifically for goat meat, owners should be aware that drug residue testing is conducted on milk and meat produced for human consumption.
6. The last criterion details the information that must be listed on the drug dispensed for extra-label use. The label should include the name and address of the veterinarian, the established name of the drug(s), and the specific directions for use including: dosage, routes of administration, frequency of treatment, duration of therapy, cautionary statements, and the withdrawal time for any food that might be derived from the treated animal.

Ten Drug Use Tips

The following drug use tips can help ensure the proper administration of drugs and adherence to proper withdrawal times. All producers should restrict access to drugs to prevent indiscriminate or improper use. Remember that animal health products can be human health hazards.

1. Read the label carefully – labeling directions change frequently.
2. Use drugs only in animal species listed on the label or follow the "extra label" directions of a veterinarian.
3. Use the proper dose for the size of animal to be treated – overdosing can cause illegal residues.
4. Calculate pre-slaughter drug withdrawal times accurately – determine pre-slaughter withdrawal and milk discard times from the latest drug administration.
5. Use the correct route of administration – giving drugs incorrectly can lead to drug ineffectiveness, adverse reactions, illegal residues, and possible animal deaths.
6. Do not "double dose" – use of the same drug in the feed and by injection can cause illegal residues.
7. Select needle size and injection sites carefully, if injections are necessary – misuse can lead to tissue damage, reduced effectiveness, and/or illegal residues.
8. Allow proper withdrawal times for feed containing drugs – during the withdrawal time ensure that storage bins and feed are completely free of medicated feed and feed only drug-free feed or illegal residues may result.
9. Keep accurate records of drugs used and animals dosed – poor records can be costly if drug residue violations occur.
10. Seek the advice of your veterinarian – your records will allow him/her to provide safer and more effective treatment and save you money by preventing illegal residues.

For a complete explanation of all the precautions you need to take in using any particular drug or feed medication, first consult the drug label or feed tag. If you have any questions about the proper use of any drugs, see your veterinarian.

Medications Commonly Used in Goats and Approximate Withdrawal Times

Dr. Seyedmehdi Mobini, Georgia Small Ruminant Research & Extension Center, Fort Valley State University, Fort Valley, GA

The drugs listed in this table are commonly used in goats. There are only a few drugs approved by the FDA to be used in goats. ***Use of drugs listed as "extra-label" is legal only if prescribed by your veterinarian in the context of a valid client-patient relationship.*** The withdrawal times for various drugs were compiled from different sources. The listed dosages and withdrawal times, as well as drug status and legality of use, is subject to change. Your veterinarian will prescribe the latest, most up-to-date drugs, dosages, and provide the correct withdrawal period. ***Consult your veterinarian before beginning any treatment!***

I. Antibiotics:	Brand Name	Approval	Dosage	Route	Frequency	Withdrawal Time	
						Meat	Milk
Ceftiofur	Naxcel®	APPROVED	0.5-1 mg/lb	IM	Once a day	0 days	0 days
Neomycin	Biosol® and other products	APPROVED	5 mg/lb	PO	Twice a day	3 days	NA
Amoxicillin	Amoxi-inject®	extra-label	5 mg/lb	SQ	Once a day	26 days	120 hours
Ampicillin	Polyflex®	extra-label	5 mg/lb	SQ	Once a day	10 days	72 hours
Benzathine Pen G	Pen BP-48®	extra-label	20,000 IU/lb	SQ	Every 48 hours	30 days	NA
Erythromycin	Erythro-200®	extra-label	1 mg/lb	SQ	Once a day	5 days	96 hours
Florfenicol	Nuflor®	extra-label	9 mg/lb	IM	Every 48 hours	28 days	120 hours
Oxytetracycline	LA-200®	extra-label	9 mg/lb	SQ	Every 48 hours	29 days	144 hours
Procaine Pen. G	Crysticillin®	extra-label	10,000-20,000 IU/lb	SQ	Once a day	16-21 days	120 hours
Sulfadimethoxine	Albon®	extra-label	25 mg/lb Day 1, 12.5 mg/lb Days 2 - 5	PO	Once a day	12 days	5 days
		EXTRA-LABEL USE IS PROHIBITED IN LACTATING DAIRY COWS. DO NOT USE IN LACTATING DAIRY DOES.					
Tylosin	Tylan®-200	extra-label	10 mg/lb	IM	Once a day	30 days	96 hours
Chloramphenicol	Chloramphenicol	EXTRA-LABEL USE IS PROHIBITED					
Enrofloxacin	Baytril® 100	EXTRA-LABEL USE IS PROHIBITED					
Furacin, nitrofurantoin	Furox®	EXTRA-LABEL USE IS PROHIBITED					
Gentamicin	Gentocin®	DO NOT USE					
Tilmicosin	Micotil®	DO NOT USE – TOXIC TO GOATS					

II. Anti-inflammatory Drugs:	Brand Name	Approval	Dosage	Route	Frequency	Withdrawal Time	
						Meat	Milk
Aspirin	Aspirin	extra-label	100 mg/kg	PO	Once a day	1 day	24 hours
Flunixin meglumine	Banamine®	extra-label	1.1-2.2mg/kg	IV or IM	Once a day	10 days	72 hours
Phenylbutazone	Bute	extra-label	10-20 mg/kg	PO	Once a day	60 days	DNU
		DO NOT USE IN LACTATING ANIMALS					
Dipyrone	Dipyrone	EXTRA-LABEL USE IS PROHIBITED					

III. Prevention of Coccidiosis:	Brand Name	Approval	Dosage	Withdrawal Time	
				Meat	Milk
Decoquinate	Deccox®	APPROVED	13-91 gm/ton of feed	0 days	24 hours suggested minimum, DNU
Monensin	Rumensin®	APPROVED	15-20 gms/ton of feed	0 days	96 hours suggested minimum, DNU
Amprolium	Corid®	extra-label	25-50 mg/kg BW in feed or water	2 days	48 hours
Lasalocid	Bovatec®	extra-label	20-30 gms/ton of feed	0 days	24 hours

IV. Anthelmintics:	Brand Name	Approval	Dosage	Route	Withdrawal Time	
					Meat	Milk
1. Avermectins:						
Doramectin	Dectomax®	extra-label	0.3 mg/kg	SQ	56 days	40 days
Eprinomectin	Eprinex®	extra-label	0.5 mg/kg	PO	NA	NA
Ivermectin	Ivomec® Drench	extra-label	0.3 mg/kg	PO	14 days	9 days
Ivermectin	Ivomec® 1%	extra-label	0.3 mg/kg	SQ	56 days	50 days
Moxidectin	Quest®, Cydectin®	extra-label	0.5 mg/kg	PO	23 days	56 days
	Cydectin® drench	extra-label	0.3 mg/kg	PO	14 days	NA
	Cydectin® Injectable	extra-label	0.2 mg/kg	SQ	30 days	DNU

2. Benzimidazoles:						
Albendazole	Valbazen®	extra-label	10 mg/kg	PO	7 days	120 hours
Fenbendazole	Panacur®/ Safeguard®	APPROVED at 5 mg/ Kg, extra-label as recommended	10 mg/kg	PO	14 days	120 hours
Oxfendazole	Synanthic®	extra-label	10 mg/kg	PO	14 days	120 hours
3. Cholinergic Agonists:						
Morantel Tartrate	Rumatel®	APPROVED	10 mg/kg	PO	30 days	0 days
Levamisole	Levasole®	extra-label	8 mg/kg	PO	10 days	4 days

V. Anesthetics and Tranquilizers	**Brand Name**	**Approval**	**Dosage**	**Route**	**Withdrawal Time**	
					Meat	Milk
Ketamine	Ketaset®	extra-label	5-10 mg/kg	IV or IM	3 days	48 hours
Lidocaine	Lidocaine	extra-label	Variable for local anesthesia use, 1% in goats			
Thiamylal Na	Biotal	extra-label	10-20 mg/kg	IV	1 day	24 hours
Xylazine	Rompun®	extra-label	0.05-0.1 mg/kg	IV or IM	5 days	72 hours
Yohimbine	Yobin	extra-label	0.25 mg/kg	IV	7 days	72 hours

VI. Hormones:	**Brand Name**	**Approval**	**Dosage**	**Route**	**Withdrawal Time**	
					Meat	Milk
Cloprostenol	Estrumate®	extra-label	125 microgram	IM	0 days	0 days
Dexamethasone	Azium®	extra-label	20-25 mg	IM	14 days	4 days
Dinoprost	Lutalyse®	extra-label	5-10 mg	IM	1 day	24 hours
Oxytocin	Oxytocin	extra-label	10-20 IU	IM	0 days	0 days

VII. Electrolytes	**Brand Name**	**Approval**	**Dosage**	**Route**	**Withdrawal Time**	
					Meat	Milk
Calcium	Calcium borogluconate	extra-label	60 to 100 ml of 20 to 25% Solution	IV	0 days	0 days
Calcium	Calcuim gluconate	extra-label	50 to 100 ml 10 to 23% calcium ion solution	IV	0 days	0 days

NOTE: In the table above PO = oral administration; SQ = subcutaneous injection; IM = intramuscular injection; IV = intravenous injection.

DNU = insufficient data available to make WDI estimation, this drug is not approved for lactating goats.

Medications Commonly Used in Goats and Approximate Withdrawal Times

The following tables list medications commonly used in goats with their dosages and estimated withdrawal times (WDT). These tables are adapted with permission from the author Dr. Seyedmehdi Mobini of Fort Valley State University, Fort Valley, GA, from a paper that appeared in the proceedings of the Georgia Veterinary Medical Association Food Animal Conference in 2003. These recommendations were formulated by Dr. Mobini through a review of the literature in the United States and foreign countries, recommendations of the Food Animal Residue Avoidance Databank (FARAD), and personal experience. For many of the drugs mentioned, FARAD has calculated a Withdrawal Interval (WDI) to distinguish from the regulatory and approved WDT. The WDI is based on foreign drug approvals or extrapolations based on available tissue residue and/or related pharmacokinetic data on these drugs. In some cases, there is insufficient or no pharmacokinetic data from which FARAD can derive a WDI for goats. In those instances, FARAD has relied on sheep or cattle data and then added a scientifically-based time period to extend beyond the approved WDT to ensure safety as well as compliance with the Animal Medicinal Drug Use and Clarification Act of 1994 (AMDUCA).

Finally, the reader should be aware that there are several drugs which may be approved for specific species at a specific dose and route of administration, but are PROHIBITED FROM EXTRA-LABEL USE in any major or minor food animal species. These include Fluoroquinolones/Enrofloxacin (Baytril) and Phenylbutazone (Dairy). Other drugs are PROHIBITED FOR USE UNDER ANY CONDITION IN ANY ANIMAL THAT WILL BE USED FOR HUMAN FOOD. These drugs are: Dipyrone, Clenbuterol, Nitrofurazones, Nitrofurans (Furacin), Nitroimidazole (Metronidazole, Dimetridazole, Ipronidazole), Diethylstilbesterol, Glycopeptides (Vancomycin) and Chloramphenicol.

Herd Health at Different Production Stages

Goats have different health needs according to their stage of production. Providing for these health needs will increase your chances of having a healthy, productive herd.

Pre-breeding

Breeding does

Thirty to sixty days before the breeding season does should be examined for their udder and teat conformation, dentition (teeth), musculo-skeletal problems, and feet and body condition. Culling decisions should be made. Some common conditions seen in does include lameness, chronic mastitis, bad teats, and poor body condition due to a chronic disease, parasitism, old age, or other cause. Doelings should be at least 65 to 70% of their mature weight before their first breeding.

Prebreeding vaccination for *Chlamydia* should always be given. *Leptospirosis* and *Campylobacter* are less common causes of reproductive failure and abortion and vaccinations may be done, if the disease is present. Monitor fecal egg counts and deworm if needed. Does can be supplemented (flushed) with grain 2 to 4 weeks before breeding this will improve their fecundity (number of kids born per doe). Abrupt fence line exposure to bucks in the late transition period in the fall when does can begin to come into heat can help bring about cycling.

Breeding bucks

Bucks are too often neglected and omitted from herd health management practices. Some of the common conditions seen in bucks are urinary calculi (stones), lameness, urine scalding around the prepuce, and front leg injury due to a dominant buck in the pen. In the case of urinary scald, wash the affected area. Application of petroleum jelly can help protect the affected areas. Maintain a 2:1 ratio of dietary calcium to phosphorous

and provide a high level of salt (up to 4%) and 1 to 2% ammonium chloride in the diet to prevent urinary calculi. Bucks should be vaccinated at the same time as the does and for the same diseases. Body condition and breeding soundness should be evaluated at least 4 weeks before the breeding season and adjustments made to prevent bucks from becoming overly thin or obese. As breeding season approaches, extremely aggressive and dominant bucks may need to be penned separated to prevent injury. Monitor fecal egg counts in bucks or FAMACHA score and deworm as needed.

Breeding Season

Watch does and bucks carefully during the breeding season. This is a particularly strenuous time for bucks. Lame or sick bucks will not be able to breed adequate numbers of does. Fertility is drastically decreased by hot weather. Do everything you can to cool the buck off. This may include shade and fans during the day in very hot climates.

Gestation

Pre-parturition

A kid health and management program should actually begin prior to parturition with attention to the nutritional needs of the gestating doe in late lactation and during the dry period. An adequate diet for dry does is essential to produce healthy kids. Pregnant does should be fed to have a good body condition (score of 3.0 to 3.5 just prior to kidding). Does should be scored in early pregnancy and again six weeks prior to kidding. Remember that most fetal growth occurs in the last one-third of gestation and feed quantity and quality may need to be increased during this time. Clean, cool water and free choice trace-mineralized salt should be available.

Booster vaccinations for Clostridium perfringens C and D and tetanus toxoid should be given not less than 3 weeks prior to kidding. Vitamin E/selenium injections may be given during the dry period to prevent white muscle disease in kids, especially in areas where soils are selenium deficient and supplementation is inadequate. However, a nutrition program designed to provide adequate dietary selenium is preferable to providing injections. Provide other vaccinations or boosters for diseases causing abortion. Monitor fecal egg counts or FAMACHA score and deworm as needed.

Parturition (kidding)

While most meat goat does kid on pasture, there may be times when animals are brought indoors for kidding. The doe should kid in a clean environment; either a well-drained clean pasture or a stall bedded with straw or other absorbent material. The kid prior to birth has been existing in a germ-free environment and parturition represents exposure to common disease organisms to which the mature animal has developed resistance. The kidding stall or pasture should be located near a well-traveled area so that the doe can be frequently observed for kidding difficulties. Few adult does require assistance at the time of kidding though

Normal presentation.

Leg-back presentation.

Head-back presentation.

Drawings by K. Williams.

problems are always a possibility. First-freshening does should be closely watched, especially if bred to bucks known to sire large kids.

Signs of impending kidding include udder engorgement, swelling of the vulva, restlessness, and mucous discharge. The ligaments in the pelvic area will relax and the udder secretion's will change from clear honey-like to thick white milk (colostrum). The doe may also lose appetite. There are three stages of parturition. Stage 1 consists of uterine contraction and cervical dilation. This stage may last from three to six hours or more. The water bag ruptures at the end of this stage. Abdominal contractions will occur in Stage 2 and the fetus should be born within one hour. If the doe is having to provide undue straining or birth is delayed then examination and assistance may be needed; particularly if the doe is straining hard for 15 minutes or more. A veterinarian may need to be called. Stage 3 consists of expulsion of the placenta and usually occurs within a few hours after the last fetus is born.

Problems in parturition

Most does will kid with little to no assistance required; however, problems can occur. Many of these problems revolve around either incorrect presentation of the fetus or a kid that is to large for the mother's pelvis. In a normal birth presentation the forefeet will enter the birth canal first, the hooves will be pointed downwards, and the head will be between the legs. Another presentation that is sometimes seen that usually causes little problem is when the rear legs enter the birth canal first. In this case, the kid's hooves will be pointed upwards. Abnormal presentations include the rump first (breech) or any of the legs or the head bent backwards. In these cases, assistance is required.

When assisting birth, it is important to clean the area around the vulva with disinfectant soap and warm water and to have clean hands. Wear gloves. There are certain diseases that can be transmitted to humans during this time period. Pregnant women should not assist with the kidding process. Lubricate the hand prior to entering the vagina. Feel and identify the parts of the kid. Try to ensure that all body parts felt belong to the same kid and not to two separate bodies. If you feel only one leg or no legs at all, reach further and try to determine the exact position of the fetus. Arrange the legs and/or head gently in a proper position for birth. The fetus may have to be pushed forward towards the doe's head until a leg can be grasped and repositioned. Once the limbs are in a proper position, the kid should be gently pulled out and downwards using only your hands. Clear the mouth and nasal passages of the kid with straw or a towel and ensure it is breathing. Rubbing the body with a piece of cloth can sometimes stimulate breathing. Never pull on any presentation other than a normal presentation of two front legs and a head or a presentation of two hind legs and a tail. Pulling on any other arrangement of limbs and body parts will only make the problem worse.

If the anticipated kidding problems appear severe, call for a veterinarian immediately.

Kid management at birth

At birth two management practices are critical to the future health and survival of the newborn kid. The navel cord should be dipped in a solution of tincture of iodine (7% iodine solution) to prevent entry of disease-causing organisms through the navel cord and directly into the body of the kid. Make sure the entire cord is immersed in the iodine solution. If necessary, a long navel cord can be cut to 3 or 4 inches in length. Dipping the cord in iodine not only prevents entry of organisms but promotes rapid drying and the eventual breaking away of the cord from the navel.

Another critical practice is the feeding of colostrum as soon after birth as possible. The colostrum, or first milk, contains antibodies, which the doe does not pass to the fetal kid in the womb. Consumption of colostrum must occur as early as possible, ideally within 2-4 hours of birth. At 24 hours after birth there is a rapid reduction in the permeability of the intestinal wall to colostral antibodies. If a newborn kid does not or cannot nurse, the colostrum should be bottle-fed or the kid should be tube fed to insure adequate

consumption. Excess colostrum can be frozen for use in orphan or bonus kids. Recent research indicates that disease organisms, especially caprine arthritis encephalitis (CAE), may pass from doe to kid through milk and transmission might be avoided through the use of extra colostrum frozen from does tested and shown to be CAE-free or by feeding pasteurized colostrum. CAE is not considered to be a problem on most meat goat farms.

Kids should receive colostrum equal to 10% of their body weight during the first 24 hours of life. For example a six pound kid (96 ounces) should receive 10 ounces (roughly 300 ml) of colostrum within 24 hours of birth. This should be divided into at least 3 feedings. If fresh or frozen goat colostrum is not available, a commercial goat, sheep or cow colostrum replacement could be used. Fresh cow colostrum may also be used if necessary.

Under certain conditions newborn kids may benefit from injections of vitamins A and D approximately four days after birth. An iron dextran injection can be given but care is needed as iron is potentially toxic. A vitamin E/selenium injection may be beneficial in areas of selenium-deficient soils. These injections should be planned with your veterinarian as part of your herd health calendar. In general injection of vitamins and minerals is not necessary. If supplementation is necessary it is done more safely by dietary supplements. Realize that the fat soluble vitamins and minerals are toxic if given in excess.

Kids should be checked carefully at birth for any physical deformities or abnormalities. Pneumonia is a major killer of young kids. A clean, dry, draft-free environment is an excellent preventative measure.

Artificial raising of kids

Milk is the principal component of the diet of the pre-weaning kid. Most meat goat kids will nurse their dam until weaning. However, for orphaned kids or for kids of does that have lactation problems it may be necessary to use a milk replacer. Goat milk replacers are commercially available. If necessary, a lamb milk replacer may be used as a substitute for goat milk. Typical lamb milk replacers contain 22 to 24 % protein and 28 to 30% fat (on a dry matter basis). If no other milk replacer is available whole cows milk or calf milk replacers can be used. Maintaining milk replacer quality after mixing is particularly important when kids are fed ad libitum (all they can consume).

Milk can be fed by using bottles, pails, or self-feeder units. The method chosen will depend upon such factors as the size of the herd and available labor, as well as personnel preference. With any system, the health of the kid, sanitation, and available labor are the major factors to consider.

Under natural suckling, kids consume small amounts of milk at very frequent intervals. Ideally, artificial rearing should mimic natural suckling but the constraint of available labor precludes frequent feeding. Nevertheless, kids should be fed 4 to 5 times daily for the first and second week and 2 to 3 times daily thereafter. Bottle feeding is more labor intensive but kids receive more individual attention and are easier to handle post-weaning than kids that are allowed to suckle does. Pail or pan feeding may reduce labor somewhat but bodyweight loss and need for extra "training sessions" at the beginning must be expected.

Feeding schedule and amount for bottle fed kids.

Age	Amount of Fluid/Feeding	Feeding Schedule
1 to 3 days	4 ounces	5 times a day
3 days to 2 weeks	8 to 12 ounces	4 times a day
2 weeks to 3 months	16 ounces	3 times a day
3 months to 4 months	16 ounces	2 times a day

For larger herds, self-feeder units such as a "lamb bar" may successfully reduce labor. The key to use of the system is the maintenance of a low temperature of the milk (40°F) that will limit intake by the kid at any one time. Small, frequent feedings increase digestibility and decrease digestive disturbances. Rapid consumption of large quantities of milk may lead to fatal bloat due to entry of milk into the reticulo-rumen. Rapid passage of milk through the abomasum and small intestines can result in diarrhea or nutritional scours.

The biggest problem with kids bottle fed lamb milk replacer occurs with the feeding schedule. Frequently kids become "pets" and there is a tendency to feed them as much milk as they will consume each feeding. Unfortunately, this may result in bloat and sudden death due to enterotoxemia or diarrhea. A restricted feeding schedule and amount is necessary.

Dam raised kids

Most meat goat kids will be raised with their dams on pasture. While this removes the need for feeding milk replacer, these kids should not be forgotten in terms of nutritional and health needs. Producers must remember that since these kids are raised in the same environment as their dams, they are also exposed to the same health, disease, management, and grazing conditions. If internal parasites are a problem in the dams, expect the same in the kids and take management steps to reduce exposure to internal parasites through pasture rotation or other means. Crowding should be avoided and, if housed at any time, clean bedding and adequate ventilation are a must. Kids are naturally curious and will begin nibbling on items in their surroundings early in life. If there are toxic substances or plants, plastic, or other harmful materials lying about chances are some kids will eat them. If pasture is of very poor quality, kids beginning to nibble on grass or hay will not receive much nutritional benefit. This can slow down early growth.

Early access to a creep feed or creep pasture containing lush, nutritious forage will benefit kids becoming accustomed to solid feed, the development of their gastrointestinal tract, and in their early growth. Entry into the area containing creep feed or pasture should be restricted to kids by fencing or gates that prevent the entry of adult animals.

Weaning

In raising goat kids, increases in size and weight are not the only measure of success. A well-formed skeleton and proper development of internal organs are often neglected when the emphasis is on rapid gains. Dry feed consumption is important in developing body capacity. By increasing body capacity, feed intake and digestion increase.

In bottle fed kids over two weeks of age, limiting daily milk consumption to about 48 ounces will encourage daily consumption of dry feed. No later than three to four weeks of age a goat/lamb creep feed, other suitable creep feed, or even a calf starter should be offered. As the hay and grain consumption increases, gradually reduce the milk being fed. When the kid is eating ¼ pound of grain per day plus some hay and is drinking water from a bucket, it is time for weaning. Research has shown that at two months of age a weaned kid has a reticulo-ruminal capacity 5 times as large as suckling kids of the same age.

Kids on pasture should be consuming forages such as pasture grass or hay by two weeks of age and grain within four. Careful attention needs be given to formulation of a concentrate supplement for the pre-weaning kid. Palatability is of primary concern. Molasses at the rate of 10% of the total dry matter, corn (preferably chopped or rolled) and whole or rolled oats make up the energy "core" of a good pre-weaning diet. Balance the crude protein needs by adding cottonseed or soybean meal or another high protein source. Though few studies with kids have been done, crude protein contents of the pre-weaning ration should be within the range of 14-18%. Ground alfalfa may be added at 5% or less to provide additional stimulation for reticulo-ruminal development.

Several factors need to be considered when making the decision as to weaning. The most important consideration is whether or not the average daily consumption of concentrate and forage is adequate for growth and development to continue in the absence of milk. Fixed weaning ages are less desirable than weight goals such as 2.0 to 2.5 times birth weight.

Period	Time to Vaccinate	Disease	Booster
Kids	4 and 8 weeks of age.	C. perfringens C&D*. C. tetanus – toxoid.	Prebreeding.
	Between 8 and 12 weeks of age (single vaccination).	Contagious ecthyma.	If a problem in herd.
	8 and 12 weeks of age.	Caseous lymphadenitis.	If a problem in herd.
	16 weeks of age.	Rabies.	Given if there is a rabies concern. Yearly booster.
Prebreeding			
Doelings and bucklings	60 and 30 days prior to breeding.	Chlamydia. Campylobacter. Leptospirosis.	If a problem in herd.
Does and bucks	30 days prior to breeding.	Chlamydia. Campylobacter. Leptospirosis. C. perfringens C&D*. C. tetanus - toxoid.	If a problem in herd.
Gestation			
Does	30 days prior to kidding.	C. perfringens C&D*. C. tetanus - toxoid.	

-8-way clostridials like Covexin 8 could be used instead of C. perfringens C, D &T.

Vaccination Schedule for Meat Goats

Other disease preventive measures

Dam – 1 month prior to kidding

- CDT vaccine to help increase antibodies against enterotoxemia and tetanus in the colostrum. In areas deficient in Se and where supplementation is inadequate, BoSe® to raise selenium levels and prevent white muscle disease in kids and retained afterbirth in dam. Providing a proper mineral nutrition program to ensure adequate consumption of all minerals is preferable. Get local veterinary advice on selenium injections as the need and dosage level depend upon how much selenium is in the soil in the region, as well as on the dietary supplementation.

Kid – birth to first week

- BoSe® + vitamins A&D – use depends on soil in the region and the diet of the dam.

Kid – 3 weeks – begin coccidiosis prevention

- 4 and 8 weeks – CDT series.
- 4 to 8 weeks - BoSe® - repeat if in selenium deficient area.
- 6 to 8 weeks – begin monitoring for parasites and deworm as needed, especially if kid has access to outdoors.

Herd Health Calendar

A custom designed calendar is an excellent way to ensure the health of the herd is maintained. A calendar can be designed based upon your specific herd's production cycle. Consult with a veterinarian on the timing and need for vaccinations and other management procedures related to the health and well-being of your herd.

Planning Calendar for Meat Goat Herd Health

Stage	Suggested Health Practices	Additional Practices
Pre-breeding (30-60 days)	*Bucks* • Be aware of heat stress. • Breeding Soundness Evaluation done. • Vaccinate for Clostridium perfringens type C&D, plus Tetanus Toxoid. • Vaccinate for Chlamydia, Campylobacter and Leptospirosis, if necessary. • Trim feet. • Body Condition Score and adjust management accordingly. • Deworm based upon fecal egg counts or FAMACHA score. *Does* • Vaccinate for Chlamydia, Campylobacter, and Leptospira if necessary. • Vaccinate for Clostridium perfringens type C&D, plus Tetanus Toxoid. • Trim feet. • Body Condition Score and adjust management accordingly. • Deworm based upon fecal egg count or FAMACHA score at least two weeks before breeding. • Final cull of does based on production records, udders, feet, and type.	• Vitamin E and selenium given to does 30-45 days before breeding in selenium-deficient areas. • See Vaccination Schedule for Meat Goats • Put bucks next to doe pens. The "buck effect" will bring transitional does into heat.

Breeding	*Bucks* • Provide additional feed. • Be aware of heat stress, provide shade. *Does* • Observe for heat or use marking harness on bucks • If desired, check for pregnancy at 45-60 days with ultrasound.	• Make sure cats are not defecating in feed to prevent Toxoplasmosis. • Perform fecal egg count or check FAMACHA score and deworm if necessary. • Treat for flukes if a problem in the herd.
Pre-kidding (15-30 days)	*Does* • Booster Clostridium perfringens type C&D, plus Tetanus Toxoid. • Deworm based upon fecal egg counts or FAMACHA score. • Body Condition Score, adjust management accordingly • Watch for pregnancy toxemia.	• Perform fecal egg count or check FAMACHA score and deworm if necessary. • Begin to collect supplies for kidding.
Kidding	*Does* • Observe 3-5 times per day. • Assist if needed. *Kids* • Clip, dip, and strip: • Clip navel cord to 2-4”, • Dip navel in 7% iodine, • Strip small amount of milk to make sure teat ends are open.	

Nursing/Lactation	*Does* • Feed extra feed to does with multiple kids. *Kids* • Observe daily for signs of diarrhea or respiratory disease. • Vaccinate – Clostridium perfringens type C&D and Tetanus, revaccinate at four weeks after first injection. • Castrate males before three months of age. • Start creep feeding by two weeks of age.	• See Vaccination Schedule for Meat Goats
Weaning	• Weaning at three to five months or when marketed as young kids. • Check for internal parasites and deworm if needed.	• May want to use coccidiostat in creep feed and post-weaning feed.
Post-weaning/Drying	• About every four weeks, check for internal parasites and deworm as needed. • Reduce feed to does just before weaning. • May want to reduce water availability for a day or two after weaning.	

Goat Guideline for Anthelmintic Dosages (internal parasite dewormers) July 2006

Important --- Please read notes on the following page before using this chart

		Oral dosing. Note: 1 ml = 1 cc						Subcutaneous injection
		Valbazen Albendazole[1]	SafeGuard Fenbendazole[2]	Ivomec Ivermectin[3]	Levasole Levamisole[4]	Cydectin Pour-on Moxidectin[5]	Cydectin Drench Moxidectin[6]	Cydectin *Injectable* Moxidectin[7]
Animal Weight		20 mg/kg	10 mg/kg	0.4 mg/kg	12 mg/kg	0.5 mg/kg	0.3 mg/kg	0.2 mg/kg
lbs	kg	2 ml/ 25 lb	1.1 ml/ 25 lb	6 ml/ 25 lb	3 ml/ 25 lb	1.1 ml/25 lb	3.4 ml/25 lb	1 ml/ 110 lb
20	9.1	1.6	0.9	4.8	2.4	0.9	2.7	0.2
25	11.4	2.0	1.1	6.0	3.0	1.1	3.4	0.2
30	13.6	2.4	1.4	7.2	3.6	1.4	4.1	0.3
35	15.9	2.8	1.6	8.4	4.2	1.6	4.8	0.3
40	18.2	3.2	1.8	9.6	4.8	1.8	5.4	0.4
45	20.5	3.6	2.1	10.8	5.4	2.1	6.1	0.4
50	22.7	4.0	2.3	12.0	6.0	2.3	6.8	0.5
55	25.0	4.4	2.5	13.2	6.6	2.5	7.5	0.5
60	27.3	4.8	2.7	14.4	7.2	2.7	8.2	0.5
65	29.5	5.2	3.0	15.6	7.8	3.0	8.8	0.6
70	31.8	5.6	3.2	16.8	8.4	3.2	9.5	0.6
75	34.1	6.0	3.4	18.0	9.0	3.4	10.2	0.7
80	36.4	6.4	3.6	19.2	9.6	3.6	10.9	0.7
85	38.6	6.8	3.9	20.4	10.2	3.9	11.6	0.8
90	40.9	7.2	4.1	21.6	10.8	4.1	12.2	0.8
95	43.2	7.6	4.3	22.8	11.4	4.3	12.9	0.9
100	45.5	8.0	4.6	24.0	12.0	4.6	13.6	0.9
105	47.7	8.4	4.8	25.2	12.6	4.8	14.3	1.0
110	50.0	8.8	5.0	26.4	13.2	5.0	15.0	1.0
115	52.3	9.2	5.2	27.6	13.8	5.2	15.6	1.0
120	54.5	9.6	5.5	28.8	14.4	5.5	16.3	1.1
125	56.8	10.0	5.7	30.0	15.0	5.7	17.0	1.1
130	59.1	10.4	5.9	31.2	15.6	5.9	17.7	1.2
140	63.6	11.2	6.4	33.6	16.8	6.4	19.0	1.3
150	68.2	12.0	6.8	36.0	18.0	6.8	20.4	1.4

Footnotes:

1. **Valbazen** Suspension (11.36 % or 113.6 mg/ml): ***Do NOT use in pregnant does in the first trimester of pregnancy.*** Meat withdrawal time is 9 days and 7 days for milk (FARAD).
2. **Safe-Guard/ Panacur** Suspension (10% or 100 mg/ml): Approved in goats at 5 mg/kg with meat withdrawal time of 6 days and no withdrawal period for milk. Although the label dose in goats is 5 mg/kg, it is generally recognized that 10 mg/kg dosage is required for good efficacy. At 10 mg/kg dosage, meat withdrawal is 16 days and 4 days for milk (FARAD).
3. **Ivomec Sheep Drench** (0.08% or 0.8 mg/ml): Protect from light. Coughing may occur during and following drenching. Meat withdrawal time is 14 days (FARAD).
4. **Levasole Soluble Drench Powder (Sheep)**: Oral solution ONLY. To prepare use 1 packet (13 gm/11.7 gm active ingredient) dissolved in 262 ml [8.9 oz.] water (44.7 mg/ml) {or 52 gram packet dissolved in 1048 ml water [35.4 oz.].} NOTE: This is different dilution from the label directions for administration. Meat withdrawal time is 4 days (FARAD).
5. **Cydectin Pour-on for cattle** (0.5% or 5 mg/ml): Meat withdrawal time is 23 days. ***Not for use in lactating dairy goats.***
6. **Cydectin Drench for sheep** (.1% or 1 mg/ml): Meat withdrawal time is 14 days. ***Not for use in lactating dairy goats***.
7. **Cydectin Injectable for cattle** (1% or 10 mg/ml): GIVE SQ. Meat withdrawal time is 30 days. ***Not for use in lactating dairy goats.***

NOTE for Guideline for Anthelmintic Dosages in Goats

The attached chart was developed by Ray M. Kaplan, D.V.M., Ph.D. (University of Georgia) and modified by Patty Scharko D.V.M., M.P.H. (University of Kentucky) and Lionel Dawson D.V.M., M.S. (Oklahoma State University). It is provided as a possible guideline for anthelmintic (deworming) dosages for goats. Producers should consult their veterinarian for advice on their specific management situation for determining dosages for their herd. ***With the exception of fenbendazole administered at the 5 mg/kg dose, these drugs are not approved by the Food and Drug Administration (FDA) for use in goats, and when used in goats are considered extra-label use (fenbendazole at the recommended dose rate of 10 mg/kg is considered extra-label usage). The FDA regards extra-label use of drugs as an exclusive privilege of the veterinary profession and is only permitted when a bona fide veterinarian-client-patient relationship exists and an appropriate medical diagnosis has been made. The chart is intended to serve as guideline for improving accuracy when dosing goats with an anthelmintic, but these drugs should be used in goats only when appropriate veterinary advice has been received.***

Drug resistance in parasites of goats is extremely common. The effectiveness of an anthelmintic should always be tested before being used by performing a FECRT (Fecal Egg Count Reduction test) or larval development (DrenchRite) assay if available.

*** The current recommendation is to use the Cydectin cattle **injectable** formulation and **NOT** the **pour-on** formulation (orally) or the sheep oral drench. When administered by subcutaneous injection, moxidectin provides improved drug levels as compared to oral administration.*

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Goat Farm Budgeting

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Introduction

Investing in a farm is often an expensive undertaking and can be financially stressful. Land ownership in particular is costly. Historical rates of return to agricultural assets average 4 to 5% making it difficult to make principal and interest payments on land notes with farm income only. Hence, business planning is especially important in ranching operations even if the decision to produce goat meat is a lifestyle choice or hobby rather than strictly an economic one. An expensive hobby may create a serious financial drain on the producer's checking account.

The agricultural producer or farm manager is challenged when organizing and managing farm resources to maximize economic returns to owned or controlled resources. Resources include land (owned and rented) and associated improvements, capital (borrowed and owned), and labor (hired, farm operator, and additional family). The manager is responsible for combining available resources and knowledge to best achieve the desired goals and objectives of the farm business.

As a key component of a business plan, budgeting is a management tool that helps the beginning producer evaluate the feasibility of a proposed venture and helps established producers identify areas for improvement. Budgets identify financial resources needed for both farm investment and annual operating costs. With budgets, management can begin to answer such questions as:

- How may the available resources best be used?
- What enterprises (crops and/or livestock) can be produced and which will contribute most to returns to owned resources?
- How much of the controlled land should be devoted to each enterprise?
- What equipment and machinery will be needed to produce the potential enterprises?
- What production practices should be used to produce each of the enterprises?
- How much labor (both family and hired) will be needed on the farm?
- What are the capital requirements?

Budgets help ensure that investors make decisions based on realistic data, not just emotions. Knowledge of budgeting and the ability to use them will help make the right decision.

Enterprise Budgets

Questions may arise as to whether goats will help supplement farm income or if a larger operation is even technically feasible. In an enterprise with seasonal and cyclical price changes, sensitivity to variable grain and hay prices, and a vulnerability to drought, appropriate management practices and an identification of key cost components are important. Circumstances over which the producer has no control can wreak havoc in the short run if a producer neglects strategic planning and risk management.

An enterprise budget estimates the full economic costs and returns projected to accrue to an activity - raising livestock or producing grain - for some period, generally one year. Enterprise budgets incorporate information about the specific resources, management practices, and technology used in the production process. Budgets help provide a decision framework for assessing both short- and long-range economic analy-

ses of production agriculture. Budgeting allows producers to evaluate options before committing resources. Budgets can also be used to estimate potential income and the size of farm needed to earn a specified return or to compare the profitability of two or more systems of production. Budgets provide the documentation necessary to project cash flows and obtain/maintain credit-worthiness. Budgets can be used to estimate the amount of rent that can be paid for land or machinery.

A goat enterprise budget is a statement of what is generally expected from a set of particular production practices, listing the expected revenue and expenses incurred. It is designed to show profitability, not just cash flow. Profit is shown as residual earnings after resources utilized in the operation have been assigned a payment. The enterprise budget shown in Table 2.1 lists anticipated costs of operating inputs plus fixed costs (interest, depreciation, taxes, and insurance) on machinery, equipment, and livestock along with expected production per doe. Since the budget documents variable and fixed costs, it is useful in calculating profitability, break-even values, and the potential return on an investment.

An enterprise budget should contain several components. A detailed description should include a production goal, the production techniques to be employed, the land resource required, and even something about the capital and labor requirements. An enterprise budget should include all costs and all returns associated with the defined enterprise.

Production

Historically, a lack of a developed nationwide marketing system in the United States caused seasonal price fluctuations and wide variations by location. Goat meat is favored by a number of ethnic groups who have immigrated to this country and many producers have traditionally supplied goat meat to these populations on an individual basis. However, with goat meat demand steadily increasing and domestic producers raising more goats to meet this growing appetite, market outlets such as livestock sales auctions are becoming more common.

A sample budget considering a herd size of 50 does and two bucks is shown in Table 2.1. The kids are marketed at four months of age. The total quantity of production is multiplied by the actual or expected price to determine value of production. Gross or total receipts are the sum of production values for individual items. For example, the expected returns in the budget are averaged for reporting on a per doe basis. A herd technically does not market 30.5 male kids for sale. This is a statistical result of the averaging process for the herd. The averaging process yields a realistic estimate of the budget unit (doe) returns to the entire herd given the assumed kid crop percentage, death loss, and cull doe replacement rates.

Table 2.1 – Meat Goat Budget, 50 Head Unit, 180% Kid Crop, 10% Kid Death Loss, 20% Doe Replacement Rate, Central Oklahoma Native Pasture, Per Doe Basis.

	Weight	Unit	Price/Cwt	Quantity	Total	$/Head
PRODUCTION						
Male Kids	70.0	Lbs.	$99.23	40.50	$2,813	$56.26
Female Kids	70.0	Lbs.	$99.23	30.50	$2,119	$42.37
Cull Does	85.0	Lbs.	$55.00	7.00	$327	$6.55
Cull Replacement Doe Kids	70.0	Lbs.	$125.00	0.00	$0	$0
Cull Bucks	135.0	Lbs.	$80.98	0.00	$0	$0
Total Receipts					$5,259	$105.18
OPERATING INPUTS		**Unit**	**Price**	**Quantity**	**Total**	**$/Head**
Pasture		Head	$1.60	1	$80	$1.60
Hay		Head	$9.24	1	$462	$9.24
Grain		Head	$0.00	1	$0	$0.00
Protein Supplement		Head	$33.94	1	$1,697	$33.94
Salt/Minerals		Head	$2.37	1	$119	$2.37
Vet Services/Medicine		Head	$2.09	1	$105	$2.09
Vet Supplies		Head	$3.25	1	$163	$3.25
Marketing		Head	$8.50	1	$425	$8.50
Mach/Equip Fuel, Lube, Repairs		Head	$6.89	1	$345	$6.89
Machinery/Equipment Labor		Hours	$9.50	0.90	$428	$8.55
Other Labor		Hours	$9.50	2.00	$950	$19.00
Annual Operating Capital		Dollars	8.50%	50.16	$213	$4.26
Total Operating Costs					$4,985	$99.69
Returns Above Total Operating Costs					$274	$5.49
FIXED COSTS		**Unit**	**Rate**		**Total**	**$/Head**
Machinery/Equipment						
Interest at		Dollars	8.00%		$87	$1.74
Taxes at		Dollars	1.00%		$18	$0.36
Insurance		Dollars	0.60%		$7	$0.13
Depreciation		Dollars			$163	$3.25
Livestock						
Interest at		Dollars	8.00%		$393	$7.85
Taxes at		Dollars	1.00%		$69	$1.37
Insurance		Dollars	0.60%		$30	$0.59
Depreciation		Dollars			$78	$1.56
Land			$0			
Interest at		Dollars	0.00%		$0	$0
Taxes at		Dollars	0.00%		$0	$0
Total Fixed Costs					$843	$16.85
Total Costs (Operating +Fixed)					$5,827	$116.54
Returns Above all Specified Costs					$(568)	$(11.36)

Source: OSU Enterprise Budget Software.

Production Costs

Three general types of costs comprise the total cost of producing any type of farm commodity. They are variable (operating), fixed, and overhead expenses. Overhead expenses (also known as indirect costs) are difficult to allocate among individual enterprises. Examples include telephone, electricity and accounting services. Overhead expenses are included in whole-farm budgets, but are generally excluded in enterprise budgets.

Variable Costs

Variable costs are those operating inputs that vary as the level of production changes. They are items that will be used during one operation year or one production period. Examples include feed, fuel, vet medicine and supplies. They would not be purchased if production were not undertaken.

Variable costs may also be classified as cash or non-cash in nature. For instance, labor expenses are included in the operating input section of Table 2.1. No differentiation between owner supplied or hired labor is assumed. If the farm operator or a family member supplies labor, a wage rate or salary that represents earnings if employed elsewhere would be shown. This illustrates one of the most important concepts in economics – opportunity costs. Every resource used in the production process has one true cost, its opportunity cost. The opportunity cost of labor is the return the resource can earn when put to its best alternative. If the operator decides not to assign a charge to the labor item, residual earnings (as defined by Returns Above Total Operating Costs) includes labor income. The producer can then determine whether the return is adequate compensation for his/her labor efforts.

Fixed Costs

Fixed costs are not affected by short-term enterprise decisions and do not vary with the level of production. Generally, fixed costs are those ownership costs associated with buildings, machinery, and equipment that are pro-rated over a period of years. Fixed costs may also be cash or non-cash in nature. Real estate taxes, personal property taxes, and insurance on buildings are examples of cash fixed costs. Non-cash costs include depreciation and interest on capital investment.

The interest charge for capital assets such as machinery, equipment, and breeding livestock used in the goat operation is based on the average amount of capital invested over the ownership period, usage per year, and an interest rate. It is important to note that money invested in purchased capital assets has an opportunity cost as well – the return they can earn from their best alternative use. This interest on investment reflects a payment to a farmer's owned resources.

Depreciation represents an attempt to spread the investment costs or purchase price of durable assets over their productive lifetime. It is typically the largest cost associated with asset ownership. For example, when a tractor is worn out, it should have been completely "paid for" by depreciation. A producer must, in effect, save this much every year or reinvest it in machinery and equipment, or he/she will eventually end up with worn out items and no cash reserves to replace them.

Taxes vary by region but are generally a function of average value. In the goat budget, the annual charge for taxes is based on 1% of the purchase price.

Insurance policies are usually carried on more expensive machines while the farmer generally assumes the risk of loss on the simpler, less expensive assets. The insurance costs are based on the average amount of capital invested times an insurance rate.

Returns Above Total Operating Costs

The return to fixed costs, risk, and management (that is, the returns above total operating costs) is computed by subtracting total operating costs from total receipts. When returns above operating costs are positive, production is economically rational for an established enterprise. Positive returns above total operating costs indicate that the enterprise generates enough revenue to cover all variable costs and some portion of fixed costs. If returns above total operating costs are negative, the enterprise is not generating enough revenue to cover even variable costs. Unless the producer is willing to subsidize the operation (for instance, by contributing off-farm income), eliminating this enterprise will increase profits or decrease losses on the overall farm business. The return above total operating costs is also known as gross margin.

Returns Above All Specified Costs

In determining overall enterprise profitability, fixed costs also have to be part of the profit equation. The return above all specified costs is calculated by subtracting total variable and fixed costs from operating revenues. This amount represents residual earnings for management, risk, and to land (because land costs can have a large variation within a region, land costs are excluded). Each individual must decide whether this return is a sufficient reward for management skills, risk exposure, and to land devoted to the enterprise. It should be noted that since non-cash items may be included in fixed costs, operating profits are not the same as net cash or operating receipts as shown in a cash flow statement.

In Table 2.1, the return above total operating costs is positive. Having a positive return above operating costs indicates the operation is able to contribute to fixed costs associated with owning capital assets. In similar fashion, a positive return above all specified costs indicates that the operation is self-supporting and shows an amount available for reinvestment in the business or family living. When operating costs are covered, but the return above all costs is negative, insufficient income is generated to cover all fixed costs. Any loss may be a short-run problem, however.

Building on budgets to determine break-even prices or yields and view sensitivity analysis is helpful in evaluating the financial risk associated with an enterprise. The break-even price is the price at which all costs will be covered given average production; the break-even yield is the level of production needed to cover all costs given average market prices. Break-evens above variable costs and above all costs both provide useful information. With sensitivity analysis, income variability due to price and production risk is demonstrated, typically with tables of numbers showing returns under different price and yield scenarios. This information helps the managers assess their willingness to assume the risk of these variations.

One of the most important keys to successful goat operations is to be as cost effective as possible. As mentioned previously, one needs to periodically evaluate the contributions of all resources used in the operation. Look at possibilities for improving cost control through new technologies or cultural practices. Identify key leverage points that can generate the "most bang for the buck". Are there ways to reduce the number of trips to the feed store while still meeting nutritional requirements? Can you do a better job of taking care of the herd instead of regular visits from the veterinarian? Benchmark what other producers are doing. Spending dollars wisely given the appropriate management practice can generate major dividends that impact the bottom line. After all possibilities to improve the budget have been exhausted and long-run earnings still appear unsatisfactory, the best decision may be to exit the enterprise and employ resources in a different enterprise or investment.

OSU software is available to develop a customized budget for an individual operation (http://www.agecon.okstate.edu/budgets). The Microsoft Excel-based software provides users access to important agricultural references during an "interactive" budget building process. Through a series of links and pop-up menus, users may override defaults with their own values to customize the budget if their experience and

farm records indicate different values and production practices. Where possible, web-links are built into the spreadsheets to provide users important economic and agricultural science information on the Internet. Link examples include OSU Extension publications, Oklahoma Agricultural Statistics Service data, and Langston University goat information.

The software is designed to be flexible and user-friendly. After specifying a base livestock budget setting via a start-up form, the budget (as shown in Table 2.1) may be further customized by clicking on any budget item which links to a corresponding supporting sheet within the workbook. For example, to access and change the default kidding percentage for the herd, one may click on any of the production items linking to the Production sheet. The Production sheet summarizes herd information, kid retention and sales, culling and replacement practices, and herd buck information. Default values for kidding percentages, kid death losses, and average sale weight are based on information from the E. (Kika) de la Garza Institute for Goat Research at Langston University. Kidding percentages can then be tailored to match a particular operation on the screen.

Other Aids to the Process

Education

The producer needs to know what they are doing or raising goats will be a painful lesson in the pocketbook. You will need to have an eye for detail, be able to follow set procedures, and understand the risks involved. Use the best information available and include all decision makers in the business planning process. Talk to local growers and Extension personnel. Other sources of information are books/periodicals on meat goat production and industry, commodity organizations, and meat goat websites such as Langston University . The National Ag Risk Education Library provides risk management education on a variety of topics including goats. Focus on financial management as much as production performance. Realize that alternatives that appear profitable for one producer may not work for another. Everyone's experience levels, managerial abilities, and willingness to assume risk is different. Do your homework!

Financial Records

Records are the foundation for accurate budgets, financial statements, and tax reports. While tax reporting is the primary motivation for record keeping for many producers, research has shown positive returns to investments in record keeping and analysis in support of farm and ranch decisions. The sample budget previously discussed may be tailored to fit an individual producer's operation, but its reliability as a planning tool is only as good as the quality of the data.

Since budgets should be based on the best information possible, the producer's own records are a good place to start. A variety of tools are available to assist producers in keeping financial records. The record-keeping system that a farm manager should use depends on the cost - time, effort, and cash – in obtaining a system, maintaining it, and the value of the output as a decision tool. Farm record systems vary in the amount of information collected, the method of entering data, and the structure of final reports. Goat producers should choose the method appropriate to the size and complexity of their operation.

Computerized record-keeping systems are affordable and especially useful for manipulating data for different types of reports. Although a computerized system may not reduce the amount of time spent keeping records, computerized records make financial summaries simple, more efficient and effective for management needs. For instance, an annual or monthly cash flow statement based on actual income and expenses can be generated in a matter of seconds. Income and expenses can be sorted by enterprise so that farm managers know where "profit centers" are on the farm. Whole farm or enterprise budgets can be prepared and compared to actual transactions so that financial progress can be monitored at regular intervals. Graphs prepared with

a few keystrokes can show where cash is coming from and where it is going and are invaluable in getting a quick feel for the farm's financial situation.

A number of user-friendly commercial software products are now available that can be adapted for farm use. One such software program that is appropriate for farms and ranches requiring only cash records is Quicken®. Quicken® is user-friendly, widely available, and inexpensive. More information on using Quicken® for farm financial record keeping is available from the OSU Department of Agricultural Economics at http://www.agecon.okstate.edu/quicken/. Producers who need a payroll system plus the ability to invoice and maintain accounts payable and receivable may want to use QuickBooks®, which is a small business double-entry accounting system, or a comparable package. Cash flow features and investment tracking are lacking in QuickBooks.

Hand record books are available through the Oklahoma Cooperative Extension Service and from many lenders. The OSU Agricultural Economics website offers a book from which individual pages are available to be printed as needed: http://www.agecon.okstate.edu/farmbook/.

Oklahoma farmers and ranchers can call on the Intensive Financial and Management Planning Support (IFMAPS) program to receive free, confidential assistance in farm business planning, including analyzing the potential for a new farm business. Trained financial specialists work with families one-on-one to develop financial statements and evaluate alternative plans. The plans typically include budgets for the farm enterprise(s), a cash flow plan, income statement, balance sheet, debt worksheet, and financial measures. Contact your local agricultural Oklahoma Cooperative Extension Educator or call the IFMAPS Center at 1-800-522-3755.

Budget Limitations

Although "best estimates" should be used to develop budgets for use in farm business analysis, it is important to remember that projections are influenced by production and price uncertainty. Such variability creates risk to the operator and puts pressure on the reliability of the estimates used in the enterprise budgets. Everything doesn't proceed just like you planned it. Even under careful use, errors can compound themselves to the point where budgets can have little or no value. This element of risk should be considered and evaluated by the manager when determining the solutions that best meet the goals and objectives of the farm family. Successful farm managers adjust their numbers throughout the year at regular intervals by comparing actual outcomes versus planned. This internal evaluation will help identify existing or potential problems and will result in fewer unpleasant surprises.

Budget preparation is time consuming, but it can pay major dividends. It requires pencil and calculator activity as well as searching data sources for information to be used in preparing the budget. Software is also available to assist in budget calculations. Not only is it important to work hard, but also to work smart.

Conclusion

Budgets are management tools to help evaluate the farm business. Like a puzzle, each budget brings to the table an important piece that will help address how available resources best fit together on the farm. Specific questions such as how and what to produce, production levels, and achieving goals can be answered once the puzzle is completed.

Business management requires that producers focus on financial management as much as production performance. Successful managers discover that life is a whole lot easier saving money through budget planning. Goat producers interested in being profitable should expect to do no less.

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Meat Goat Nutrition

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Introduction

Proper nutrition is essential for the health and productivity of all animals and is the basis of successful production systems. A well planned and executed preventive health program cannot overcome problems that are created by poor nutrition. Nor can advanced reproductive technologies overcome nutritional limitations of reproduction. Therefore, nutrition of the goat is of paramount importance for successful goat production. Nutrition is the science of providing nutrients to animals in adequate amounts and in forms that the animals will consume. For sustainable and profitable production, these nutrients must also be provided in a cost-effective manner.

The ruminant stomach

Goats are ruminants, animals with a four-compartment stomach, as are cattle, sheep, and deer. The compartments are the reticulum, rumen, omasum, and abomasum (true stomach). Monogastric or simple-stomached animals such as humans, dogs, and cats consume food that undergoes acidic breakdown in the stomach and enzymatic digestion in the small intestine where most nutrients are absorbed. In ruminants, feed first undergoes microbial digestion in the reticulum and rumen (together often called the reticulo-rumen) prior to acidic digestion in the abomasum and enzymatic digestion and nutrient absorption in the small intestine. It is the microbial digestion in the reticulo-rumen that allows ruminants to consume and utilize grass, hay, leaves, browse, etc.

The reticulum and rumen form a large fermentation vat that contains microorganisms, mainly bacteria, that breakdown and digest feedstuffs, including the fibrous component of grass, forbs, and browse that cannot be digested by monogastric animals. Some of the breakdown products produced through digestion of feed by bacteria are absorbed by the animal through the rumen wall and can supply a large part of the energy needs. The rest of the byproducts of digestion, undigested feed, and ruminal microorganisms flow out of the reticulo-rumen into the omasum where large feed particles are trapped for further digestion and water is reabsorbed. Material then flows into the abomasum where acidic digestion takes place and then to the small intestine for further enzymatic digestion and nutrient absorption.

The rumen provides several advantages to the goat in addition to digestion of dietary fiber. The bacteria in the rumen are capable of synthesizing all B vitamins needed. Bacteria can also synthesize protein from nitrogen recycled in the body, which may be advantageous on low protein diets. For proper ruminal function, goats require a certain level of fiber (measured as crude fiber, acid detergent fiber, or neutral detergent fiber) in the diet. Goats have bacteria in the rumen that can detoxify antinutritional factors, such as tannins. This enables goats to better utilize feedstuffs containing high tannin levels such as those found in browse. There are very few situations in which a goat will not consume adequate fiber, but one is when a very high grain diet is being fed. Inadequate fiber consumption can then lead to several disease conditions. The most important disease condition is acidosis or an extremely low pH in the rumen, causing decreased feed consumption.

When ruminants are born, the first three compartments of the stomach are underdeveloped and the stomach functions similar to that of a monogastric animal. This enables absorption of antibodies in colostrum and efficient utilization of nutrients in milk. As the young ruminant consumes solid feed, especially high in

fiber, and the microbial population is established, the rumen is stimulated to develop. The rumen must have an acceptable degree of development for successful weaning.

The greatest asset of goats is the ability and tendency to utilize woody plants and weeds, not typically consumed by other species of animals (e.g., cattle and sheep), converting them into a saleable product. Therefore, these plant species can be inexpensive sources of nutrients and make for a very profitable goat enterprise. Goats typically consume a number of different plant species in any one day and can utilize some poisonous plants because they do not consume enough to be toxic. Similarly, goats are believed to have a relatively high ability to detoxify absorbed anti-nutritional factors. Goats are more resistant to bloating than other ruminants, and after a brief adaptation may graze alfalfa without bloating.

Nutrients

Nutrients are defined as substances that aid in the support of life. The six classes of nutrients include protein, carbohydrate, fat, vitamins, minerals, and water. Nutrients are often classified as organic (carbon-containing) or inorganic (minerals).

Energy is not considered a nutrient, but can be derived from the breakdown of several nutrients including fat, protein, and both simple and complex carbohydrates. Energy is required to propel the biochemical processes that are necessary to sustain life. A deficiency of energy will cause weight loss, low productivity, and ultimate death of an animal. An oversupply of energy will usually result in excessive fatness, which is also unhealthy. A simple unit of measurement of energy is pounds of total digestible nutrients (TDN). A lb of TDN, equivalent to a pound of digested carbohydrate, equals 2,000 Kilocalories (or Calories as used in human nutrition) of digestible energy. There are a number of other measures of energy used, but they are less easily understood.

Water

Water is an essential nutrient for all animals and is sometimes overlooked. While goats require less water than cattle, they do need water and require additional quantities when lactating or coping with hot weather. A 110 lb goat will require 1 to 3 gallons of water per day depending upon diet, intake, and weather, toward the lower range in winter and toward the upper range in the hottest days of summer. A lactating goat will require an additional 1 quart of water for every 1 pint of milk produced. If a goat is producing 5 pints of milk at peak lactation while raising twins, 2.5 gallons of water are required each day. If goats are eating green material, a substantial part of their water requirement can be met by water contained in the plant material. However, if dry feed such as hay is consumed, water must be supplied to meet the requirement.

Water should be kept clean to encourage intake. This usually involves regular cleaning of the waterer. It is important that the area around the waterer not be muddy, as this is a good environment to spread foot rot and internal parasites. Placing some rock or gravel around the waterer can help keep feet dry and reduce disease problems. Water cleanliness is especially important for bucks on high grain diets. Their water needs to be shaded in summer and warm in the winter to encourage intake and reduce the risk of urinary calculi.

Carbohydrates

Carbohydrates usually provide the majority of energy to goats. Carbohydrates can be classified as simple, such as sugars (easily identified by their sweet taste; maybe 1, 2, or 3 sugar molecules linked together), or complex, such as starch (found in grains) or cellulose (i.e., fiber). Grass, forb, and browse plant species generally contain high levels of cellulose, which must be digested by rumen bacteria to provide energy.

Cellulose is often referred to as fiber, although the term fiber also pertains to other substances such as hemicellulose and lignin. Fiber in young plants may be highly digestible and provide a high level of energy, but fiber in older, mature plants is often poorly digested and may only provide half the energy of other

carbohydrates. Fiber in the diet may be characterized chemically in several ways, such as crude fiber (CF), acid detergent fiber (ADF), and neutral detergent fiber (NDF). These abbreviations are used in hay analysis and may appear on feed tags. In general, the lower the fiber level, the higher the level of digestible energy. However, a certain minimum fiber level is required for healthy rumen function.

Goats do not adapt as easily to high concentrate diets as cattle and sheep and are more likely to get acidosis, founder, urinary calculi, and enterotoxemia. To avoid these problems, very gradually increase the concentrate level in the diet when placing goats on high concentrate diets and maintain a minimum of 12% crude fiber in the diet or about half of the diet as grass, browse, or hay. Goats are typically not feed efficient, except for some rapidly growing Boer goats, and may require 7 lbs or more of feed per pound of gain. Also, one must be very alert for health problems with goats on high grain diets.

Fats

Fats, also called lipids, are very high in energy, providing more than twice the energy of carbohydrate on a weight basis. The fat content of ruminant diets is generally low, as plants have a low fat content. Plant waxes are fats that goats consume as they graze and browse, but they are not digested. Fat may be added to diets to increase the energy content. However, high levels of added fat depress fiber digestion unless treated to be inactive in the rumen. These fat sources are termed "bypass" and may be used in dairy goat diets but are generally not used in meat goat diets.

Protein

Protein is composed of building blocks called amino acids that the body uses to produce all of the different proteins required for growth, production, and maintenance. Protein is required in the diet for accumulation of new body mass (growth) and for replacing protein lost by normal wear and tear.

Ruminant animals are usually fed supplemental protein to make up for dietary shortfalls. In the rumen, bacteria degrade much of the consumed protein and use the amino acids to form bacterial protein. Bacteria can also form protein from nonprotein sources such as urea and, if provided with sufficient energy, can form significant quantities of protein. To prevent breakdown and digestion by ruminal bacteria, some protein sources are protected from degradation by coating or other means. Some natural proteins are also resistant to ruminal degradation by bacteria. These types of proteins are referred to as "bypass protein" as they bypass digestion in the rumen. Other common terms for bypass protein are "ruminal escape" and "rumen undegraded." Bypass protein sources are very important in dairy cow nutrition, but have lesser significance in most meat goat production systems.

Urea is the main nonprotein nitrogen source fed to ruminants. However, goats are not fed urea as frequently as cattle. This may be because goats are more subject to urea toxicity than cattle. Goats appear more efficient than other species at recycling nitrogen in the body to the rumen where it can be used to form microbial protein, given that sufficient energy is available. This recycling of urea to the rumen helps to reduce the amount of protein required in the diet. When animals are consuming a low quality forage, a grain supplement may also improve protein status by providing additional energy for protein synthesis by ruminal microbes.

Vitamins

Vitamins function as critical chemicals in the body's metabolic machinery and function as co-factors in many metabolic processes. A deficiency of a vitamin will slow or block the metabolic process in which that vitamin is involved, resulting in deficiency symptoms. Vitamins are divided into those that are fat soluble (i.e., A, D, E, and K) and those that are water soluble (i.e., B vitamins and C).

The bacteria in the rumen of the goat can synthesize adequate amounts of the water soluble vitamins. Thiamine, or vitamin B1, may become deficient under some conditions (e.g., feeding a high concentrate diet, especially those with high sulfur which may come from a high level of molasses) and cause the disease

polioencephalomalacia. Another situation that could lead to thiamine deficiency is improper feeding of the coccidiostat Corid®. The coccidiostat ties up thiamine, making the coccidia unable to reproduce. Feeding Corid® longer or at higher levels than recommended could lead to polioencephalomalacia. Polioencephalomalacia is a nervous disorder where the animal becomes blind, depressed, presses with his head, and the pupil slit in the eyes becomes up and down rather than the normal side to side profile. Treatment requires immediate injection of large quantities of thiamine.

Fat soluble vitamins must be supplied to the goat because the body cannot directly make them. The recommended levels of vitamins in formulated feed is 5,000 IU (international units, a measure of the potency of vitamins) of vitamin A per lb, 2,000 IU/lb of vitamin D, and 80 IU/lb of Vitamin E. The liver can store significant amounts of the fat soluble vitamins.

Vitamin A can be synthesized from carotene, the pigment that gives grass and hay their green color. As long as sufficient green feed is consumed, vitamin A intake will be adequate. Vitamin A is necessary for normal epithelium (skin) development and vision. A deficiency of vitamin A causes many symptoms, including tearing of the eyes, diarrhea, susceptibility to respiratory infection, and reproduction problems. Vitamin A is often supplied to animals not consuming green forage such as in winter months. Many mineral and vitamin supplements contain vitamin A.

Vitamin D is called the sunshine vitamin because animals can synthesize the vitamin with the help of the sun. Ultraviolet light in sunshine converts pre-vitamin D found in the skin to a pro-vitamin D form that is used by the animals. Usually, even limited sunlight exposure is adequate to provide a day's supply of vitamin D. Sun-cured hay contains Vitamin D. Vitamin D is necessary for calcium absorption and metabolism by the body. A deficiency of vitamin D, called rickets, results in lameness, weak bones, and bowed and crooked legs. The liver is the main Vitamin D storage site in the body. Vitamin D is normally present in mineral supplements and often added to complete feeds.

Vitamin E functions as an antioxidant in conjunction with the mineral selenium. The requirements for one can be partially met by the other. Thus, vitamin E is very important in areas with marginal or deficient levels of selenium. A common vitamin E deficiency disease, particularly in newborn or young animals, is white muscle disease, where white spots are seen in the heart and skeletal muscle due to oxidation damage. A marginal deficiency of vitamin E can depress the immune system and cause reproductive failure. Green grass and green sun-cured hay have high levels of vitamin E. Most mineral supplements and complete feeds contain vitamin E, especially in areas that are deficient in selenium. Vitamin E is expensive and minimal supplemental levels are used in contrast to vitamins A and D that are less expensive and often included at generous levels.

Vitamin K is technically required by animals and functions in the clotting of blood. Vitamin K is produced by bacteria in the digestive tract and absorbed. Generally, goats do not need to be supplemented with vitamin K.

Minerals

The inorganic nutrients are called minerals. Minerals are further subdivided into macrominerals, those required at 0.1% or more in the diet (macro means large), and microminerals, those required at the part per million (ppm) level (micro means small). A ppm is the weight of a paperclip in a thousand pounds of feed. A hundred ppm is equal to 1.6 ounces in a thousand pounds of feed. Macrominerals include calcium, phosphorus, sodium, potassium, chloride, sulfur, and magnesium. Microminerals include iron, copper, cobalt, manganese, zinc, iodine, selenium, molybdenum, and others. Minerals function in many ways in the body. Some such as calcium and phosphorus are major structural components of bones and teeth, as well as having other functions. Other minerals facilitate nerve functioning or fulfill a role as electrolytes. The mineral requirements

for goats are not as well known as they are for other livestock species and have often been extrapolated from sheep or cattle requirements due to a lack of studies in goats. As such, mineral recommendations for goats often have a wide range because of lack of accurate goat-specific information.

Macrominerals

The macrominerals are listed below, followed by the abbreviation, normal dietary range, function, deficiency symptoms, and major dietary sources.

Calcium (Ca) 0.3 - 0.8%

The major biological function of calcium is for bones. Bones contain 99% of the calcium in body. Calcium is also necessary for muscle contraction, nerve conduction, and blood clotting. The main deficiency symptoms are seen in the skeletal system. Bones can become soft and weak and may be deformed resulting in lameness. This condition is called rickets or osteomalacia. Vitamin D deficiency causes similar symptoms due to the role of vitamin D in the absorption and metabolism of calcium. Calcium is relatively high in milk and lactating goats need adequate levels of calcium for milk production. Does can get hypocalcemia (milk fever) while lactating due to a metabolic disorder which results in a shortage of calcium in the blood due to calcium being used for milk production. Urinary calculi is a condition brought about in part by an imbalance in the calcium to phosphorus ratio in the diet. Generally, twice as much calcium as phosphorus should be in the diet of ruminant animals. An excess of calcium can cause abnormal bone growth. Major common dietary sources of calcium include limestone and dicalcium phosphate.

Phosphorus (P) 0.25 - 0.4%

Approximately 80% of the body's phosphorus is found in bones, with the remainder in the blood and other tissues. In addition to skeletal structural functions, phosphorus is essential in energy metabolism, acid-base balance, and is a constituent of enzymes and genetic material. The major symptoms of phosphorus deficiency include reduced growth, listlessness, unkempt appearance, depressed fertility, pica (depraved appetite-eating wood, rocks and bones), and decreased serum phosphorus. Phosphorus is the most commonly encountered mineral deficiency and also the most expensive macromineral. Sources of phosphorus include protein supplements, cereal byproducts, mineral supplements, and dicalcium phosphate.

Sodium (Na) 0.2%
Potassium (K) 0.8 - 2.0%
Chloride (Cl) 0.2%

All three of these minerals function as electrolytes in the body. Electrolytes are mineral ions, carrying a positive or negative charge that the body uses for osmotic balance, pH balance, and water movement. They are also essential in transmission of nerve impulses. These minerals are highly water soluble and are easily lost with diarrhea. Electrolyte solutions used to treat animals with diarrhea contain all three of these minerals. A deficiency of potassium could occur on high concentrate diets, with symptoms including poor appetite, urinary calculi, body stiffness progressing from front to rear, and pica (depraved appetite as described above). A deficiency of chloride depresses growth. A deficiency of sodium causes reduced growth and feed efficiency. Salt provides both sodium and chloride. Most forages have adequate levels of potassium.

Sulfur (S) 0.2 - 0.32%

The major biological function of sulfur is as a component of sulfur-containing amino acids. Therefore, sulfur is important in protein synthesis, milk and hair production, enzymes, hormones, hemoglobin, and connective tissue, and is a component of the vitamins biotin and thiamine. The major deficiency symptoms include poor animal performance, hair loss, excessive salivation, tearing of eyes, and weakness. Major source of sulfur is protein which contains sulfur as a component of some of the amino acids. Therefore, sulfur is important in diets where nonprotein nitrogen (e.g., urea) is used to substitute for some protein. Sulfur-containing mineral

blocks are often used for control of external parasites in goats. Excessive sulfur in high concentrate diets can contribute to polioencephalomalacia as discussed for the water soluble vitamin thiamine.

Magnesium (Mg) 0.18 - 0.4%

Magnesium is found in bones (60 to 70% of that in the body), liver, muscle, and blood. It is required for normal skeletal development, and nervous and muscular system functions, as well as for enzyme systems. It is also closely associated with metabolism of calcium and phosphorus. In ruminants, a major magnesium deficiency disease is grass tetany, often seen on fast-growing, lush, cool season pastures. Affected animals have low blood magnesium levels, exhibit a loss of appetite, are excitable, stagger, have convulsions, and may die. High fertilization rates, cool temperatures, and high levels of plant potassium and(or) rumen ammonia may contribute to the disease. A major supplemental source of magnesium is magnesium oxide. It is often supplemented on winter wheat pasture and mixed with a protein source to encourage consumption.

Micro or trace elements

The first level after the mineral name is what is thought to be the minimum requirement in the diet, while the second is the value above which the element can become toxic. Most supplemental trace minerals are provided by trace mineralized salt or mineral mixes that are designed to provide 25 to 50% of requirements. This is adequate if the animal's diet is marginal in a mineral but inadequate if that mineral is severely deficient. Unless a documented deficiency exists, it is best not to provide 100% of a trace mineral, because an excess of one mineral may depress the absorption of another creating a deficiency. Excess supplementation of some minerals can cause toxicity problems, especially with copper and selenium.

Iron (Fe) 50 - 1000 ppm

The major function of iron is as a component of hemoglobin, required for oxygen transport. It is also a component of certain enzymes. The major iron deficiency symptom is anemia. Anemia can also be caused by blood loss due to several factors, including injury, internal parasites (barberpole worm or liver fluke), and a bad case of external parasites such as lice. Iron is stored in the liver, spleen, and bone marrow. Milk is very low in iron; therefore, kids raised for a long time on milk alone will develop anemia. Soil contamination on forages can provide significant levels of dietary iron. Iron sulfate is a common means of adding iron to the diet. Forages in some areas have excessively high levels of iron that suppress utilization of other trace minerals.

Copper (Cu) 10 - 80 ppm

Copper is essential in formation of red blood cells, hair pigmentation, connective tissue, and enzymes. It is also important in normal immune system function and nerve conduction. Deficiency symptoms include anemia, "bleached" looking (lighter color) and rough hair coat, diarrhea, and weight loss. Young goats may experience progressive incoordination and paralysis, especially in the rear legs. High dietary molybdenum can depress absorption of copper and cause a deficiency. There should be at least four times as much copper as molybdenum in the diet.

Sheep (both hair and wool types) are sensitive to copper toxicity, whereas goats require copper levels similar to beef cattle. Angora goats may be more sensitive to copper toxicity than meat and dairy goats. There are differences in copper requirements for several sheep breeds, and this could be true for meat goats, but no data are available. Although most of the United States has adequate copper levels (Figure 7), many areas have high levels of molybdenum (Figure 6) due to soil geology and, therefore, require copper supplementation. The liver stores copper, which can protect against toxicity in the short term. However, when liver capacity is exceeded, animals can die rapidly from a hemolytic crises caused by stress, such as being chased.

Cobalt (Co) 0.1 - 10 ppm

The only well accepted biological function of cobalt is as a component of vitamin B12. Rumen microbes utilize cobalt for growth and produce vitamin B12. Cobalt deficiency symptoms include loss of appetite, anemia, decreased production, and weakness. Most natural feedstuffs contain adequate levels of cobalt. There are cobalt-deficient areas in the United States (Figure 1).

Zinc (Zn) 40 - 500 ppm

Zinc is found in all animal tissue and is required by the immune system and for normal skin growth. Zinc is also essential for male reproduction. Deficiency symptoms include dermatitis (thick, dry patches of skin), hair loss, skin lesions, swollen feet, and poor hair growth. The bran and germ of cereals contain high levels of zinc.

Manganese (Mn) 40 - 1000 ppm

Manganese is important for bone formation, reproduction, and enzyme functioning. Deficiency symptoms include a reluctance to walk, deformity of forelegs, delayed onset of estrus, poor conception rate, and low birth weight. It is unusual to have a manganese deficiency.

Selenium (Se) 0.1 - 20 ppm

Selenium functions with vitamin E as an antioxidant, protecting cell membranes from oxidation. Selenium also affects reproduction, metabolism of copper, cadmium, mercury, sulfur, and vitamin E. Deficiency symptoms include poor growth rate, kids being unable to suckle, white muscle disease (cardiac and skeletal muscles have white spots), sudden death by heart attack, progressive paralysis, and retained afterbirth. Selenium is deficient in many areas because of low soil levels (geological factors; Figure 8); however, there are a few regions of high selenium soils leading to high to toxic levels in plants. Toxic levels of selenium cause shedding of hair, diarrhea, and lameness. Most plants that are not grown in selenium deficient soils will have adequate selenium levels. It is more effective to provide selenium supplementation through feed than by injection.

Molybdenum (Mo) 0.1 - 3 ppm

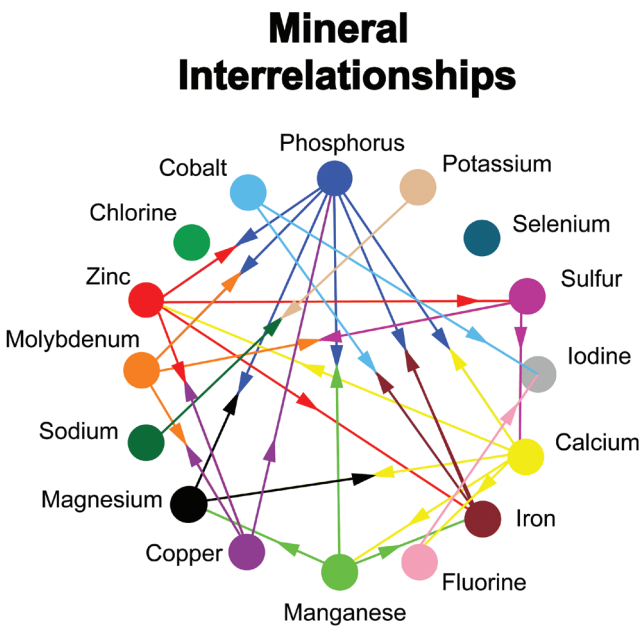
Molybdenum deficiencies are very rare. Toxicity occurs above 3 ppm due to reduced copper absorption, resulting in a copper deficiency. The copper level must be four times the molybdenum level to overcome this effect. High dietary levels of molybdenum are usually related to soil content. Molybdenum (as ammonium tetrathiomolybdate) is often used to treat copper toxicity in animals (Figure 6).

Iodine (I) 0.5 - 50 ppm

The only proven biological function of iodine is as a component of thyroid hormones that regulate energy metabolism and reproductive function. The major iodine deficiency symptom is goiter - a swelled or enlarged thyroid gland in the neck. This should not be confused with the thymus gland in the neck on young animals (the thymus gland is especially pronounced in Nubian kids, but shrinks after several months of age). Also, iodine deficiency causes reduced growth and milk yield, pregnancy toxemia, and reproductive problems such as late term abortion, hairless fetus, retained placenta, and weak kids. Most of the southern U.S. has adequate iodine in the soil and most minerals and trace mineralized salts contain iodine. A number of areas in the northern U.S. are deficient in iodine due to soil geology.

Mineral nutrition considerations

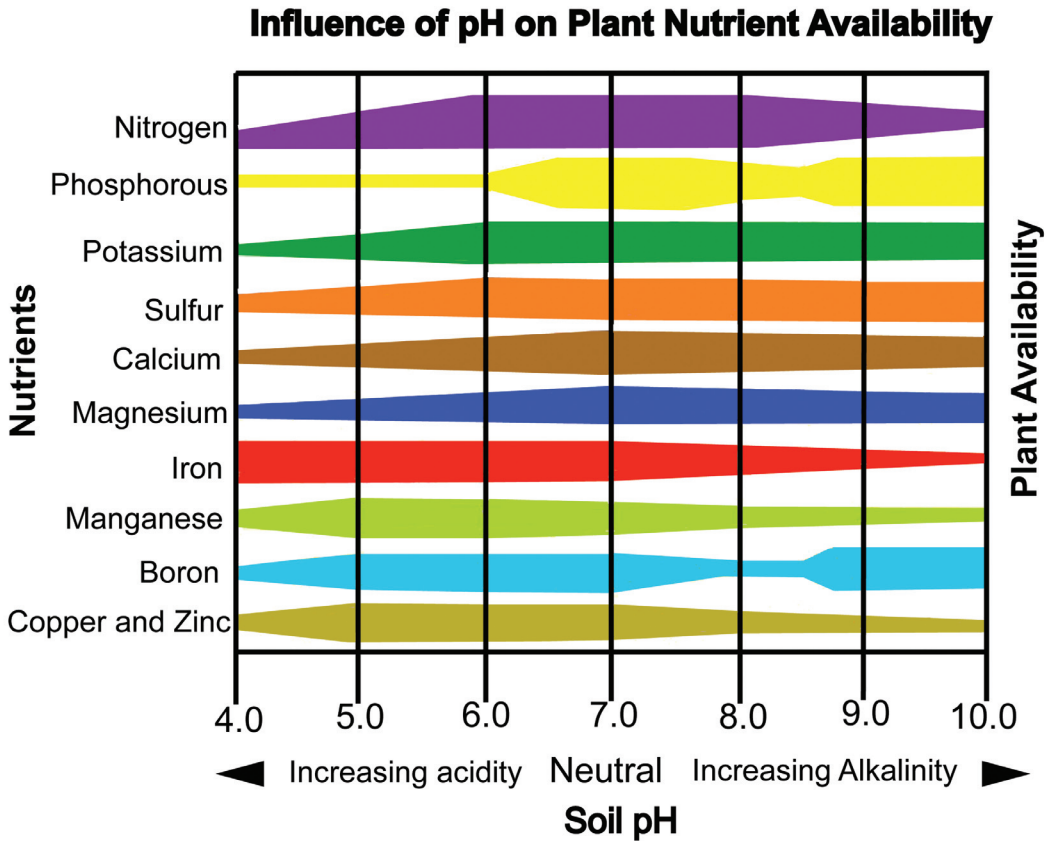
Plants are a major source of minerals for the goat, requiring all minerals that goats require except iodine. However, plant requirements for minerals, such as cobalt and selenium, may be much lower than the level required for animals. Some soils are inherently deficient in some minerals such as iodine and selenium due to soil geology. Plants grown on soils deficient in a mineral are likely to be deficient in that mineral. However,



Drawing by K. Williams.

some plants have an ability to concentrate the minerals available in the soil. Maps of mineral deficient areas of the U.S. are available. However, consulting local extension agents is a better method of determining soil mineral deficiencies or toxicities that could affect mineral levels in local forages. Soil maps showing deficient areas of selenium, copper, molybdenum, and cobalt are located at the end of this article.

Various factors other than soil mineral level can interact to influence the mineral content of forages. Soil pH is one factor that affects mineral uptake by plants. Under acidic soil conditions, many trace minerals are less available for plant uptake. Environmental temperature at certain times of the year may also affect mineral uptake. Interactions among minerals after soil fertilization can also affect their availability for incorporation into plant material. Season of the year affects plant mineral concentrations, mainly due to a



Influence of pH on availability of plant nutrients.
Redrawn from S.S.S.A.P., 1946. 11:305 by K. Williams.

dilution effect, with decreasing mineral levels as plants mature. Different plant species will also have varying contents. Browse and forb plant species may have higher mineral concentrations than do some grasses. As goats eat a variety of plants, they are less likely to have mineral deficiencies than other species of animals that eat predominantly one plant species.

To determine plant mineral content a producer can collect and send samples for analysis. Parts of plants that are being consumed throughout the day and growing season should be sampled. Analysis of a sample will cost a minimum of $25.00. To obtain enough data to formulate a custom mineral supplement would require sampling several times over a growing season and over more than 1 year if possible. This could be worthwhile for a large goat herd but too expensive for most producers. The alternative is to use a commercially prepared mineral block or loose supplement. Some mineral mixes are formulated for regions and are more appropriate to use than a mineral formulated for the whole United States. Many state extension specialists know what minerals are likely to be deficient in given areas of a state and know what levels of calcium and phosphorus are appropriate for beef cattle production. Those recommendations are a good place to start for goat mineral nutrition.

Mineral supplements should not be overfed. Mineral supplements are formulated for goats to consume a sufficient quantity. Many minerals interact with one another (interactions shown on following page) and excess consumption of one mineral may decrease absorption and(or) utilization of another. For example, it is well known that excess iron depresses absorption of zinc, copper, manganese, and selenium. There are several regions of the United States that have high enough levels of iron to depress absorption of these other minerals, requiring them to be supplemented. Feeding a regional mineral with no supplemental iron would be preferable to feeding an all-purpose mineral containing high levels of iron that would further depress absorption of these minerals.

The range between safe supplementation and toxic levels is narrow for many of the trace minerals. Do not overfeed trace minerals or mix additional minerals in a diet if another source of trace minerals, such as a trace mineral block, is present. Formulation of mineral supplements requires considerable expertise since the addition of high levels of one mineral may depress the utilization of another, causing a deficiency. Also, some trace minerals can be toxic in excess.

Calculation of supplemental levels for feed formulas requires a certain amount of technical expertise and specialized scales for weighing, along with sophisticated mixing equipment. Most common farm mixing methods are inadequate, resulting in “pockets” of dangerously high mineral levels in a batch of feed.

Choosing a mineral supplement

The most important consideration in choosing a mineral supplement is the level of calcium and phosphorus. Some mineral mixes are designated 12 - 8, which means they contain 12% calcium and 8% phosphorus. The levels of these two minerals should be the same that is being fed to cattle in your area (contact your county agent or livestock extension specialist). Phosphorus is expensive, so a 12 - 12 mineral will cost more than one that is 12 - 8. However, most forages are low in phosphorus, making it the most common mineral deficiency.

The mineral supplement should also contain trace minerals that are deficient in the area. Levels of trace minerals used in local cattle supplements can provide a guide for goats. Most mineral supplements are formulated to provide less than half the trace mineral requirements due to toxicity concerns. A mineral supplement should be provided in the loose form to maximize consumption. The salt level in the mineral drives intake; therefore, no other sources of salt should be available. A mineral feeder should be used to protect from rain and keep the supplement clean. Replenish minerals frequently to keep them fresh.

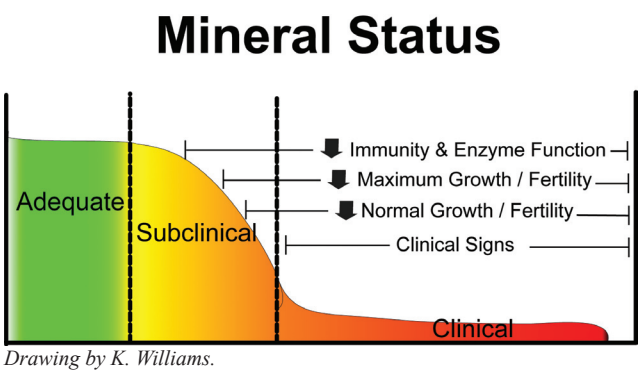
Current approximate wholesale costs for supplying 100% of mineral needs of a 150 lb goat for various minerals in 1 year are as follows:

Calcium	$1.15
Phosphorus	$4.50
Salt	$0.40
Magnesium	$1.11
Potassium	$1.50
Trace minerals	$0.45
Other minerals	$0.65
Total	$9.70

Feedstuffs will normally provide at least half of all minerals and in some cases all required. It should be noted that phosphorus alone accounts for half the mineral cost.

Diagnosing mineral deficiencies or toxicities

The proper procedure for diagnosing a mineral deficiency or toxicity depends on which mineral is being considered. Secure the assistance of a local veterinarian and extension animal nutritionist in the state who are familiar with minerals in the region.



Drawing by K. Williams.

1. Deficiency or toxicity symptoms usually provide initial indications of mineral status (e.g., manganese and "knuckling over"). However, deficient animals do not always show classic symptoms and the major symptom may only be a 'poor doing' animal.
2. Blood tests are adequate for some minerals such as magnesium, calcium, and phosphorus, and for other blood factors that give an indication of mineral status. Examples of these factors include: glutathione peroxidase for selenium, hemoglobin for iron, zinc binding protein for zinc, and thyroid hormones for iodine.
3. Hair analysis has been used for zinc and selenium but in general is a poor diagnostic test.
4. The liver is a good tissue to test for iron and copper adequacy. Liver samples can be obtained via biopsy or from animals that are slaughtered or die.

Take home lessons on mineral nutrition

1. The diet should contain adequate levels of calcium and phosphorus and have close to a 2:1 calcium to phosphorus ratio.
2. Provide a free-choice loose mineral supplement with appropriate levels of calcium and phosphorus that contains trace minerals deficient in the region.
3. Monitor intake of the mineral to make sure the animals are eating an appropriate amount.
4. Avoid excessive feeding of any supplementation.

Body Condition Scoring

The adequacy of a nutritional program can be assessed by observing changes in body weight and condition of the animal. If animals lose weight, body condition will be reduced (animal is thinner), alerting an observant manager to a problem. Body condition is particularly responsive to energy and protein adequacy.

Body condition scoring is a system of assigning a numerical score based on physical characteristics indicative of fatness. These include the amount of muscle and fat covering the spine in the loin area and ribs and fat pad at the sternum. Body condition scores range from 1 (very thin) to 5 (obese) in one-half score increments. Langston University has information on the American Institute for Goat Research website describing Body Condition Scoring of Goats (see following section on BCS or http://www2.luresext.edu/goats/research/bcshowto.html) and Examples of Body Condition Scores in Goats (see following section on BCS or http://www2.luresext.edu/goats/research/bcs.html).

Animals should achieve a certain body condition during specific periods of the production cycle. For example, animals should have a body condition of at least 2.5 but no more than 4.0 at the beginning of the breeding season. Prior to entering the winter a minimum score of 3.0 is desirable. Also, if body condition score is 4.5 or greater, pregnancy toxemia prior to kidding is likely, as also is the case with a score of 2.0 or less.

Using the Langston Interactive Nutrient Calculator

Practical goat nutrition involves providing sufficient nutrients for a desired level of productivity (milk, meat, or kids) at a reasonable cost. Nutrients are supplied via a combination of pastures, hay, supplements, and other feedstuffs; adequate amounts are required for animals to produce at an economically viable level. For commercial meat goat production, the economics of nutrition are of paramount importance due to their great impact on cost of production and subsequent profit. For show, purebred, and companion goats, the economics of nutrition may be of lesser importance.

Applied nutrition involves determining nutrient requirements and then working with available feedstuffs, including pasture, hay, or supplemental feeds, to provide the required nutrients in proper amounts. Nutrient requirements are affected by an animal age, weight, and production type and stage. For example, pregnancy, number of fetuses, etc. will affect the amount of nutrients needed by a doe.

Calculating nutrient requirements by hand can be difficult, but the Langston Interactive Nutrient Calculator (LINC) makes the task easy, only requiring answering several questions. In addition, it is linked to a nutrient balancer program that allows selection and use of pastures and feeds to meet the requirements. The calculator will determine not only protein and energy requirements, but also calcium and phosphorus needs.

Getting started

To teach you to use LINC, we will go through an example. Here is the assignment, calculate the nutrient requirements for a nonpregnant 3 year old mature ½ Boer cross doe that had twins 6 weeks ago. The doe has a 32 inch heartgirth and is under intensive grazing management. Her body condition score is 2.5.

First, go to the Langston web site http://www2.luresext.edu/goats/research/nutritionmodule1.htm.

Question 1 asks the biotype of goat. A drop down menu will give the choices of Boer, Boer cross, Spanish or indigenous (native) goat, dairy goat, or Angora goat. For Kiko goats, use the selection for Spanish and indigenous. Select “Boer cross.”

Question 2 asks the class of goat, and selections include suckling, growing goat less than a year and a half of age, mature goat including late gestation, and lactating goat including meat and dairy goats. If a lactating goat is selected, another drop down menu asks information needed to predict milk production. This information includes litter size (number of kids), week of lactation (weeks since she kidded), and age of doe at kidding in years. Milk production, along with fat and protein percentages, are then predicted. These figures can be edited, which is useful for dairy goat producers who are more likely to know the amount of milk produced and its fat and protein contents.

For the example, select "lactating goat". Then in the subsequent menu, select the number of kids (twins) and input week of lactation (6) and age at kidding (2 - 3 years). The program predicts that the doe will produce 3.6 lbs of milk containing 3.6% fat and 3.3% protein.

Question 3 asks the gender of the goat, and the drop down menu has choices of doe, buck, and wether. Select "doe."

Question 4 asks the body weight of the goat. If the weight is known or a good estimate is available, it should be entered in the box. If the weight is unknown, the heartgirth (chest circumference) can be measured to predict body weight. Check the box to estimate weight via heartgirth and enter heartgirth in inches. A menu will appear with choices of genotype (breed) of goat (Alpine, Angora, Boer, ½ or less Boer, ¾ or ⅞ Boer, La Mancha, Nigerian dwarf, Oberhasli, Saanen, Toggenberg, and Spanish). Some breeds require input of body condition score. Body weight is then estimated. Input "32" inches for a "½ or less Boer" and the estimated weight of the doe is 105 lbs. This can be used for estimating bodyweight for medicine dosage or weights for management purposes.

Question 5 asks the desired amount of weight gain or loss expected in a 1 month period, with selections ranging from losing 5 pounds (-5) to gain of 30 pounds. This gain is in addition to any pregnancy weight gain. Select 0 lbs per month.

Question 6 adjusts nutrient requirements for the energy expended during grazing if goats have access to pasture. The drop down menu includes choices of stable feeding, intensive management, semi-arid grazing (goats on extensive ranges), and arid (desert) grazing. For the sample calculation select "intensive management, temperate or tropical range." This selection will be used in all the examples that follow.

Question 7 asks the percentage TDN of the diet being fed and uses a default value of 60. If the TDN level in the feed is known, this value can be adjusted. For dairy goats, the default value is 65%. Use the default of 60%. If you know the value of the feed you plan to use put it in here. This value is important in prediction of intake.

Question 8 asks the percent protein in the diet and the default is 10%. For dairy goats, the default is 14%. Use the default of 10%. If you know the value of the feed you plan to use, put it in here. This value is used to help predict intake.

Click on the "Calculate Requirements" button to calculate the energy and protein requirements, estimated dry matter intake, and calcium and phosphorus requirements. In this example, the requirements should be 2.5 lbs of TDN for energy, 0.34 lbs of crude protein, 6.65 grams of calcium, and 4.65 grams of phosphorus, with a predicted intake of 3.65 lbs of dry matter.

Providing needed nutrients

After calculating the nutrient requirements for goats, those nutrients must be provided using feedstuffs such as pasture, hay, concentrate, and minerals. For most goats throughout much of the year, nutrient requirements can be met by available pasture, a mineral supplement, and water. During times of limited forage availability or quality such as winter, or feeding poor quality hay or stockpiled forage, a supplement will be needed to supply deficient nutrients. The level of supplemental feeding should be adjusted with changes in animal requirements, such as increased needs of late pregnancy. Sometimes it may be preferable to put an animal in a lot and feed a complete diet or one high in concentrate such as with dairy goats.

There may be periods when nutrient requirements cannot be met, resulting in loss of body weight. This is acceptable at certain times in the production cycle if body condition is sufficient for the animal to draw upon body reserves and maintain the desired production level. An example would be weight loss during early lactation because sufficient nutrients cannot be consumed. However if the doe is in poor body condition, is a growing yearling, or has severe weight loss during this time, milk production will be depressed. During a

drought, it may be acceptable for open or early pregnant animals that are not lactating to lose weight. During late pregnancy, inadequate nutrition can have adverse effects on pregnancy outcome and subsequent lactation. We can estimate what the projected bodyweight losses would be by reducing the bodyweight gains in question five and then calculating nutrient requirements until the energy and protein requirements match intake of those nutrients. Severe undernutrition can cause abortion, reduced livability of the kid(s), reduced milk production and adversely affect maternal behavior.

Feeding Different Classes of Goats

The feeding suggestions that follow are oriented to commercial goat producers. Purebred, show, and companion animals are often fed more for larger frames and better body condition, but excessive body condition can be deleterious to the animal health.

Feeding bucks

Mature bucks can obtain most of their nutrients from pasture. However, yearling and 2 year old bucks have greater nutrient requirements since they are still growing. Bucks need to be in good body condition (BCS greater than 3) before the breeding season because feed intake may be relatively low during that time, with loss of body weight. Thus, body condition should be evaluated 3 months before the breeding season. Decisions can then be made on the supplemental nutrition needed for the buck to achieve the desired BCS.

Whenever bucks cannot meet nutritional needs from pasture, supplementation is necessary. Under most conditions, whole shelled corn or sweet feed at 0.25 to 0.5% of body weight will be adequate (0.5 to 1 lb of feed for a 200 lb buck). Feeding bucks high levels of grain (greater than 1.5% of body weight) for a long period of time makes them prone to urinary calculi. The levels of grain recommended above are safe for bucks. When pasture is scarce, bucks can be fed medium quality hay free-choice (all they can eat).

Using LINC, calculate the nutrient requirements for a 3 year old, 200 lb Boer cross buck, gaining no weight, and on pasture (intensive management). The calculated requirements are 2.39 lbs of TDN, 0.26 lbs of crude protein, 5.05 grams calcium, and 4.09 grams phosphorus, with predicted dry matter intake of 3.55 lbs. However, it is important to note that the estimated dry matter intake is influenced by the dietary TDN and CP concentration inputs. Therefore, if the default values are used and a forage, which makes up all or most of the total diet other than a mineral supplement, has different levels, then the predicted dry matter intake may not be close to the actual amount. In the example above, default values were assumed. To determine if these nutrient requirements can be met by native range with a mineral supplement, click on "Select Feed Ingredients" at the bottom of the page. A page listing different feeds will appear. In the "Forages" section below "Concentrates," click on "range, early summer," and under "Minerals" choose a 12-12 mineral supplement. Go to the bottom and click on "Input These Feed Ingredients into the Ration."

The ration window will appear that lists each ingredient chosen. Intake figures should be entered in the column labeled "Amount, lbs as fed." The estimated intake for this buck is 3.55 lbs dry matter (lbs of diet not including the water content of the feedstuffs), whereas in this window the consumption amount is entered as the "as fed" form. Because feedstuffs vary in water content (compare the water content of fresh, green pasture to the same forage dried and harvested as hay), nutrient requirements and intake estimations are calculated on a "dry matter basis." Dry matter basis means that all water has been removed. However, animals eat feed in an "as-fed" form. This calculator will determine the amount of dry matter intake for each ingredient from the as-fed figures entered. This relieves the producer from having to estimate dry matter, allowing the amount fed to the animal to be entered, with the program performing the needed dry matter calculations.

The mineral supplement bag label predicts intake of 0.5 to 1 lb/month/hundred lbs of body weight. At that rate, the 200 lb buck will consume 2 lbs/month or 0.067 lbs/day (2 lbs ÷ 30 days), roughly 1 ounce. Some supplements estimate an intake such as 1 to 1.5 oz/day, but this can vary with the size of the goat. Enter 0.07

lbs for the mineral. Therefore, in this example it can be assumed that forage dry matter intake is 3.55 lbs. The value of 3.55 is entered into the "Amount, as-fed" column for range forage. Clicking in the "Amount, lbs DM" column will calculate the amount of DM and nutrients provided (Running total) compared with the Requirements. The amount of as-fed native range grass provided should be increased until the forage dry matter provided equals the 3.55 lbs previously calculated. This is done by trial and error method until a correct answer is found. In this case, the correct amount is 3.95 lbs of as-fed native range, which will provide 3.55 lbs of dry matter. Therefore, the estimated daily ration for this buck is 3.95 lbs of native range grass hay, or an equivalent amount of pasture, on a dry matter basis plus 0.07 lbs of mineral per day.

Comparing the Running total with the Requirements shows that this diet did not meet the requirement for TDN (2.12 lbs provided vs a requirement of 2.39; 89%). Crude protein, calcium, and phosphorus are supplied in excess of requirements. Because the equations used in these predictions include a small safety margin (i.e., requirements are most likely slightly greater than actual), if the deficiency is not marked the diet could be used as is with careful monitoring of performance measures, most notably BCS. In addition, one should consider that the diet actually consumed could be higher in quality than the 'book' composition values used. In this regard, when taking plant samples, plants are often cut at the ground level, such as for hay. Conversely, goats select certain plant parts (especially leaves) that have higher nutrient contents. Therefore, the composition analysis used in the calculations might not have matched what was actually eaten. For example, if a TDN concentration in consumed forage of 65% and a crude protein level of 12% are assumed, the predicted TDN intake is 95% of that necessary to satisfy the TDN requirement.

Accurate and abundant data on the nutrient content of plant parts consumed by goats are lacking. When hay is fed and animals are 'forced' to consume most of it, the hay analysis will closely match what is consumed. The same applies to supplemental feeds that are totally consumed. One way to more accurately determine the true composition of diets of grazing goats is to follow the animals for a couple of hours and hand pluck the portions of plants consumed and send the sample in for analysis. However, plant composition and plant parts selected vary over time, making it desirable to sample plants monthly or more frequently.

In the absence of feed nutrient analysis, it is important to try to match the description of feeds or pasture as closely as possible to that in the LINC feed tables. If actual analysis has been determined, it can be entered into LINC at the bottom of the feed library. Information required includes concentrations of TDN, crude protein, calcium, and phosphorus. Hopefully in the future, more applicable data will be available for herbage grazed by goats.

Feeding replacement bucks and does

Replacement bucks and does must gain sufficient weight from weaning to breeding to be adequately large and sexually mature. A Spanish doe weaned at 12 weeks of age would be expected to weigh 40 lbs and gain 5 lbs per month to achieve a minimum breeding size of 60 lbs at 7 months of age. A Boer doe weaned at 12 weeks of age would be expected to weigh 50 lbs and would need to gain 7.5 lbs per month to be 80 lbs at breeding. These are minimum weights, and it is advantageous for animals to be slightly heavier. Some purebred breeders wait to breed their doelings at 19 months of age because a doe with a bigger frame size is desired. Most commercial goat producers cannot afford the cost of an extra year of maintaining an animal with no production.

Does will generally gain sufficient weight if an adequate amount of a moderate quality forage is available. If doelings are not gaining adequate weight (as measured by a scale or through the heartgirth conversion program), they could be supplemented with whole shelled corn at 0.5 to 1% of body weight per day (¼ to ½ lb of corn per head per day for 50 lb doeling). Feeding excessive grain to does causes an overly fat condition. Fat may be deposited in the udder, leading to reduced formation of milk secretory tissue. The doe is also more likely to have pregnancy toxemia and birthing problems. If sufficient good quality pasture is not

available, growing doelings will need good quality hay and a supplement such as whole shelled corn, sweet feed, or range cubes or pellets at 0.5 to 1.0% of body weight.

Bucklings must gain more weight than doelings to reach puberty. While there are no available recommendations for weight of meat goat bucklings at first breeding, these animals need to reach an adequate size to achieve puberty. Like doelings, body condition should be monitored and supplemented at 0.5 to 1% of body weight per day (¼ to ½ lb of corn per head per day for 50 lb buckling). Most bucks do not let a lack of body weight interfere with breeding, but some body reserves are necessary to maintain fertility and mating activity throughout the breeding season.

Feeding does throughout their life cycle

The four production periods of does are dry nonpregnant, pregnant, late gestation, and lactating. Does that are open (nonpregnant) or in the early stage of pregnancy (< 95 days) have fairly low nutrient requirements. For open does, the goal is to gain a little weight to be in good condition for breeding. A medium quality pasture, such as in late summer, or a medium quality hay is sufficient to prepare for breeding and the early stage of pregnancy. However, adequate quantities of feed are necessary.

Use the LINC to calculate the nutrient requirements for a 130 lb nonpregnant, mature Boer doe without change in body weight and with intensive pasture grazing. The requirements are 1.50 lbs of TDN, 0.18 lbs of crude protein, 4.03 grams of calcium, and 2.82 grams of phosphorus, with an estimated dry matter intake of 2.31 lbs (based on the composition of fall bermudagrass; 50% TDN and 9% CP). Feeds used are fall bermudagrass and a mineral supplement. A 130 lb doe is expected to consume the mineral at 0.1% of body weight per month = 1.3 lbs/30 days = 0.04 lbs of mineral per day. The estimated 2.27 (2.31-0.04 = 2.27) lbs dry matter intake of fall bermudagrass (3.25 lbs as-fed) provides 1.14 lbs of TDN (76% of requirement) and 0.20 lbs of crude protein (111% of requirement). In this example, it appears questionable as to whether or not body weight of the doe could be maintained with this forage (i.e., 50% TDN). The goat's ability to select higher quality plant parts, as noted above, might enable them to maintain their body weight. In this regard, if they are able to select a diet with a TDN concentration of 60% rather than 50% then the amount of TDN supplied is (2.27 × 0.60 = 1.36 lbs) which is 91% of the required amount, somewhat close to her requirements. Again, it is important to monitor body condition.

Calculate the nutrient requirements for a Boer doeling weighing 70 lbs, gaining 5 lbs per month, and with intensive pasture grazing, using LINC. The requirements are: 1.3 lbs TDN, 0.25 lbs crude protein, 2.98 grams of calcium, and 2.08 grams of phosphorus with a dry matter intake estimate of 2.06 lbs. If we adjust estimated TDN and estimated protein for the forage (questions 7 and 8 in LINC) since the 50% TDN of fall Bermudagrass is different than the 60% assumed, and use 9% CP instead of the 12% assumed, predicted dry matter intake is 2.32 lbs. Using the same feeds, fall bermudagrass and mineral, with a mineral consumption of 0.02 lbs (1% of body weight /month, divided by 30) and using fall bermudagrass for the remainder of her intake (3.3 lbs as fed), both TDN (1.16 lbs intake, 89% of requirement) and crude protein (0.21 lbs intake, 84% of requirement) are inadequate. To achieve the desired growth rate, supplementation may be necessary. By trying sweet feed as a third feedstuff it is determined, through trial and error, that 0.75 lbs of sweet feed along with 2.0 lbs of fall pasture will provide most of the energy requirement but only 0.19 lbs of crude protein (76% of requirement), which is inadequate. By deleting the sweet feed and changing to a 16% dairy ration to supply the needed crude protein, it is finally determined that 0.75 lbs of a 16% crude protein dairy ration, 2.0 lbs pasture, and 0.02 lbs of mineral will provide 1.3 lbs of TDN (100% of requirement) and 0.25 lbs of protein (100% of requirement). The weight gain to achieve adequate breeding size should continue to be monitored with possible feeding adjustments made. The lesson here is that this doeling, because of the need for growth, has higher requirements than a mature doe and needs extra nutrition.

Flushing meat goats

Some people advocate "flushing" of meat goats prior to breeding. Flushing refers to the practice of providing extra nutrition to does approximately 2 weeks prior to breeding and for a variable portion of the breeding period (e.g., 1-2 weeks) to increase the number of ovulations and have a greater proportion of twins and triplets. This is widely advocated with sheep producers and Angora goat producers. Producers have extrapolated the practice to meat goats. However, several controlled studies with Spanish goats in reasonable body condition (BCS 2.5 – 3.5) have shown no response in kidding or conception rate of meat goats to flushing with extra protein, energy, or both. The practice may have utility for meat goats in poor body condition, but there does not appear to be justification for flushing does in acceptable body condition.

Winter feeding of does

Early to mid-winter is a time when does should be in early pregnancy. The goal of a wintering program is to economically provide the necessary nutrients to maintain a reasonable body condition, lose no weight, and keep them warm. In general, most wintering programs consist of both forage and supplement components. The forage component can consist of hay, stockpiled forage, or a cheap byproduct roughage feed. The supplement usually contains energy, protein, and often vitamins and minerals, although these may be provided separately as a mineral mix. Commonly utilized supplements include whole shelled corn (inexpensive source of energy), range cubes (inexpensive source of energy and protein), sweet feed, protein blocks, molasses blocks or tubs, and liquid feed.

Stockpiled forage is forage that is grown during the summer or fall upon which animals are not allowed to graze, reserving it for the winter months. In drier areas, the forage is well preserved, but in a more humid climate quality declines rapidly, making the practice less satisfactory. Stockpiled forage is a very inexpensive forage source since it does not have to be mechanically harvested (baling forage doubles the cost of forage); animals harvest stockpiled forage by grazing. Animals make much more efficient use of stockpiled forage when strip grazed (using temporary electric fence to limit animal access to an area containing a 1 to 3 day supply of forage) to minimize trampling. Fescue is used in many temperate regions for stockpiling and retains its quality well into late winter even in humid areas. Most recommendations for stockpiling fescue include late summer fertilization, clipping, and deferred grazing. Warm season grasses such as native range and bermudagrass can be stockpiled. The amount of deterioration is dependent on grass species and rain. If local cattlemen are using stockpiled forage it will probably work for certain classes of meat goats. Consult your state forage extension specialist for further information.

Calculate the requirements for wintering a 95 lb mature Kiko doe (use Spanish biotype) in early pregnancy gaining no weight and with intensive pasture grazing, using LINC. The requirements are 1.19 lbs TDN, 0.14 lbs protein, 3.13 grams of calcium, and 2.19 grams of phosphorus, with 1.86 lbs of dry matter intake estimated (based on default dietary TDN and CP levels). Feedstuffs that can be used include stockpiled (winter) bermudagrass and a 16% molasses lick. The estimated intake from the molasses lick label is 4 ounces or 0.25 lbs. Assume the remainder of dry matter intake is from the stockpiled bermuda pasture.

The molasses lick is not in the feed library so must be entered manually as a new feedstuff. Click on "Add/ Delete Ingredient to Feed Library," to bring up a table to be filled out. First, the feedstuff class is selected. This molasses lick is in the "concentrate" class. Then the name "16% molasses lick" is entered, and remaining values are entered. These values can be obtained from the feedstuff tag or label or by calling the manufacturer. If a value is unknown, leave it blank. For this example, enter dry matter of 85%, 16% crude protein, 75% TDN, 2.8% calcium, and 0.45 % phosphorus. Click on "Add Feed Ingredient to Library" and the Select Feed Ingredient page appears. If needed, click on refresh feed library and 16% molasses lick appears under "Your Feed Ingredient Library." If you have a dry hay or feed, 85% dry matter is a good assumption.

To continue formulating the ration, select the 16% molasses lick and winter bermudagrass, then click on "Input these Feed Ingredients to the Ration." Enter 0.25 lbs for the 16% molasses lick under the "Amount, as-fed" column and guess at 1.5 lbs of winter bermudagrass. Through trial and error a total of 2.0 lbs bermudagrass is selected to fulfill intake requirement. The table shows that this diet provides 0.91 lbs of TDN (76% of requirement), 0.12 lbs CP (86% of requirement), 4.74 grams of calcium, and 1.52 grams of phosphorus (deficient). The diet is quite deficient in energy. To provide additional energy, add whole shelled corn. The diet is then reformulated to contain 0.6 lbs whole shelled corn, 1.4 lbs winter bermudagrass, and 0.25 lbs of lick molasses. This provides 1.15 lbs TDN (97% of the energy requirement) and meets the CP needs. Phosphorus is slightly deficient (13%), but if the bermudagrass is better than average the requirement can be satisfied. Mineral supplements vary in their phosphorus levels as phosphorus is an expensive ingredient. If a mineral supplement with a high phosphorus level is selected for feeding, the requirement would be met but likely at a high monetary cost.

Feeding does in late gestation

Energy requirements increase dramatically in late pregnancy (Figure 4). Using LINC, calculate the nutrient requirements for a 130 lb mature Boer doe, 140 days pregnant (10 days from kidding), gaining no weight, other than that due to pregnancy, and carrying twins. Under question 3, after clicking on the box for greater than 95 days pregnant, a form drops down for pregnancy number (twins), breed (predicts birth weight, can enter yours if known), and days of pregnancy (140). The requirements are 2.45 lbs TDN, 0.45 lbs crude protein, 3.97 lbs intake, 6.03 grams calcium, and 4.22 grams phosphorus.

A ration can be balanced using bermudagrass hay and 20% range cubes to meet the requirements by feeding 1.5 lbs of range cubes and 3.0 lbs of bermudagrass hay. This illustrates the high level of nutrition that is needed, especially in the last 3 weeks of pregnancy. High quality hay as well as supplementation is usually required. The range cubes contain a mineral supplement so no additional mineral mixture is needed.

Doelings require more supplementation than mature does, as the doelings are still growing. The nutrient requirements for a 95 lb growing Boer doeling with a predicted intake of 3.37 lbs, gaining 1 lb per month in addition to pregnancy weight gain and 140 days pregnant with a single kid are 1.77 lbs TDN, 0.36 lbs CP, 5.23 grams calcium, and 3.66 grams of phosphorus. If the same ingredients are used as those for the mature doe, how much of each will be required? The doeling could be fed 3.8 lbs of bermudagrass hay alone to meet the nutrient requirements for pregnancy with a single kid. However, if the doeling is carrying twins and is 140 days pregnant, her requirements are 2.27 lbs TDN and 0.47 lbs CP. This doeling will require 1.0 lbs of range cubes and consume 3.3 lbs of hay. If an abundance of high quality pasture is not available, the doeling will need some type of supplementation. If the forage (or hay) of adequate quality is available, only 1 to 1.5% of body weight of whole shelled corn may be needed as an energy supplement. This is important in that feed intake may be reduced in the last 4 to 6 weeks of gestation by the growing kids that reduce available abdominal space.

Feeding the lactating doe

The lactating doe has very high nutrient requirements. Calculate the requirements for a 4 year old 110 lb Boer cross doe nursing twins in week 4 of lactation. When lactating is selected under question #2 on LINC, a form drops down. Select litter size (twins), week of lactation (4), and age at kidding (4). The program then predicts production of 4.5 lbs of milk per day with 3.6% fat and 3.3% crude protein. Nutrient requirements are 2.8 lbs of TDN, 0.41 lbs of protein, 7.61 g of calcium, and 5.33 grams of phosphorus, with 4.14 lbs of dry matter intake predicted (based on default dietary TDN and CP concentrations). During lactation, the doe can consume nearly enough nutrients if an abundant supply of high quality pasture is available, such as in spring or early summer. However, does will likely lose some bodyweight due to the high demands of peak lactation (weeks 3 to 8 of lactation) and an inability to consume an adequate quantity of feed. Kidding

should take place when there is an adequate supply of high quality pasture. If there is not adequate pasture, supplemental feed will be required. Inadequate nutrition will decrease body condition, reduce milk production, reduce kid weaning weight, and increase kid mortality.

If feeding bermudagrass hay and a 16% dairy ration, 2.6 lbs of hay and 2.0 lbs of the ration are required to fulfill requirements. However, the doe will still lose 2.0 lbs of bodyweight per month. When feeding high levels of grain such as the amount in this example, the animal should go through an adjustment period of two to three weeks during which time the grain portion of the diet is gradually increased to prevent digestion and other problems from occurring. Feeding a dairy ration and hay to a doe during late gestation and the lactating period will cost approximately $30 per animal. Utilizing available pasture as a feed source is a much cheaper alternative.

Kids are usually weaned at about 12 weeks of age. Milk production of the doe begins to decrease after the 6th week of lactation and is quite low by the 12th week. Nutrient requirements decline as stage of lactation advances, enabling the doe to maintain body condition or even increase it on pasture alone. Kids may be creep fed while nursing to increase growth rate of the kids and reduce nutrient demands on the doe for milk production.

Creep feeding

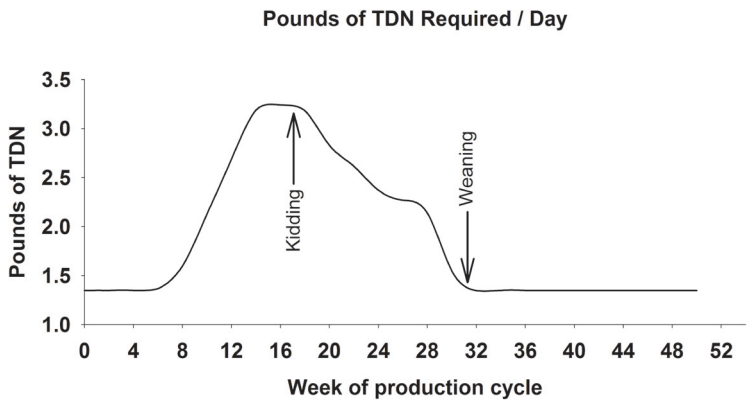
Creep feeding is a method of providing feed for the kids only. This is accomplished by fencing around a feeder and using a creep gate that has holes about 5 inch wide by 1 ft high. These holes are small enough so that kids can enter the feeder, but adults are excluded because they are too big to go through the hole. Creep feeding will provide extra growth for the kids and train them to eat feed, facilitating weaning. A commercial creep feed with at least 16% crude protein that is medicated with a coccidiostat should be used. It requires about 6 lbs of feed to produce 1 lb of animal gain. The more rapid growth from creep feeding may be beneficial for producing show prospects.

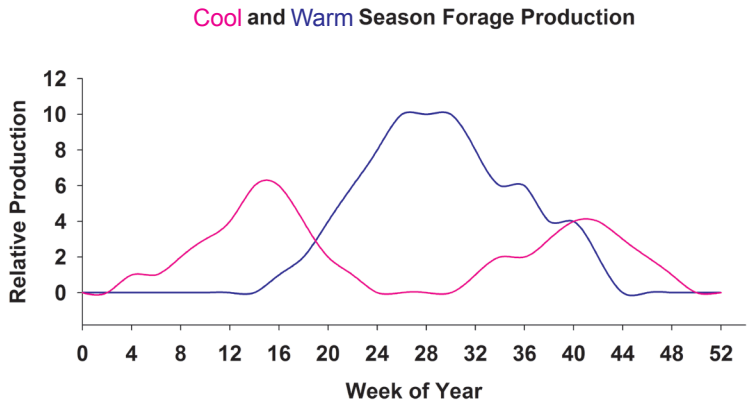
An alternative to grain-based creep feeds that is used in the beef cattle industry is to creep graze calves, using a creep gate that allows calves access to ungrazed high quality pasture. This may have application for goats using high quality pastures (crabgrass or sudangrass that is planted for the kids). In rotational grazing of cattle, the calves are often allowed to creep graze the next pasture before cows so that they have relatively high nutrient intake. Those pastures often have less parasites and disease organisms because of the time since last grazing.

Effect of Kidding Season on Nutrient Requirements

Nutrient requirements of does change dramatically with stage of production. Requirements increase dramatically the last 6 weeks of gestation due to increasing fetal growth and remain high in early lactation (kidding occurred on week 20 in chart). During the month prior to kidding and for the following 3 months (assuming weaning at 12 weeks of age), the doe will consume nearly as much nutrients as in the remaining 8 months of the production cycle. Thus, during that time it makes sense to supply nutrients from an inexpensive source, typically pasture. The cost of providing the same nutrients as hay is more than twice that of pasture, and supplying through purchased feeds may be four to five times greater than for pasture.

Kidding should be planned for a time when pasture is rapidly growing. This period corresponds to late spring for pastures comprised of warm season forages such as bermudagrass or native range, browse, and forbs, but could be either fall or early spring for cool season grasses such as ryegrass, wheat, orchardgrass, and fescue. Cool season grasses usually produce less forage per acre than warm season forages, but generally are higher in energy and protein. The accompanying figure shows the relative production of cool and warm season forages for central Oklahoma. Consult a local pasture extension specialist or livestock extension specialist for local forage growth patterns. Rapidly growing pasture is high in protein and energy. A major consideration in





determining the date to kid is level of forage production at that time. However, there are other considerations in selecting kidding date, such as parasites and market opportunities. Some markets provide a substantial price premium from kidding at a specific time of the year, such as producing prospect show wethers or registered animals. However, it may take a considerable market premium to cover the cost of purchased feed, so general reliance on pastures and forages is best.

Artificial Raising of Kids

Sometimes it is necessary to bottle feed young kids due to death of the mother or the mother refusing to take them. Milk feeding of commercial meat goats is usually not economical. It may be avoided by cross-fostering kids onto another doe as described under the goat management section. If a bottle raised kid is with other kids and does, they may learn to 'steal' sufficient milk to raise themselves. Kids can be raised on cow milk replacer, goat milk replacer (expensive) or, if none is available, cow milk from the store may be used.

It is very important that kids receive colostrum within 12 hours of birth. After 12 hours, antibodies absorption decreases. Colostrum may be milked from another doe that recently kidded. Colostrum contains antibodies that strengthen the immune system for the first months of life. A kid should be fed one ounce of colostrum per lb of weight (average birthweight 7 lbs, therefore, 7 ounces of colostrum) at each of three feedings in the first 24 hours. If the kid is too weak to nurse, it is appropriate to provide the colostrum via stomach tube. This does take some practice, but obtaining colostrum is critically important to kid survival.

Initially kids can be fed using a baby bottle or a nipple such as the Pritchard teat which fits on a plastic soda bottle. Kids can be bottle fed twice a day, although three times a day the first 4 to 6 weeks of life may increase growth rate. Kids are very susceptible to bloating and other gastrointestinal problems from milk replacers that contain a high level of lactose due to use of dried whey in their formulation. Reduced lactose milk replacers will reduce bloating problems.

A calf starter feed (with a coccidiostat such as Rumensin or Deccox, sometimes called medicated) and high quality hay should be made available the second week of life. Deccox can be used in the milk from week 2-6 to prevent coccidiosis. After 4 weeks of life, kids can be limit fed milk at one pint in the morning and also in the afternoon. This will stimulate consumption of starter feed and facilitate weaning.

Kids can be weaned after 8 weeks of age if they are consuming 2 ounces of starter per day and weigh two and a half times their birth weight (about 18 lbs). Weaning shock can be reduced by going to once a day milk feeding for several days to encourage consumption of the starter.

Considerations in Ration Formulation

Rations should be balanced not only for protein and energy, but calcium and phosphorus contents should be calculated, macrominerals supplemented, and a trace mineralized salt used to provide microminerals. A vitamin premix should be used to provide at least vitamin A and E.

If the diet is being fed at high levels to bucks or wethers, there is risk of urinary calculi. To prevent urinary calculi, the ration should be formulated with a minimum of phosphorus, over twice as much calcium as phosphorus, and a urine acidifier such as ammonium chloride at 0.5-1.0 % of the diet. Salt can also be included in the diet, such as at 1%, to reduce incidence of urinary calculi.

If the ration is being fed at high levels, sufficient fiber should be included in the diet to prevent acidosis. Dried brewers yeast and probiotics are often used in rations fed to animals at high levels to help prevent them from going off feed.

Feeds may have a coccidiostat included in the formulation to prevent coccidiosis. There are a number of coccidiostats, but Food and Drug Administration approved drugs commonly used include Deccox and Rumensin. Since goats are very susceptible to coccidiosis when stressed, such as at weaning or shipping, many starters and show feeds contain coccidiostats and have the term 'medicated' on the feed tag. Management considerations to reduce coccidiosis incidence include sanitation, cleanliness, and dry housing.

Feeding Systems

There are many methods of feeding goats. Feeds should be offered in such a way to minimize mold growth or fecal contamination that reduces intake. Mineral mixes must remain dry and should be replenished at 2 week intervals to avoid caking. Feed troughs should be designed to facilitate removal of feces and leftover feed. Troughs generally require a bar running above the length of the trough to keep goats from defecating in them.

Self feeders can be used for feeds containing sufficient roughage for use as a complete feed or for feed that has a built-in intake limiter. For large range operations, feeds such as whole shelled corn or range pellets or cubes are often fed on the ground. The feeding area is moved each day to have clean ground upon which to feed.

Round hay bales should be fed in a rack off the ground. Feeding round hay bales on the ground results in hay wastage and leaves a mess that is difficult to clean. Hay can be fed in a manger or hay feeder with keyhole slots, but horns may cause problems preventing access to feed. For large operations, unrolling round bales on the ground works well.

Nutritional Disorders

There are several diseases associated with nutritional management. These include acidosis, founder, enterotoxemia, pregnancy toxemia/ketosis, polioencephalomalacia, and urinary calculi.

Acidosis, founder, and enterotoxemia are all related to either feeding high levels of grain or a rapid increase in the level of grain in the diet. Acidosis is associated with the production of high levels of lactic acid in the rumen from a large supply of starch that the animal consumed. Endotoxins may also be produced by ruminal bacteria that exacerbate the problem.

Founder refers to problems that occur with the feet of the animal as a consequence of acidosis. The blood vessels in the hoof constrict and in the long-term cause the hoof to grow rapidly, necessitating weekly hoof trimming.

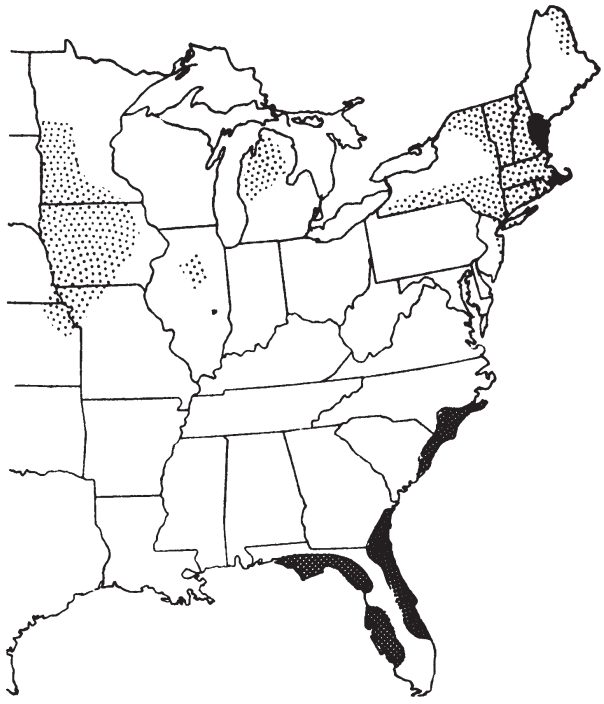
Enterotoxemia is caused by bacteria in the intestine that grow rapidly and produce an endotoxin in response to high levels of starch (grain) in the diet. Animals are in extreme pain from the effect of the endotoxin and often die quickly. Vaccination will help prevent this disease.

High levels of grain in the diet and stress are associated with polioencephalomalacia, which is a thiamine deficiency. High dietary levels of sulfur (such as from molasses in the diet) can increase incidence of the condition. The animals appear drunk, may not be able to stand, become blind, and slowly die. There is often a dramatic response to a large dose of thiamine (5 mg/lb), which may need to be repeated. These diseases can be best prevented by increasing the grain level in the diet slowly and maintaining 50% forage in the diet. Thiamine can be added to high concentrate diets at 0.25 lb/ton to aid in the prevention of polioencephalomalacia.

Pregnancy toxemia is a metabolic disease usually caused by animals being too fat (body condition score greater than 4) prior to kidding; although very thin animals (body condition score less than 2) are subject to the disease also. It is caused by a high demand for nutrients by the growing fetus in late pregnancy that is not being met (excess fat in the body and the growing fetus limit room in the stomach for food, reducing intake of the diet). This unmet nutrient demand causes a rapid breakdown of fat reserves, forming ketone bodies at high levels which are toxic. Treatments include administration of propylene glycol, large doses of B vitamins, glucose given intravenously and possibly Caesarian-section (to remove the fetuses and immediately reduce energy demand; see the Goat Health section). Prevention of the disease is far easier and more effective than treatment. Simply monitor animal body condition and adjust nutrition, especially energy, to manipulate body condition. Do NOT sharply reduce feed in late gestation as this may cause pregnancy toxemia. Also, pregnant goats in the last third of pregnancy will need a more nutrient dense diet (higher quality) due to fetal growth and reduced intake because of reduced stomach capacity. Exercise will help. Does can be encouraged to exercise by separating hay, feed and water at a substantial distance, forcing them to walk more.

Soil-Related Nutritional Problem Areas for Grazing Animals

Figure 1. Geographical distribution of Co-deficient areas in the eastern United States (ppm = 1 $\mu g/ g^{-1}$). From Kubota and Allaway, 1972, by permission Soil Science Society of America.



All soil maps were taken from Kubota, Welch, and Van Campen. 1987. Adv. Soil Sci. 6:189-215.

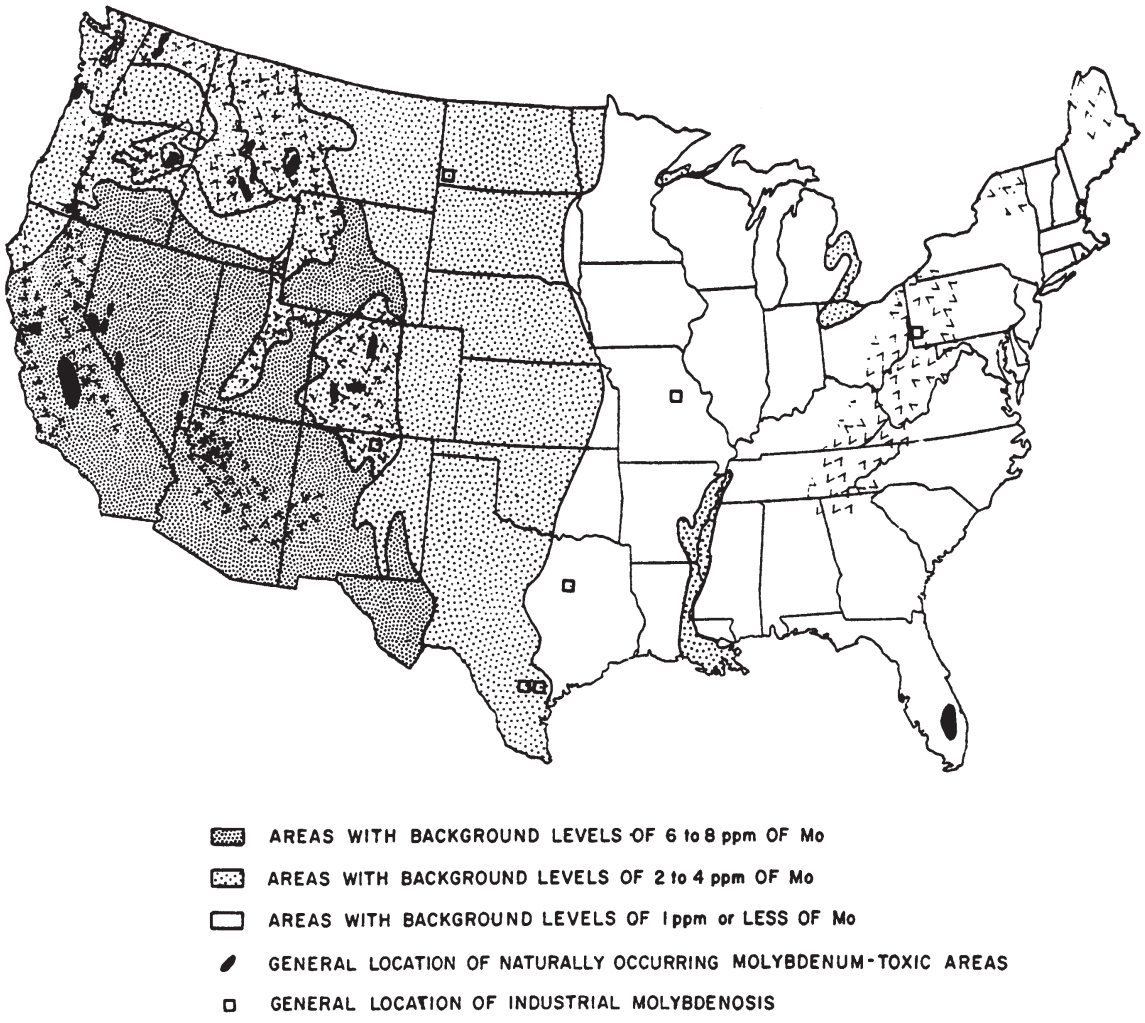


Figure 6. Generalized regional pattern of molybdenum concentration in legumes of the United States (ppm = 1 $\mu g/g^{-1}$). From Kubota, 1977, by courtesy Marcel Dekker, Inc.

All soil maps were taken from Kubota, Welch, and Van Campen. 1987. Adv. Soil Sci. 6:189-215.

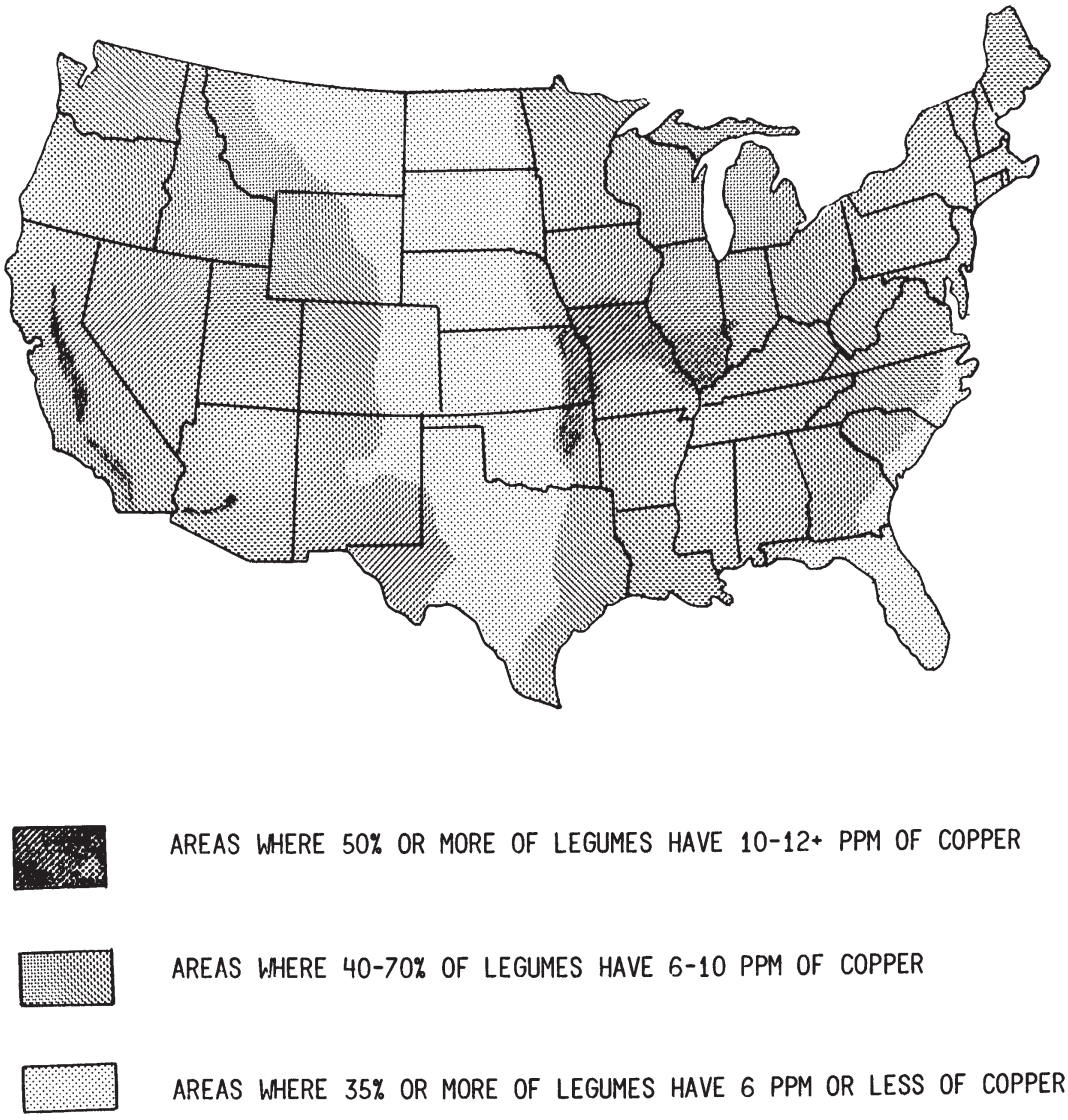


Figure 7. Generalized distribution of copper concentration in legumes of the United States (ppm = 1 $\mu g/g^{-1}$). From Kubota, 1983a, by permission Amer. Society of Agronomy.

All soil maps were taken from Kubota, Welch, and Van Campen. 1987. Adv. Soil Sci. 6:189-215.

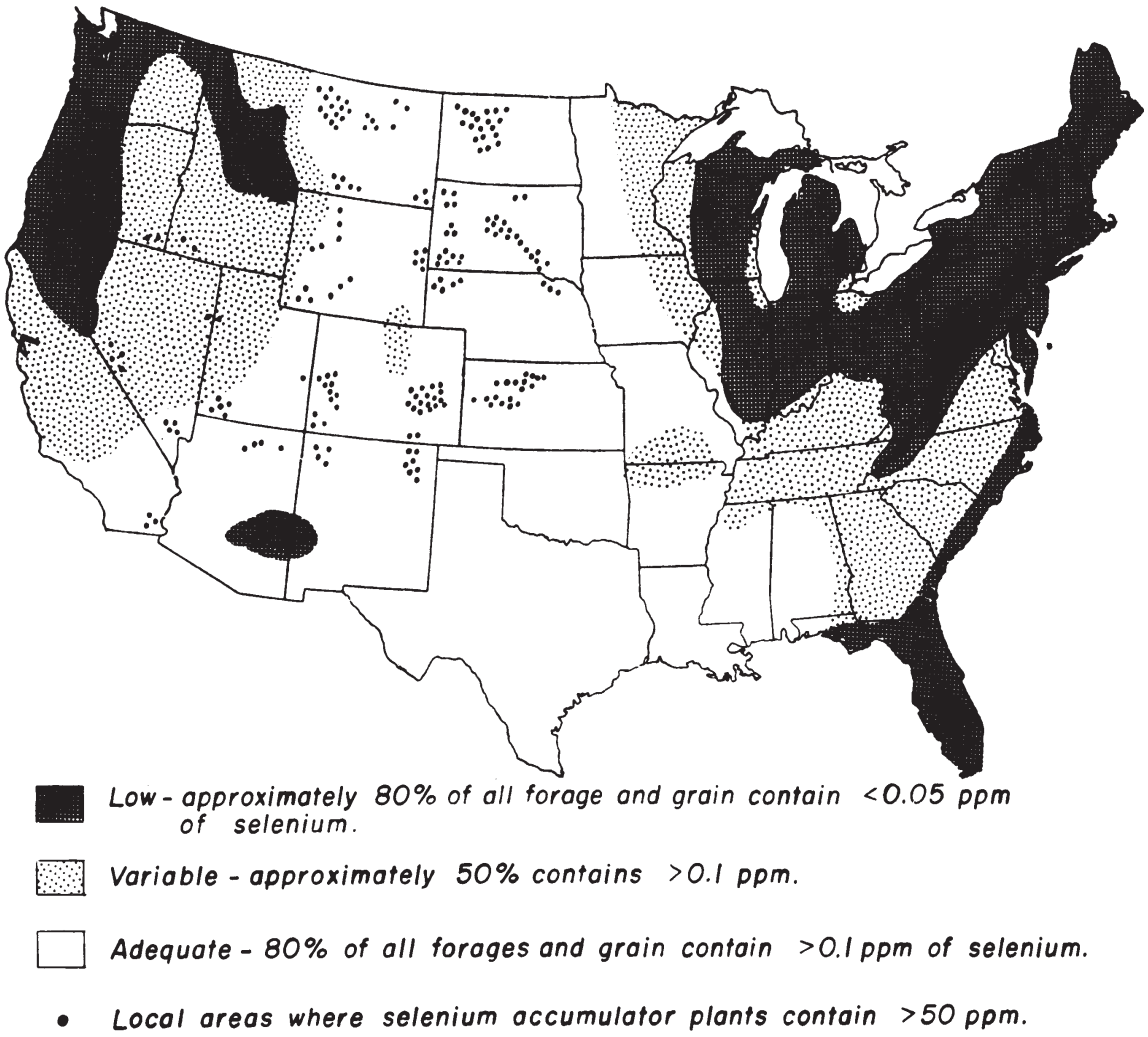


Figure 8. Geographical distribution of low-, variable-, and adequate-Se areas in the United States (ppm = 1 μg/g). From Kubota and Allaway, 1972, by permission Soil Science Society of America.

All soil maps were taken from Kubota, Welch, and Van Campen. 1987. Adv. Soil Sci. 6:189-215.

Definitions useful for this section

Acidosis - A disease usually caused by feeding too much grain or increasing the level of grain in the diet too rapidly. It results in the rumen having very acid conditions, and endotoxins may be produced that adversely affect various parts of the body.

Body condition score - Abbreviated BCS. Applying a numerical score to describe the amount of muscle and fat cover on an animal. Usually performed by feeling along the backbone in the loin area, over the ribs, and at the breastbone (sternum). Scores range from 1 (extremely thin) to 5 (extremely obese).

Browse - Vegetative parts of woody plants, primarily leaves and twigs, that typically contain high levels of tannins.

Carbohydrates - The major energy source found in most feedstuffs. Carbohydrates contain twice as many hydrogen atoms as carbon and as many oxygen atoms as carbon, commonly designated as CH_2O. They include substances such as sugar, starch, fiber, cellulose, and hemicellulose.

Cellulose - A major structural carbohydrate in plants. A component of fiber that is poorly digested by nonruminant animals. Cellulose is composed of glucose molecules chemically linked by a "beta" linkage that is only digested by bacteria such as those in the rumen and(or) cecum.

Coccidiosis - An infectious intestinal disease caused by protozoan organisms (coccidia). The disease causes diarrhea and damages the lining of the intestine. Moisture, stress, and unsanitary conditions are conducive to coccidiosis.

Concentrates - A feed with less than 20% crude fiber and usually more than 60% TDN on an as fed basis. Often a mixture of feedstuffs with added minerals and vitamins.

Crude fiber - The more fibrous, less digestible portion of a plant primarily consisting of cellulose, hemicellulose, and lignin. A method of estimating the fiber content of a feedstuff through sequential extraction with acid and alkaline solutions.

Enterotoxemia - A disease caused by an overgrowth of bacteria (*Clostridia perfringens*) in the intestine usually due to fermentation of a large quantity of starch, with production of endotoxin. Usually causes rapid death of animals.

Fiber - A component of the feed that consists of cellulose, hemicellulose, and lignin. It is necessary for normal rumen health.

Forage - The edible part of the plant, other than separated grain, that can provide feed for grazing animals.

Founder - Refers to a consequence of acidosis, resulting in rapid growth of the hoof.

Mineral - The inorganic group of nutrients including elements such as calcium, phosphorus, copper, etc.

Nutrient - One of six classes of chemical compounds having specific functions in the nutritive support of animal life.

Nutrient requirements - The level of specific nutrients required to keep an animal healthy and productive.

Nutrition - The study of nutrients, determining what nutrients are required, what levels of nutrients are necessary for various levels of productivity, and how to provide those nutrients.

Polioencephalomalacia, PEM, or 'polio' - A neurological disease of goats caused by thiamine deficiency. The rumen normally produces adequate levels of thiamine, but under some conditions such as a high grain diet, high sulfur in the diet, stress, or being 'off feed,' the thiamine is degraded, thus causing the disease.

Stockpiled forage - Forage that is allowed to accumulate for grazing at a later time.

Supplement - A feed designed to provide nutrients deficient in the animal's main diet.

TDN - Total Digestible Nutrients, a measure of digested energy. A lb of TDN equals 2,000 Calories (kilocalories).

Vitamins - Specific organic substances required for various metabolic functions.

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Internal Parasite Control for Meat Goats

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Introduction

Two of the most common questions on the minds of many goat producers are; "when should I deworm my goats?", and "what should I use to do so?". Unfortunately, there are no simple answers to these questions because all production programs differ in many ways. Therefore, we will look at some of the factors that affect these answers so you can better make the decisions for your herd.

When it comes to internal parasites, goats have special problems. In cattle, roundworms are usually an economic problem in that they waste feed inputs and decrease growth and production. In goats, these same considerations are valid, but the very life and health of the animal may be threatened by *Haemonchus contortus*, or the "barber pole worm." It bleeds the goat and causes death by anemia. In addition there is a serious lack of parasiticide drugs that are labeled for legal use in goats. Only two such drugs exist at this time and research has shown that neither is very effective on Oklahoma goat farms. While there is a strong temptation to use drugs labeled for cattle or sheep according to the dose and route of administration for these species, goats are actually very different. Using cattle or sheep doses and routes will likely not be effective and can lead to resistance problems.

The reason for the lack of research and availability of legal drugs for use in goats is simple economics. A market of one million goats just can't support the research and development costs that a market of 100 million cattle can. For this reason, many of the drugs used today are used "off-label". This means that in order to be legal they must be prescribed by a licensed veterinarian who has first hand knowledge of the animals. Because all goat operations are different and any effective program will probably involve usage of off-label drugs, your local veterinarian is the best source for helping you set up a comprehensive treatment and management parasite control protocol for your farm.

Life Cycle of Roundworms

Although there are many different roundworms that live within livestock, they all have very similar life cycles. A common characteristic is that part of the life cycle takes place inside the host animal and part of it is lived in the environment. Although details will vary between parasites, the cycle can be broken down into three stages: a developmental period, a prepatent period, and a patent or adult period. Understanding what happens in each period will help to understand how management practices can reduce parasite burdens.

The developmental period is the time that the parasite lives in the environment. This period starts when the eggs passed in the host animal's manure hatch and the larvae crawl away into the grass. In the environment the larvae undergo several maturation changes, until the infective larvae (also called L3 or 3rd stage larvae) are able to climb up vegetation, on films of moisture, to await ingestion by a grazing animal. The rate at which this period progresses is determined by environmental conditions. Parasites prefer warm, wet conditions, so the cycle progresses faster and survivability is greatest in the early summer. This is the time of greatest pasture contamination. L3 can survive freezing conditions, but are very susceptible to drying. The eggs do not handle freezing well, but can survive drought conditions.

The prepatent period is extends from the time the L3 are ingested by a grazing animal until the mature worms start to lay eggs in the digestive tract. During this period the parasite develops through the L4 and

L5 or young adult stages, and may migrate through various tissues of the body during these stages before taking up residence inside the digestive tract. The preferred area of residence in the gut will vary with the species of worm. The prepatent period usually lasts from 2 to 3 weeks in young animals. Due to the higher level of immunity in adults, the prepatent period may last longer. This is important in timing parasite control program as this is how long it takes from ingestion until that animal starts contributing to pasture contamination. It is also possible for the L4 to enter an arrested development phase by burrowing into the wall of the gut if environmental conditions are not conducive to starting another generation. This allows the parasite to over-winter in the goat as well as in the environment.

The adult or patent period is the time when adult worms are present in the gut and shedding eggs into the environment via the stool. This is the time when the worms are most susceptible to control by parasiticide drugs. In the case of Haemonchus, this is also the time that the adult worm is attached to the gut wall and sucking blood from the host. Adult Haemonchus females can produce up to 5,000 eggs per female per day, and go through as many as 4 generations in one season. The adult barber pole worm population in the digestive tract of the goat can consume up to 1/10th of the goat's total blood per day.

Deworming Programs

Parasite control programs can be categorized as either therapeutic, tactical or strategic. Implementing the right program will have a tremendous impact on the level of rewards you reap from your goat operation.

Years ago all parasite programs were therapeutic programs. These involved treating the animals only when the condition progressed to the point where it caused clinical disease. At this point the program becomes an effort to salvage the affected animals. Therapeutic programs do nothing to address the subclinical losses such as decreased performance, nor do they address the problem of pasture contamination.

Tactical parasite control programs involve treating all animals in the population, often when it is convenient for the herdsman. Tactical programs help to minimize subclinical losses, but they probably do not minimize recontamination and may, in fact, contribute to parasite drug resistance problems.

Strategic parasite control programs involve a combination of management, responsible drug usage, and proper timing to ensure that animals are grazing "parasite safe" pastures for most or all of the year. Strategic programs usually take less drug inputs but require more in management, observation and herdsmanship. They address all the issues of clinical disease, subclinical losses, and contamination of the environment with subsequent reinfestation.

Parasite Control Drugs

Drugs available today for parasite control fall into four classes. It is important to know which active ingredients are in which classes because usually, when resistance occurs to one drug it confers to other drugs within that class. The main concern with parasite resistance to drugs that we have today is due to the fact that there are no new drugs on the horizon. It takes up to 10 years to get approval for a new drug and there are currently no parasite control drugs in development. Most of the drugs on the market today still work very well in cattle. Since this is the major market for food-animal drugs, there is no incentive for drug companies to undertake the massive cost of getting new drugs on the market at this time.

Only two of the drugs in the table above, albendazole and morantel, are labeled for legal use in goats. All other parasite control drugs, when used in goats, constitute "off label use" which is the domain of licensed veterinarians. As stated above, goat dosages are not the same as for sheep and cattle because their metabolism is not the same. Goats have larger livers as a percent of their body weight so they clear the drugs faster. The route of administration may also be different. Goats do not absorb drugs as easily through their skin as do other food animals. In addition to providing the correct dosage and route of administration instructions,

the prescribing veterinarian must also address the correct withdrawal time requirements for goats. Goats, when slaughtered, are randomly sampled for drug residues, and any violations are attributed to the producer who originally marketed the goat. Violations can lead to federal prosecution, stiff penalties, and for repeat offenders even incarceration.

Examples of active ingredients in the different classes of de-wormer medications.			
Benzimidazoles	*Imidazothiazoles*	*Macrocylic Lactones*	*Tetrahydropyrimidines*
Albendazole	Levamisole	Doramectin	Morantel
Fenbendazole		Eprinomectin	
Oxfendazole		Ivermectin	
		Moxidectin	

Drug Resistance

Not many years ago we began to hear of farms in Australia and New Zealand where they could no longer graze small ruminants because of the resistance of the parasites to parasite control drugs. Today we have farms in the Southeast United States that have the same problem. A recent study done by Langston University shows that serious resistance to parasiticides is developing on most goat farms in Oklahoma. Although there is nothing we can do to completely eliminate this resistance, today's parasite control programs must be designed to slow and delay it as much as possible. We can achieve this by proper use of the drugs we have, incorporating management practices into the plan, and selecting the right individuals to build our future herds on.

The following chart shows the degree of resistance found on several Oklahoma farms to Ivermec, Valbazin, Levisole, and in one case Cydectin. The numbers in the respective columns represents the percent kill the drugs achieved based on the results of fecal egg count reduction tests.

FARM	IVM	VAL	LEV	CYD
1	12	87	98	
2	37	88	99	
3	7	67	99	
4	63	85	92	
5		55	99	100
6	46	42	98	
7	41		91	
8		0	97	
9	69	74	94	

We get drug resistance because we select for it, or because we pay good money for it and bring it home in animals we purchase from other farms who have selected for it. When we deworm using drugs that are not completely effective, or when we use dosages that are too low, we kill the more susceptible worms and leave the more resistant worms. These resistant worms then become the parents of the next generation of worms. Over time as our program selects for more and more resistant worms, the drugs are less and less effective.

When deworming, it is important to leave some susceptible worms to provide competition for the resistant ones. It is also important to know what drugs are or are not effective on your farm. When half of the worms are killed you will see a good clinical response, but it will be short lived and deworming will get more and more frequent. If anything less than 95% of the worms are killed, resistance is developing. This means that by the time that you are aware clinically that the drug you are using is no longer effective, the kill rate has dropped to less than 50% and the use of this drug is lost to you. Once parasites are resistant to a drug, the resistance lasts for many years. A means to measure the effectiveness of parasiticide drugs is discussed later in this paper.

Newly purchased animals should be quarantined and aggressively dewormed in a dry lot until stool samples are shown to be clean. This prevents introducing someone else's resistance problems into your goats and across your pastures.

Management as a Parasite Control Tool

There are several ways that proper management and grazing techniques can help to control parasite problems on Oklahoma goat farms. When goats are allowed to browse as they do in nature they have few parasite problems. When we mold them to domestically managed situations we often cause these problems. Grazing and browsing systems that mimic nature as closely as possible will usually reduce the degree of parasite problems experienced.

One management technique that helps is to closely monitor the grazing height. This is not the same as the height of the vegetation. You need to actually watch and see at what level the goats are eating when they select their plants to consume. As previously stated, the L3 climb on a film of water up the vegetation so that they can be ingested. Their ability to climb, however, is not limitless. Eighty percent of the infective larvae are located in the lower 2 to 3 inches of vegetation. The goats will get almost no infective larvae if they are grazing at or above the 4 to 5 inch level. Time of grazing also is important. The film of water is vital for the larvae to climb. Producers with heavily contaminated pastures during warm and wet times of the year may consider confining the goats at night and turning them out to graze after the dew is off the plants. This greatly reduces the infestation rate.

Pasture rotation is beneficial to improve pastures and maximize utilization of the forage. It is commonly thought that this practice also reduces parasite problems, but this may or may not be true. In order to be effective as a parasite control technique, rotational grazing must be timed to break up the life cycle of the roundworms. If the animals stay in one paddock long enough for the eggs to hatch and mature to the L3 stage, or if they go around the system and return as the larvae mature to the L3 stage, the rotation doesn't help with control. Additionally the timing will change as the season, and thus the maturation process, changes.

Perhaps the most important management tool in controlling parasites is to treat only the individual goats that need help. This helps to maintain a base population of susceptible worms to compete with resistant worms. It is equally important to identify and cull those animals that repeatedly have problems. Eighty percent of the eggs that contaminate the pastures are passed by 20% of the goats. There is a good economic reason for culling these problem individuals as well. A culled goat is worth a lot more than a dead goat.

Larger commercial producers should consider a multiple species grazing program, usually involving goats with cattle or, less frequently, horses. Although all domestic animals have roundworms that are closely related, the actual species of worms are host specific. This means that cattle worms cannot develop in goats and goat parasites cannot develop in cattle. When one type of animal ingests the infective larvae of another type of animal, those larvae are essentially cleaned up or eliminated. There are economic benefits as well because cattle are grazers and prefer grass, while goats are browsers and prefer weeds, shrubs, and brush.

There is limited overlap of their preferred food supplies and it is possible to realize two income streams from one land resource, which is usually one of the highest input costs for the operation.

Parasite Resistance and Parasite Tolerance

Some goats have more problems with parasites than others, while some goats are relatively problem free under proper management. There are actually two phenomena at play here, parasite resistance and parasite tolerance. Parasite resistance is the goat's ability to suppress the population of worms that is trying to develop in the digestive tract. This is a function of the individual goat's immune system. Some individuals may have stronger specific immunity to the worms while others just have stronger ability to respond to any immunological challenge. Both genetics and nutrition play a roll here. Parasite tolerance is the individual goat's ability to carry a given parasite load with minimal impact on the goat's system. Again, both genetic and nutritional factors come into play.

These characteristics are very desirable in Midwestern goats. Researchers at Tennessee State University have shown that there are definite differences expressed between breeds. In general, breeds that were developed in wet, rainy climates have an advantage over breeds that were developed in hot, arid climates for production of goats in areas of significant rainfall. Differences between individuals within a given breed exist as well. Record keeping is important to eliminate genetics that are predisposed to parasite problems while propagating genetics associated with fewer problems.

Evaluating Parasite Problems

In order to tailor a parasite control program for your herd, it is necessary to be able to quantify what problems you are having, how serious they are, and which individuals are having the problems. Some of the tools that facilitate this quantification are fecal egg counts, fecal egg count reduction tests, DrenchRite test, and the FAMACHA system.

Fecal egg counts are conducted by mixing a known quantity of stool into a known quantity of flotation solution and examining the resulting mix microscopically in a special egg counting slide. The result is the number of worm eggs per given quantity of stool and serves as a measure of the number of adult egg laying worms that are present in the animal. This is also an indicator of how much pasture contamination is occurring, but it doesn't give any indication of the health status of the animal.

The fecal egg count reduction test measures the effectiveness or resistance to specific parasiticide drugs. To conduct this test a sample containing at least 10 randomly selected animals serves as a control, while 10 other animals are treated with a given drug. It is important that all animals in the test be of similar age, sex, and condition. After 10 to 14 days, pooled stool samples are taken from both groups and fecal egg counts are done on both. If the drug is effective the treated group will have at least a 95% reduction in fecal egg count as compared to the control group. Reductions less than 95% indicate the severity of the resistance of the parasites on your farm to that drug. It is possible to test several drugs simultaneously with the addition of more animal groups. Once you have the required equipment, consisting of a microscope and McMasters counting slide, the test is very inexpensive. You can either have it performed by any veterinary clinic or do it yourself with minimal training. This test will help you determine which drugs to avoid, which to use, and which to save for the future.

The DrenchRite test was developed in Australia and is currently being conducted at the University of Georgia, College of Veterinary Medicine. For this test a pooled stool sample is collected from a minimum of 10 animals and sent to the lab. There the parasites are hatched and the efficacy of the various drugs is measured on the worms in a laboratory environment. The results are then reported back to you for all the various drugs tested. This is an accurate and simple measure of the parasiticide resistance status of your

herd. The lone drawback is that it is somewhat expensive, but it may well save significant losses and wasted drug expense in the long run.

The FAMACHA system was developed in South Africa as a way to determine which individuals needed to be treated for parasites. It compares the color of the animal's mucous membranes, such as the inside of the eyelids, to a standardized color chart. By detecting anemia in the individual you can treat only those animals that are in danger of clinical disease or death. By keeping a record of the findings on the individuals within the herd you can recognize which goats are perpetual problems and should be culled, and which goats are relatively trouble free and should be perpetuated. This is a good test for the barber pole worm, but doesn't address the problem of other worms which do not suck blood, but may be lesser problems by robbing the goat of nutrition.

Conclusion

Today's major challenge for goat producers is to provide a parasite safe environment for their goats while minimizing the development of parasiticide resistance. Achieving these goals requires an understanding of the parasites, selection of the right goats, and incorporating the right management practices. Your local veterinarian can be your ally in combining these considerations into the right program for your operation.

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DHI Training

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STANDARD OPERATING PROCEDURES
FOR DAIRY GOAT PRODUCTION TESTING

Effective January 1, 2004

CONTENTS

STANDARD OPERATING PROCEDURES

1.0 SCOPE & APPLICATION

1.1 This Standard Operating Procedure (SOP) is applicable to the systematic collection of data documenting milk yield including the measuring milk fat and protein for participants in DHI. The application of these procedures is to provide the framework for a uniform, accurate record system to be used for (1) making farm management decisions; (2) educational programs and research, including the genetic evaluation of does and sires; (3) breed association(s); and (4) the promotion and sale of animals.

2.0 SUMMARY OF PROGRAM

2.1 Sampling should be done in accordance with the National DHIA Uniform Operating Procedures (UOP). All UOP procedures, unless specific to dairy cows only, are to be followed. For purposes of compliance, the use of the terms “cows and heifers” is synonymous with “goats and kids”.

2.2 Procedures outlined in this document are specific to dairy goat production testing only. These basic and minimum standards are to be uniformly followed. They serve to ensure that records will provide the accuracy, uniformity, and integrity essential to dairy goat production records.

3.0 AUTHORITY

3.1 A Memorandum of Understanding exists between the ADGA and the Agricultural Research Service of the United States Department of Agriculture (USDA) to ensure the flow of DHIA records for industry purposes including genetic evaluation programs.

4.0 RESPONSIBILITY

4.1 DHIA dairy goat test supervisors and herd owners as well as persons in their employ are individually and collectively responsible for adherence to these Procedures.

4.2 To participate in this dairy record keeping program, herdowners must agree to conform to these procedures, registry requirements, the NDHIA Uniform Operating Procedures and the associated Code of Ethics.

5.0 DEFINITIONS

5.1 **Dairy Goat -** any goat from which milk production is intended for use or sale, or which is kept for raising replacement dairy kids and is an integral part of the dairy herd.

5.2 **Test Supervisor (TS) –** Any person authorized to collect milk weights and samples for inclusion in the Goat Genetic Evaluation Program (interchangeable with ‘tester’, ‘field sampler/technician’ or ‘supervisor’).

5.3 **Group Testing** – Must meet registry requirements. Each member of the test group is trained to perform supervisor responsibilities when weighing and sampling milk in the herds of other group members. All group testing is conducted under the jurisdiction and supervision of the DHIA.

6.0 PERSONNEL QUALIFICATIONS

6.1 All Test Supervisors are required to be approved by the DHIA of record prior to engaging in any field collection activities.

6.2 Training should be done in accordance with the Council on Dairy Cattle Breeding (CDCB) QCS Field Service requirements with the following being specific to dairy goat testing.

7.0 MINIMUM PERSONNEL TRAINING REQUIREMENTS

7.1 The minimum requirements for new test supervisors (TS) to test non-commercial herds (as determined by the herd's DHIA) without immediate supervision include demonstrated knowledge of (1) barn and parlor techniques, (2) data entry, (3) the *Code of Ethics* and *Uniform Data Collection Procedures, and (4) the Standard Operating Procedures for Dairy Goat Testing*. Commercial herds must have testers meeting the criteria of the CDCB auditing guidelines.

7.2 Documentation of the initial training must include (1) the name and date of training of the new TS, (2) the name and credentials of the trainer, and (3) a list of the topics covered during the training.

7.3 Continuing Education (CE) or refresher sessions should be provided in accordance with the CDCB Auditing guidelines. In addition, newsletters, videos, attendance at an ADGA annual meeting training session can serve as meeting CE requirements. Documentation must include (1) the name of each TS, (2) the name and credentials of the trainer, and (3) a list of the topics covered during the training.

7.4 TS other than those approved to test cowherds or commercial herds (as determined by the herd's DHIA) must obtain CE or attend an initial or a refresher session every 3 years. This is an exception to the CDCB auditing guidelines as it applies to those testers supervising herds using 'pail and scale' techniques. This exception is allowed as this type of test plan is subject to little change over time. Documentation of CE/Refresher must include (1) the name of each TS, (2) the name and credentials of the evaluator, (3) a list of the topics covered during the evaluation, and (4) a performance assessment based upon the CE/Refresher information provided.

8.0 EQUIPMENT AND SUPPLIES

8.1 Equipment needed for collection of dairy goat milk samples includes:

- sample vials or whirl paks*
- approved meter*, or
- sampling device (dipper) and scale*
- sample preservative
- field data sheets

*The appropriate sampling and measuring devices must be of proper composition. See Section 10 for SOP Meters and Scales

9.0 SAMPLE COLLECTION – PREPARATION

9.1 Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.

9.2 Obtain necessary sampling and/or weighing equipment.

9.3 Coordinate with herdowner and partner agencies, if appropriate.

10.0 SAMPLE COLLECTION - METHOD OPTIONS

10.1 Meters **-** All portable weighing and sampling devices being used for the generation of certified data must be of a National DHIA approved type. Meters for goat milk sampling must be calibrated in conformance to manufacturer specifications.

GOAT METERS

Manufacturer	Device	ICAR Approved	DHIA Approved
Tru-Test Limited - New Zealand	Goat Meter model 50000		Yes
Waikato - New Zealand	Goat Meter		Yes

10.2 Scales being used for the generation of milk weights to be included in the *Goat Genetic Evaluation Program* must meet the following weight tolerance ranges at each specified weight:

Pounds	Minimum	Maximum
1	0.9	1.1
2	1.9	2.1
5	4.8	5.2
10	9.7	10.3
20	19.4	20.6

10.3 All scales must be checked for calibration by a certified meter technician or an individual approved by the DHIA prior to being placed in active service. The field technician or the herdowner may own Scales. Approved individuals must calibrate scales using certified weights.
10.4 Scales should be identified with a unique identification number.
10.5 All scales must be submitted for an approved routine calibration check by a certified meter technician or an individual approved by the local DHIA on an annual basis.
10.6 All scales receiving repairs that may have affected accuracy must be checked for calibration by a certified meter technician or an individual approved by the local DHIA before returning to active service.
10.7 Each scale must be identified with a tag, sticker, engraving, or other marking indicating the last calibration year and meter center used.
10.8 Documentation of scales must include (1) the make and unique identification number of the scale, (2) the meter technician's or approved individual's name, (3) the meter center used, (4) the date of calibration check, and (5) the final calibration check readings.
10.9 Dip Sampling must be done in a manner that assures a representative sample from the entire milk volume collected.

11.0 SAMPLE HANDLING AND PRESERVATION

11.1 Use pre-preserved sample vials.
11.2 Samples should be kept at room temperature and out of direct sunlight.
11.3 Keep samples in control of the tester – ***EXCEPTION*** – for group tests, samples may also be in control of the group leader, or person designated to ship the samples/data to the laboratory.
11.4 Record all pertinent data on a field data sheet.
11.5 Samples should be shipped so that they arrive at the lab no later than 6 days after the test is performed.

12.0 DATA COLLECTION AND RECORDS MANAGEMENT

12.1 When a breeding date is available, and a doe freshens less than 10 days prior to the expected kidding date, it will be considered a normal kidding and the record initiated will be used for buck and doe evaluations. Does freshening 10 days or more prior to the expected kidding date, whether in milk or dry, will be coded as abnormal and the record initiated will not be used for buck and doe evaluations.
12.2 If a doe aborts while in milk and has carried a kid less than 80 days, her current record will continue without interruption. If a breeding date is not available, and the doe aborts while in milk for less than 240 days, her current record shall continue without interruption. Except for specific situations stated above, the current record shall end and a new lactation will begin.
12.3 Verification tests may be a required condition of test type plan or registry recognition level. It is the herdowner's and/or test supervisor's responsibility to arrange for such tests dependent on registry or regional requirements. Verification testing should be done in accordance with registry policies.
12.4 All data and information must be documented on field data sheets
12.5 Minimum Suggested Record Retention

- Field Sheets – 2 years
- Record Center sheets – 2 years
- Verification Sheets – 2 years

13.0 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

All field QC requirements of the ADGA QA Project must be followed.

14.0 REFERENCES

Dairy Goat Registry Guidelines, 2003
Uniform Operating Procedures, June 2002
California DHIA, Dairy Goat QC Program
Council on Dairy Cattle Breeding, Auditing Guidelines, June 2002

American Dairy Goat Association - Application for Registration or Recordation

1. **Name**
   1st Choice
   2nd Choice
   If name is not available, we will alter unless you check here for return. ☐
   AI or ET Mating?

2. **Name of Sire** & his **ADGA** number (indicate if unknown or unregistered).
   Reg # **Name** **Leased?**

3. **Name of Dam** & her **ADGA** number (indicate if unknown or unregistered).
   Reg # **Name** **Leased?**

4. **Breed**

5. **Color & Markings** (Limited to 69 letters & spaces)

   Conforms to which breed standard?

6. **Sex -**

7. **Date of Birth** **How many in birth? Bucks** **Does**

8. **Horn Information** **Ears**

9. **Tattoo(s)**
   Additional tattoo information, ie. state code (optional) - please specify location
   Electronic ID Chip Location ☐ Tail ☐ Base of Ear ☐ Shoulder ☐ Flank ☐ Dewclaw Other

10. **Breeder** -Name, address & ID # of owner of dam at date of service.
    ID #
    Breeder
    Address
    City, State & Zip

11. **Signature** - I hereby certify to the truth & accuracy of the above data. I offer this goat for entry in ADGA's Herd Register.
    Signature
    _____ ID #
    Address
    City, State & Zip

12. **Transfer** - On , I sold above goat to:
    Signature of Seller
    _____ ID #
    ID #
    Name of Purchaser
    Address
    City, State & Zip

13. **Fees**

	Member Postmarked		**Nonmember** Postmarked	
	Sep 1 - Mar 31	**Apr 1 - Aug 31**	**Sep 1 - Mar 31**	**Apr 1 - Aug 31**
Doe under 30 months	$ 7.50	$ 8.50	$14.00	$15.00
Doe 30 months or older	11.00	12.00	21.00	22.00
Buck under 24 months	13.50	14.50	26.00	27.00
Buck 24 months or older	26.00	27.00	51.00	52.00

Buck Registration Fee (includes performance pedigree) $
Doe Registration/Recordation $
4-Generation Performance Pedigree for Doe $
Transfer $
☐ Rush Fee Enclosed $
Donation - Promotion ☐ Research ☐ Scholarship ☐ $

Name or ID # of Person Submitting Application

VISA/MasterCard # Exp Date Name on Card

Herd Code: _____-_____-_____ Verification Test Date:_____

DHIR Test Plan: ❑ ADGA-00 ❑ ADGA-01 ❑ ADGA-02 ❑ O/S-40 ***One Day Milk Competition?*** Yes: ❑ No:❑

❑ DHIR-20 ❑ DHIR-21 ❑ DHIR-22 ❑ DHIR-23 ❑ Other? _____ Previous Test Date:_____

American Dairy Goat Association
SUPERVISOR'S REPORT of DOE or HERD VERIFICATION TEST
ADGA VT 10/03

Herd Name_____ Person in Charge of Herd_____

Address_____ Telephone/E-Mail_____

Regular Tester_____ Tester ID #_____

PLEASE ANSWER ALL QUESTIONS COMPLETELY AND IN DETAIL, WHERE NECESSARY.

HERD INFORMATION # of Strings_____ # of Does in Milk: registered_____other_____

1. Are registration papers available for all registered does in milk & on test? Yes ❑ No ❑
   (All ADGA does must be registered at time of verification)
2. Are any breeds not on test? _____
3. Are all milking does of the breeds on test, regardless of ownership, being tested? Yes ❑ No ❑
4. Were all does for DHIR verification requirements identified by a **permanent** form of identification? Yes ❑ No ❑
5. What type(s) of visible ID are used for the herd? _____
6. # of does not visibly identified: _____ reason(s): _____
7. Is a milking machine used? Yes ❑ No ❑ _____
8. List weather conditions, feeding, or recent management changes that might have affected production:_____
   _____
9. Note any other variation from the normal milking procedure that may have taken place at the time of test:_____
   _____
   Use additional sheets if necessary, identify each page with herd code.

APPROVED WEIGHING & SAMPLING DEVICES

10. ❑ Scales: 1/10th increments? Yes ❑ No ❑ 11. Date of last calibration: _____
12. ❑ Meters: (Indicate type) _____ 13. Date of last calibration: _____
14. Other comments or observations:_____
    _____

DOES MEETING VERIFICATION TEST REQUIREMENTS – Use additional sheets if necessary, identify each page with herd code.

Index/ Control #	Reg. #	Age Yrs/Mos	Lact. No.	Date Kidded mm/dd/yy	Actual DIM	Actual Milk	Actual Butterfat	Actual Protein	Projected Milk	Projected Butterfat	Projected Protein

ADGA VT: 10/03

American Dairy Goat Association
DHIR Herd Listing

Barn Name	Registered Name	**Registry #	Date of Birth

**The DHIA #'s are on the registration papers just below the owner information. Use the breed code & the DHIA number for this column. For example: S181063423 (Inserting the '18' denotes an American Saanen) N1054332 (Purebred Nubian)

ADGA * P.O. Box 865 * Spindale, NC 28160 * (828) 286-3801 * Fax (828) 287-0476 * adga@adga.org * www.adga.org

On January 1, 1997 the DHIA Uniform Operating Procedures became effective and permitted herd owners to customize their testing plan to the management needs of their dairy. Herds no longer had to conform to one of the DHIA testing plans. However, USDA continues to use the type of test codes for reports and for several applications. Processing centers continue to use the type of test codes to specify how lactation records are calculated.

NCDHIP TESTING PLANS - JANUARY 1, 1993

Testing Plan Name	Testing Plan Tag	Type of Test Code for Data Processing	Description of Testing Plan
Official DHI	DHI	00	All milkings are weighed and sampled each test day.
Official DHI AM-PM with Milking Interval Monitoring Device	DHI-AP-T	01	One milking weighed and sampled each test day in 2x herds, alternating AM to PM milking. Two milkings weighed and one milking sampled each test day in 3x herds, rotating the milkings.
Official DHI w/Alternate AM-PM Component Sampling	DHI-APCS	02	All milkings weighed and one milking sampled each test day, rotating the milking sampled.
Official DHIR	DHIR	20	Same protocol as DHI with additional rules imposed by breed associations.
Official DHIR AM-PM w/Milking Interval Monitoring Device	DHIR-AP-T	21	Same protocol as DHI-AP-T with additional rules imposed by breed associations.
Official DHIR w/Alternate AM-PM Component Sampling	DHIR-APCS	22	Same protocol as DHI-APCS with additional rules imposed by breed associations.
Official DHIR AM-PM	DHIR-AP	23	Same protocol as DHI-AM w/additional rules imposed by breed associations. May not be accepted by all breed associations.
Official DHI AM-PM, Milking Interval Monitoring Device Not Required	DHI-AP	31	Same protocol as DHI-AP-T except in lieu of a milking interval monitoring device, test day/milk shipped relation must be monitored and Record Standards data must be reported.
Official DHI Milk Only	DHI-MO	33	All milkings weighed each test day. No samples taken for component analysis.
Official DHI Milk Only AM-PM	DHI-MO-AP	34	One milking weighed each test day in 2x herds, alternating from AM to PM milking. Two milkings weighed each test day in 3x herds, rotating the milkings. No samples taken for component analysis.
DHI Owner-Sampler	DHI-OS	40	Dairy producer weighs and samples all milkings each test day.
DHI Owner-Sampler AM-PM	DHI-OS-AP	41	Dairy producer weighs and samples one milking each test day in a 2x herd, alternating from AM to PM milking. Dairy producer weighs two milking and samples one milking each test day in a 3x herd, rotating the milkings.
DHI Owner-Sampler with AM-PM Component Sampling	DHI-OS-APCS	42	Dairy producer weighs all milkings each test day and samples one milking, rotating the milking sampled.
DHI Owner-Sampler Milk Only	DHI-OS-MO	43	Dairy producer weighs all milkings each test day. No samples are taken for component analysis.
DHI Owner-Sampler Milk-Only AM-PM	DHI-OS-MO-AP	44	Dairy producer weighs one milking each test day in a 2x herd and two milkings each test day in a 3x herd, rotating the milkings. No samples are taken for component analysis.

DHI Owner-Sampler w/Breed or Plant Average Component Tests	DHI-OS-AC	45	Dairy producer weighs all milkings each test day. No samples are taken for component analysis. Breed or plant average component tests are used for all cows.
DHI Owner-Sampler AM-PM w/Breed or Plant Average Component Tests	DHI-OS-AP-AC	46	Dairy producer weighs one milking in a 2x herd and two milkings in a 3X herd, rotating the milkings. No samples are taken for component analysis. Breed or plant average component tests are used for all cows.
DHI Owner-Sampler w/Tri-monthly Component Tests	DHI-OS-TC	47	Dairy producer weighs all milkings each test day. Samples for component analysis are taken from all milkings every third test day.
DHI-Owner-Sampler Milk-Only with Tri-monthly Milk Weights	DHI-OS-MO-TMW	48	Dairy producer weighs all milkings each test day. Test days occur at 3-month intervals. No samples are taken for component analysis.
DHI Commercial	DHI-COMM	60	DHIA supervisor weighs and samples all milkings each test day. One or more of the NCDHIP Rules are not adhered to.
DHI Commercial AM-PM	DHI-COMM-AP	61	DHIA supervisor weighs and samples one milking in a 2x herd and weighs two milkings and samples one milking in a 3x herd, rotating the milkings. One or more of the NCDHIP Rules are not adhered to.
DHI Commercial w/Alternate AM-PM Component Sampling	DHI-COMM-APCS	62	DHIA supervisor weighs all milkings each test day and samples one milking, rotating the milking sampled.
DHI Commercial Milk-Only	DHI-COMM-MO	63	DHIA supervisor weighs all milkings each test day. No samples are taken for component analysis. One or more of the NCDHIP Rules are not adhered to.
DHI Commercial Milk-Only AM-PM	DHI-COMM-MO-AP	64	DHIA supervisor weighs one milking in a 2x herd and two milkings in a 3x herd, rotating the milkings. No samples are taken for component analysis. One or more of the NCDHIP Rules are not adhered to.
DHI Supervised Sampling	DHI-SS	70	DHIA supervisor weighs and samples all milkings each test day. One or more of the NCDHIP Rules are not adhered to.
DHI Supervised Sampling AM-PM	DHI-SS-AP	71	DHIA supervisor weighs and samples one milking in a 2x herd and weighs two milkings and samples one milking in a 3x herd, rotating the milkings. One or more of the NCDHIP Rules are not adhered to.
DHI Supervised Sampling with Alternate AM-PM Component Sampling	DHI-SS-APCS	72	DHIA supervisor weighs all milkings each test day and samples one milking, rotating the milking sampled.
DHI Supervised Sampling Milk-Only	DHI-SS-MO	73	DHIA supervisor weighs all milkings each test day. No samples are taken for component analysis. One or more of the NCDHIP Rules are not adhered to.
DHI Supervised Sampling Milk-Only AM-PM	DHI-SS-MO-AP	74	DHIA supervisor weighs one milking in a 2x herd and two milkings in a 3x herd, rotating the milkings. No samples are taken for component analysis. One or more of the NCDHIP Rules are not adhered to.
DHI Basic Management Information	DHI-BASIC	80	A family of testing plans offering basic management information. These are operated differently in each DHIA, with data processed either at a DRPC or by the DHIA on an in-house microcomputer.

Other DHI Testing Plans	DHI-OTHER	98	A catchall category used for special purposes such as identifying special data for research projects.

NATIONAL DAIRY HERD IMPROVEMENT PROGRAM
UNIFORM OPERATING PROCEDURES

CODE OF ETHICS

I. PURPOSE

This Code of Ethics provides guidelines for appropriate conduct in the production, collection, and distribution of DHIA information for all persons involved with these records.

II. UNETHICAL PRACTICES

A. Impairing the reliability of DHIA information.

B. Not cooperating fully or interfering in use of the uniform data collection procedures to record DHIA information.

C. Intentionally providing inaccurate information to, or withholding necessary information, from DHIA.

D. Engaging in management practices with the intent of misrepresenting the performance of individual animals or the herd. Among these practices are the questionable movement of animals between herds, influencing the relative performance of herdmates, and selective use of management techniques in an effort to bias the DHIA record. Management practices on test day should be representative of typical practices used on other days.

E. Permitting the collection of supervised data by a technician with a direct financial or family interest in the herd being tested.

F. Any fraudulent or unethical practice defined by the Board of Directors of National DHIA.

G. Incomplete release of production data resulting in misrepresentation of DHIA information.

III. REMEDY

Any person, corporation, or other entity violating this Code of Ethics may be subject to action by an injured party.

UNIFORM DATA COLLECTION PROCEDURES

PURPOSE:

The purpose of these procedures is to provide the framework for a uniform, accurate record system that will increase dairy farmers' net profit.

The uniform records and data thus provided are used for (1) making farm management decisions; (2) educational programs and research, including the genetic evaluation of cows and sires; and (3) the promotion and sale of animals.

AUTHORITY:

These uniform data collection procedures have been developed and adopted under the direction of National DHIA.

A Memorandum of Understanding exists between the Council on Dairy Cattle Breeding and the Agricultural Research Service of the United States Department of Agriculture (USDA) to ensure the flow of DHIA records for industry purposes including genetic evaluation programs.

RESPONSIBILITY:

DHIA organizations at all levels and DHIA technicians and herd owners as well as persons in their employ are individually and collectively responsible for adherence to these Uniform Data Collection Procedures.

These basic and minimum standards are to be uniformly followed throughout DHIA. They serve to ensure that DHIA records will provide the accuracy, uniformity, and integrity essential to all segments of the dairy industry.

All DHIA Service Affiliates, field services, laboratories, dairy records processing centers (DRPCs) and meter centers must maintain certification by Quality Certification Services to verify compliance with these standards.

To participate in this dairy record keeping program a dairy farmer must agree in writing (membership agreement or service contract) to conform to these procedures and the associated Code of Ethics.

Special conditions affecting eligibility and participation are the responsibility of the DHIA Service Affiliate.

DEFINITIONS:

DAIRY COW is defined as any cow from which milk production is intended for use or sale for human consumption, or which is kept for raising replacement dairy heifers and is an integral part of the dairy herd.

DAIRY HERD is defined according to the following principles that are generally appropriate for herds enrolled in DHIA record plans:

A. All cows of one breed, housed or managed under a single management system, regardless of ownership;

B. Farms with two or more distinct breeds may calculate and report either a composite herd average or a separate herd average for each breed.

In general, herd codes should be assigned in accord with the principles stated above. However, it is recognized that legitimate exceptions may exist that warrant assignment of separate herd codes. For example:

1. A herdowner may operate separate units under separate management systems, with no movement of cows between management units.

2. Two groups of cows may be housed together but with different ownership, management goals, and with no movement of cows from one ownership group to the other; one owner may wish to test and the other owner may not.

3. Farms with two or more distinct breeds may enroll one breed on test and not the other(s).

DHIA Service Affiliates may assign herd codes that differ from the principles in A and B if they are in accordance with the code of ethics. The decision of the DHIA Service Affiliate regarding the assignment of herd codes shall be final.

TEST is defined to be the entire process of information collection at the farm, and may include some or all of the following: weighing of milk during the milking process, electronic collection of milk weights, collection and analysis of milk samples, and collection of other data. Since the actual component testing does not generally occur at the farm, this procedure should be labeled as the laboratory test or component test.

TEST DAY is defined as the 24-hour period during which milk is weighed and sampled. Herds doing daily milk recording are permitted to use longer intervals (most commonly 5, 7, or 10 days) to estimate 24-hour test-day production if appropriately labeled. (also see section 18. I.)

DHIA TECHNICIAN – This and equivalent terms such as supervisor, tester, independent service provider, etc. define the person approved by the DHIA Service Affiliate to certify production information collected at the farm. DHIA

technicians may employ others to assist them in data collection, but the DHIA technician must provide supervision and assume responsibility for the work of their assistants.

DHIA SERVICE AFFILIATE is defined as the organization conducting DHI service for dairy farmers, often coordinating the activities of DHI Service Providers.

DHIA SERVICE PROVIDERS are Quality Certified organizations that provide one or more services to DHIA Service Affiliates, including:

A. **FIELD SERVICE** is defined as an organization that collects data and/or samples on dairy farms and arranges delivery of DHIA reports to the dairy.

B. **LABORATORY** is defined as a facility that measures the composition of DHIA milk samples.

C. **DAIRY RECORDS PROCESSING CENTER (DRPC)** is defined as an organization that provides electronic processing of DHIA records using approved procedures and rules for record calculations.

D. **METER CENTER** is defined as a facility that repairs and checks calibration of devices that weigh and/or sample milk.

DATA COLLECTION PROCEDURES

1. Collection of Milk Weights and Samples

The yield of individual cows is to be measured at the time of milking with a minimum of interference to the normal routine.

Milk samples must be representative of all milk taken from the cow during the measured milking.

All weighing and sampling devices must be used strictly according to the manufacturer's written instructions at all times.

Data for each test-day for each herd must be labeled using the following categories to identify the degree of supervision used in data recording:

A. **Supervised Test**: All test-day production data and cow identification has been recorded by the DHIA technician who is expected to collect data as accurately as possible and to use approved procedures when taking milk samples. The DHI technician should employ other technicians or assistant technicians to perform these tasks when the facilities or milking processes do not permit a single DHIA technician to observe identification, milk weights, and sample collection as they occur. (AIPL supervision code 1).

B. **Partially Supervised Test**: The DHIA technician collected production data and/or cow identification information for at least one milking on test-day and someone else collected production information and cow identification for other milking(s) on test-day and the technician certifies that the test-day information is believed to be correct and accurate. (AIPL supervision code 3).

C. **Owner conducted test**: Test-day production data and/or cow identification has been recorded by someone other than the DHI technician. (AIPL supervision
code 2.)

D. **Supervised Electronic test**: The DHI technician performed a supervised test using the electronic recording of production data and cow identification together with appropriate verification that equipment for cow identification, weighing milk, and obtaining milk samples is in good operating condition and is recording accurate measurements. (AIPL supervision code 5).

E. **Partially supervised electronic test**: The DHI technician performed a Supervised Electronic test, but cow identification was manually entered by farm employees. (AIPL supervision code 7).

F. **Owner conducted Electronic Test**: Test-day production and cow identification has been collected using electronic recording and is submitted for processing without verification by a DHI technician. (AIPL supervision code 6)

2. Standard Equipment

A. **DHIA Service Affiliates**: All equipment that is owned, leased, or used by DHIA Service Affiliates and used for collection of DHIA milk weights and/or samples:

1. Must be of a model and type approved by National DHIA for use in DHIA testing,

2. Must be in good working condition when in use,

3. Accuracy of meters must be verified whenever in doubt and at least once a year using an approved method. New meters must be tested before being used for DHI testing.

    a. Portable meters must have a durable label affixed to each device stating the date that accuracy was last verified and the meter center performing the inspection.

    b. Fixed-in-place electronic meters must have records of accuracy verification on file at the dairy and in the office of the DHIA Service Affiliate. Checks of meter performance and accuracy produced by the milking system software or by DHIA software can be used to verify the accuracy of these meters.

4. Any equipment out of tolerance must be removed from DHIA service and be repaired and retested before further use.

B. Producer-Owned Equipment: The accuracy of all producer-owned equipment used in the collection of milk weights and/or samples is the joint responsibility of the DHI Service Affiliate and the dairy producer.

It is strongly recommended that DHIA producers owning their own equipment follow the same guidelines for verifying meter accuracy as DHIA Service Affiliates. The DHI service affiliate is responsible for appropriately labeling records from herds using equipment that is not in compliance with the guidelines for DHIA owned equipment.

3. Recording Programs

DHIA offers recording programs to meet the management needs of the individual dairy. Four commonly used programs are summarized:

A. **DHI-Conventional-Supervised**: The DHIA technician weighs and samples the milk from each milking for all cows in the herd during a single 24-hour period.

B. **DHI-AP-Supervised**: The DHIA technician weighs and samples alternately at AM and PM milkings. For herds milked two times during a single 24-hour period, weigh and sample alternately for two consecutive test periods. For herds milked three times during a single 24-hour period, rotate the two consecutive milkings weighed and the one sampled across consecutive test periods. A/P factors must conform to National DHIA specifications .

C. **DHI-APCS-Supervised**: The DHIA technician weighs the milk from each milking during a single 24-hour period, and collects samples for component testing at one of the weighed milkings.

For herds milked two times in a single 24-hour period, alternate the sampled milking between AM and PM milkings for consecutive test periods. For herds milked three times in a single 24-hour period, rotate the sampled milking among all three milkings.

D. **DHI-MO and DHI-MO-AP-Supervised**: The technician weighs the milk from each milking or selected milkings during a single 24-hour period. NO samples are collected for component testing. A/P factors must conform to National DHIA tolerances.

E. **Other Recording Programs** are available through DHIA Affiliates. A list of the type of test codes and plan descriptions is available from the National DHIA office and www.dhia.org.

The off-farm use of data from these programs will be determined by the users of the records.

4. Methods for Calculating Lactation Records – Lactation totals and lactation to-date totals must be calculated using an ICAR approved method.

A. The Test Interval Method(TIM) is currently used to calculate DHI lactation and lactation-to-date totals. The test interval (number of days from the previous test day through the current test day) is divided into two equal portions. Production credits for the first half of the test interval are calculated from the previous test day information, and those for the second half of the test interval are calculated from the current test day information. The totals for the two portions of the test interval are added to obtain the interval totals.

Production totals from the first day of the lactation until the first test day are based on the first test day information; and production totals for the interval from the last test day until the record is terminated are based on the last test day information. In either case, an approved regression factor shall be used to accurately reflect actual milk production and current test day. The next test interval begins on the following day. DRPCs are permitted to adjust credits for the test interval based upon average lactation curve effects, provided such adjustments more nearly reflect daily production and have been approved by National DHIA.

B. The Best Prediction method is used by AIPL for prediction of lactation totals from completed test days as a correlated response. Best Prediction produces more accurate genetic evaluations, and may be used for DHI record calculations.

5. Cows to be Tested

A. All dairy cows in the herd with the same herd code, which have ever calved, will be enrolled on a DHI record plan. Dairy cows may be removed from a DHI record plan only when they leave the herd permanently. Dairy cows used as embryo recipients are to be included.

B. Cows classified as Dry Donor Dams, may be permanently assigned to a separate Dry Donor string in the herd or to a separate Dry Donor herd. No data on the Dry Donor Dam will be included in herd average or management information. Dry Donor Dams that later calve will be returned to the milking herd, and a 365-day dry period with 0 production data applied against the herd average in the current test interval.

6. Identification

A. All cows must be identified with a permanent number for genetic evaluation. Permanent identification consists of a USDA Animal Identification Number (AIN) eartag, American ID eartag number, national uniform series eartag, or breed association registration number. If the eartag is not in the ear, the number must be cross-referenced to a picture, sketch, or a brand or tattoo that is unique within that herd.

B. For a supervised test, the DHIA technician must be able to visibly identify the cow quickly and accurately during the milking process. All visible identification must be in place on the cow prior to the beginning of the milking, and be visible from several feet. Visible identification must be cross-referenced to permanent identification if the data are to be used in genetic evaluations.

C. For all DHIA records (supervised, electronic, and unsupervised) changes in identification after the second test following the cow's entry into the herd will result in the cow's records being permanently labeled on the records transmitted throughout DHIA and on all publications of the records. Changes in identification may occur in one or any combination of the following data fields: cow ID number, cow birth date, or sire ID (consistent with reference notes for USDA-ARS-AIPL formats).

7. Bulk Tank Measurements

Bulk tank pick-up weights shall be recorded (data for shipments immediately prior to date of test) indicating the number of milkings (or days) included in each shipment. If pick-up's do not contain complete days production the DHI technician shall report their best estimate of each day's milk delivered.

If bulk tank weights are not available, the fact that they cannot be obtained, and the reasons why, should be reported in writing to the DHIA Affiliate.

Bulk tank pick-up weights for appropriate days may be used as verification of the accuracy of production credits of the herd.

8. Fresh Cows

A cow fresh four or more days will have her milk weighed and/or sampled beginning the evening milking of the fourth day after calving (morning of the fifth day for AP records), counting the day of calving as the first day. The record begins on the calving date.

9. Dry Cows

The dry date is the first calendar day the cow is not milked. Cows turned dry on test day will have their production credits projected forward from the previous test day, using the previous test day production data and approved National DHIA estimation procedures.

10. Cows Leaving the Herd

The calendar day the cow leaves the herd counts as the last day in the herd, with production being credited for that day.

11. Cows Entering the Herd

Any lactating cow entering the herd will start receiving production credits in the new herd on the calendar day following the last day of credits in the former herd.

12. Sick or Injured Cows

Actual production should be recorded on test day for all sick, injured, or in-heat cows and be coded as abnormal on the barn sheets at the time of milking. The milk weight will be adjusted by the DRPC for cows so coded if the percentage decrease in total daily pounds of milk from the previous test day exceeds the percentage obtained with the following formula:

> Percent = 27.4 plus 0.4 x days in the previous test interval.
> (As an example, for a 28-day test interval: Percent = 27.4 + (0.4 x 28) = 38.6%, and the test day weight will be adjusted if the decrease is more than 38.6%)

This does not apply to milk weights routinely adjusted at the beginning or end of lactation.

If the first test day is coded abnormal the succeeding test day will be used to calculate percentage decrease.

13. Cows Aborting or Calving Prematurely

Cows freshening 30 or more days prior to the expected calving date, whether in milk or dry, will be coded as abnormal (abortion). When a breeding date is available, a cow calving less than 30 days prior to the expected calving date will be considered a normal calving.

If a cow aborts while in milk and has carried a calf less than 152 days, her current record will continue without interruption. If a breeding date is not available, and the cow aborts while in milk for less than 200 days, her current record will continue without interruption. Except for the specific situations above, the current record will end and a new lactation will begin.

14. Cows Calving Without Going Dry

If a cow calves without a dry period, the record will end on the day immediately preceding the calving, and the new lactation will begin on the day of calving.

15. Prepartum milk will not be counted as part of the lactation, and it will not be included in the lifetime production record.

16. Cows Milked More Than Twice Per Day

Herds or cows normally milked more than twice per day will follow the same milking routine on test day.

Lactation records obtained by milking cows more than twice per day for all or part of the lactation will be labeled according to National DHIA procedures.

Herd averages, where some or all of the cows are milked more than two times a day, will be so labeled. The number of times the herd is milked daily will be rounded to the nearest whole number.

17. Missing Milk Weights and/or Samples

When complete milk weights or samples are not obtained on test day or are lost, the missing data will be estimated or the test period spanned by the DRPC, using procedures outlined below. All estimated or missing data will be appropriately labeled. Only actual data will be sent for use in genetic evaluations. Reasons for lost or missed milk weights and/or samples will be recorded by the DHIA technician. All adjustments to production credits will be made by the DRPC with routine programming. Exceptional cases should be referred to the DHIA Affiliate.

(A) First Test Day Weights or Samples Missed:

(1) Missing milk weights and component percentages shall be calculated in the succeeding test interval by appropriate factors and procedures approved by National DHIA. Records having first test day more than 90 days after calving are not used in genetic evaluations.

(2) If the milk sample cannot be tested, the percentage of each component for the succeeding test day will be used.

(B) Cows Missed For One or More Intervals During the Lactation After the First Interval

(1) Missing milk weights and component percentages shall be calculated based on the previous milk weights and component percentages using appropriate factors approved by National DHIA.

(2) The milk weights and component percentages may be held open and later computed as described in the Test Interval Method.

(3) If the sample cannot be tested, component data will be estimated according to National DHIA procedures.

(4) For herds weighed more than once daily and one milk weight is missed, AM/PM factors may be applied to the remaining weight(s) and component analysis to calculate test day yield. This yield shall be considered an actual yield.

(C) New Cows Entering The Herd:

(1) A cow purchased in milk with transfer credits will have credits computed through the sale date in the seller's herd. Her credits will start the next day in the purchaser's herd, using test-day data from the succeeding test. The Test Interval Method is required in making these computations. Dry cows will accumulate days on test in the seller's herd through the sale date, and will start on test in the purchaser's herd the next day.

(2) A cow purchased in milk with unavailable previous credits may have her record computed back to the calving date for management purposes. If the cow has no known calving date as of the first test date, the cow will receive credits for the current test interval only. The DRPC may extend the record back to the fresh date for management purposes only. Only actual data will be used in genetic evaluations.

18. Standard Calculations

A. Days carried calf = current sample date - effective breeding date +1

B. Days open = effective breeding date - previous fresh date

C. Gestation days = resulting fresh date - effective breeding date

D. Days dry = next fresh date - dry date

E. Calving interval = next fresh date - current fresh date

F. Days in milk
= dry date - previous fresh date, or
= left herd date-previous fresh date +1, or
= current test date - previous fresh date +1.

G. Assumptions:

- The day of freshening is an open day, a day in milk, and not a dry day;
- The day of breeding is a day carried calf.

H. Calculation of Ages of Cows (Truncation Method) From the year, month, and day of the fresh date, subtract the year, month, and day of the birth date. If the days are positive, discard. If the days are negative, add -1 to months. Then, if months are positive, use years and months as age of the cow. If months are negative, add 12 months, and add -1 to years. Use the resulting years and months as the age of the cow.

I. Adjusting Records to 24 Hours.
When milk that is weighed is from an interval other than 24 hours, the recorded weight shall be adjusted to a 24-hour interval using approved A/P factors or the following procedure approved by National DHIA when A/P factors are not appropriate:

Divide 24 by the interval (measured in hours), then multiply by the total milk recorded during the interval.

Examples: (1) For a 25-hour interval, (24/25) x 65 lbs = 62.4 lbs. test day weight
(2) For a 20-hour interval, (24/20) x 65 lbs = 78 lbs. test day weight
(3) For a 168 hour (7 day) interval (24/168) x 525 lb= 75 lbs test day weight

19. Verification Testing

DHIA Service Affiliates will conduct verification tests to verify the performance of cows and herds at the request of a member or allied industry representative.

DHIA verification tests will be performed based on pre-existing terms agreed to among the DHIA Service Affiliate, the Allied industry representative, and the herdowner, or based on situational terms agreed to among the parties.

DHIA verification tests requested by a member will include the entire herd. Acceptable verification procedures are as follows:

- A different DHIA technician conducts a duplicate test immediately following the regular test.
- A different DHIA technician tests the herd for one milking, in addition to the regular testing schedule.
- A different DHIA technician tests the herd using the regular testing schedule (i.e. no additional milkings).

Herd Pages may also be used to verify test results on a routine basis. Such information may be used to call verification tests as deemed appropriate by the DHIA Affiliate.

All verification test results will be used in computing credits except under extraordinary circumstances, in which case the DHIA Service Affiliate will determine which test(s) will be used.

20. Retesting -- Member's Request

If a member is not satisfied with the regular testing of the herd, a retest may be requested. Such a request will be made within 15 days of the original test day and be directed to the DHIA Affiliate. The member will pay the cost of the retest, unless otherwise determined by the DHIA Affiliate.

Retest results will be used in place of the test day data for which dissatisfaction has been registered when an obvious discrepancy exists. Both tests may be used if no discrepancy exists in the judgment of the DHIA Service Affiliate.

21. Production Reports

DHI lactation records of 305 days or less will be computed as required by National DHIA policies.

All DHI records used in genetic evaluations must be processed at a National DHIA-approved DRPC. Electronic herd summary reports and cow lactation records will carry Record Standards variables to describe the conditions under which the records were collected.

22. Yearly Averages

Herd and Affiliate yearly averages will be computed on a cow-year basis. These will be summarized and transmitted as required by National DHIA policies. A herd must have DHIA credits for 365 days before a DHIA herd average is published.

23. Transfer of herd records

Herds choosing to transfer service and herd records to a different Service Provider are required to sign an intent-to-transfer form provided by the new Service Provider.

a. The current Service Provider must transfer the herd records within 15 days of receipt of the intent to transfer form if the herd is in good financial standing.

b. Any cost associated with the transfer is the responsibility of the herdowner requesting the transfer.

24. Transfer of individual cow records – Transfer of records to new owners shall be accomplished within 10 days of notification from the buyer containing the herd and cow ID of the cow being transferred. This is best accomplished by sending a copy of the individual cow page.

25. Robotic Milking Procedures

a. Test day milk weights shall be obtained as 24 x (milk/hour) obtained from the robotic milking system software.

b. Milk samples shall be obtained using National DHIA approved sampling devices for one or more milkings during test day.

26. Data Collection Rating – This statistic is calculated by USDA and some breed associations as an index of the accuracy of the estimated lactation total based on the number of test days, amount of supervision, and completeness of data collected on each test day.

NATIONAL DHIA RECORDS DISCLOSURE POLICY

PURPOSE: The Records Disclosure concept, along with Herd and Cow Pages, Uniform Data Collection Procedures, and the Code of Ethics, was designed to replace the enforcement activities of DHIA.

POLICY: DHIA members who want their records to be available for genetic evaluations will select one of the following two Herd and Cow Page options: 1) open disclosure; or 2) limited disclosure among allied industry partners participating in appropriate agreements.

The DHI records from members choosing not to disclose their Herd and Cow Pages will not be provided to the Genetic Evaluation Program.

DEFINITIONS:

Open Disclosure is defined as unrestricted access by any party interested in viewing the Herd and Cow Pages. All DHI Records produced under this option are provided to the Genetic Evaluation Program.

Limited Disclosure restricts access of Herd and Cow Pages to allied partners for defined purposes. These purposes may include validating the records and/or conducting appropriate research. All DHI records produced under this option are provided to the Genetic Evaluation Program.
(Allied partners include the National Association of Animal Breeders, Purebred Dairy Cattle Association, USDA-ARS-AIPL, National DHIA and member Affiliates.)

Privacy Codes are available from DHIA Affiliates. Privacy codes restrict the publication of records on a local or regional level. They do not affect the flow of records to AIPL or other allies. Producers with religious (or other) objection to publication of records, that would like their records to be provided to the Genetic Evaluation Program, should use the privacy code.

Supervisors Barn Sheet: Form DMS201

Herd Code	Last Test	Date of Test
11005000	5/29/99	

Your Dairy Here
Your Name Here
Your address here
Your City

Str. Num	Old Status: Code / Brd	Old Status: Date / Reg/Tag Number	Old Status: Milk Wt	New Status: CODE	New Status: Date Changed Mo	New Status: Date Changed Day	Index: Barn Name	Milk Weights: 1st Milking Lbs	1st Milking 10TH	2nd Milking Lbs	2nd Milking 10TH	3rd Milking Lbs	3rd Milking 10TH	CAR	Body WT.	New Repro Status: CODE	New Repro Status: No. Br.	New Repro Status: Breed Date or Heat Date Mo	New Repro Status: Breed Date or Heat Date Day	BIRTH	Kid Identity or Sire: Kid: Tattoo, Tag, or Other / Sire:Reg. No., or Sire Name	Kid Identity or Sire: ID Code	Kid Identity or Sire: ID Number	Old Repro Status: # Br. / Code	Old Repro Status: Last Bred / Breed Date or Heat Date
	I	10/15/99	0				1																	0	
0	A	10876432					MARY ANN																	F	
	I	2/5/99	0				12																	0	
1	A	187309867					CREAM																	F	
	I	4/14/99	0				109																	0	
1	E	091876456					BUCKETS																	F	6/7/99
	I	1/1/99	0				124																	0	
1	A	187630298					LILLIAN																	F	
	I	1/1/99	0				334																	0	
1	A	109873245					GINGER																	F	

Status Codes
D: Dry
I: In Milk
T: Transfer from Doeling Herd
F: Freshend

Removal Codes
Removed by: S: Sold, X: Died, U: Unknown
Reason: 1: Dairy Reason, 2: Production, 3: Reproduction, 4: Disease/Inj, 5: Mast/Udder, 6: Feet/Legs, 7: Unknown

Car Codes
A: ABNORMAL, E: ESTIMATED, F: SUP. EST. FAT, H:IN HEAT, I: INJECTED, L: LAB EST. FAT, M: MILKED 3X, X: NO 305D REC.

Birth Diff.
1: No Problem, 2: Minor Problem, 3: Needed Assistance, 4: Needed Force, 5: Difficult, 6: Unknown

Kid Id Codes
Kid Count: #D - # of Does, #B - # of Bucks
Death Codes: 1 - BORN DEAD, 2 - DIED DISEASE, 3 - DIED RESP., 4 - DIED UNKNOWN

Repro Codes
A: ABORT, B: BRED, H: IN HEAT, O: OPEN, P: PREGNANT, R: REPRO. CULL, F: FRESHENED, V: VIRGIN

Herd Form - DMS213

Herd Identification

Herd Code Number			SA	Type of Test
ST.	CO.	Herd No.		
			NONE	NONE
11005000				

Name And Address

Your Dairy Here

Your address here

Unkown

Your Telep
Telephone Number

Your City | OK St. | Your Zip Zip Code

Other Herd Data

BULK TANK WEIGHTS	
# MILKS	TOTAL LBS

Supervisor

ENTIRE HERD MILKED 3X

Date of Test

Mo	Day	YR.

Milking	START TIME		END TIME		SAMPLED Y/N		WEIGHED Y/N		START TIMES FOR PREVIOUS DATE OF TEST
First Milking	:	AM PM	:	AM PM		Y N		Y N	
Second Mlking	:	AM PM	:	AM PM		Y N		Y N	
Third Milking	:	AM PM	:	AM PM		Y N		Y N	

DATE RECEIVED AT LAB	DATE MAILED FROM LAB	DATE RECEIVED AT DRPC	DATE MAILED FROM DRPC

Transfer Does

Goat Info				Date of Birth			Complete This Section if Goat Transfers From Another Herd on Test	
Index No.	Registration or Eartag No.	Br	Barn Name	Mo	Day	YR.	Old Herd Code	Index No.

Herd Options

VWP: _____
Doe Page: [None] Always Standard
Kid Id Listing: [None] Always Standard

Breed codes for new and transfer does

A-Alpine F-French Alpine L-La Mancha K-Kinder
N-Nubian P-Pygmy S-Saanen D-Nigerian Dwarf
T-Toggenberg U-Unknown B-Oberhasli
SA- Swiss Alpine E- Experimental Grade

New Goats Entering the Herd or Identity Correction

Goat Info								Sire Identity		Dam Identity		Kid		
Index No.	Registration or Eartag No. / Barn Name	Br	LACT #	BODY WT	Date of Birth Mo	Day	YR.	Registration or Eartag No. / Barn Name	Br	Registration or Eartag No. / Barn Name	Br	Kid's Sire Id Number / Registration or Eartag No.	Br	Kid's Sire Id Number

Herd Code:_____ ADD FORM DMS213A Date:_____

Goat Info								Sire Identity		Kid's Sire Id Number		Kid		
Index No.	Registration or Eartag No. / Barn Name	Br	LACT #	BODY WT	Date of Birth Mo	Day	YR.	Registration or Eartag No. / Barn Name	Br	Registration or Eartag No. / Barn Name	Br	Dam Identity Registration or Eartag No.	Br	Kid's Sire Id Number

Production Summary: FORM DMS202

11005000
5/29/99

Your Dairy Here
Your Name Here
Your address here
Unkown
Your City

Kidding/Milking Profile

	Milking, Dry, and Kidding (Monthly)					
Month	June	July	Aug	Sept	Oct	Nov
Milking	3	3	3	3	3	3
Dry	0	0	0	0	0	0
Doe Kidding	0	0	0	0	0	0
Doeling Kidding	0	0	0	0	0	0

Dry Doe Summary

	Dry Doe Profile					ID Summary			
	Dry Periods	Days Dry	< 40 Days	40 - 70	> 70 Days	%Sire ID	%Dam ID	%AIPL	%Chng
1st Lact	----	----	----	----	----	100	100	100	0
2nd Lact	0	0	0	0	0	0	0	0	0
3rd+ Lacts	0	0	0	0	0	100	100	100	0
All Lacts	0	0	0	0	0	100	100	100	0

Production Profile - Udder Health Profile

	Production Profile							SCC Summary (# of Does)				
	Total Goats	Avg Age	Avg DIM	Avg Peak	ME Milk	ME Fat	ME Protein	# 0 - 3	# 4	# 5	# 6	# 7 - 9
1st Lact	1	65	47	0.0	2888	69	59	1	0	0	0	0
2nd Lact	1	0	0	0.0	0	0	0	0	0	0	0	0
3rd+ Lacts	3	77	96	9.1	2400	68	70	0	0	0	0	2
All Lacts	5	73	79	6.1	2563	68	67	33	0	0	0	67

Yearly Production Summary

			TD Avgs		TD Avgs (All Does)				Rolling Herd Avgs			SCC Summary (% of All Does)					
Date of Test	Test Intv.	Total Does	DIM	Milk Lbs	% In Milk	Milk Lbs	% Fat	% Pro	Milk Lbs	Fat #	Pro #	% 0 - 3	% 4	% 5	% 6	% 7 - 9	Avg SCC
5/29/99	-----	3	0	9.8	100.0	9.8	3.2	3.7	0	0	0	33.0	0.0	0.0	0.0	67.0	5.3

11005000
5/29/99

	Milk Time	Spl
1st	7:40:00 PM	
2nd	9:00:00 AM	
3rd	12:00:59 AM	
4th	12:00:59 AM	

Test Day Production Summary

	TD Avg	RHA Avg
Total Does	3	0
GIM #	3	0
GIM %	100	0
Milk # (All)	9.8	0
Fat # (All)	0.3	0
Pro # (All)	0.4	0
Milk # (GIM)	9.8	-----
Fat % (GIM)	0	-----
Pro % (GIM)	0	-----

Heat/Serv Intv Length	# H/S Intv
18 - 24 Days	0
36 - 48 Days	0
Other	0

# In Breeding Herd	1
Vol Wait Period (VWP)	60
Avg Days 1st Service	.0

Breeding Profile

	Open Does			Bred Does			
	VWP - 100	> 100	Diag Open	< VWP	VWP - 100	101 - 130	> 130
# Goats	0	1	0	0	0	0	0
% B. Herd	0	100	0	0	0	0	0

Reproductive Performance

	Services			Current Reproduction Totals			
	# Serv	% Succ	Sire PTA $	Does Bred	Does Pregnant	Does Open	All Does
1st Lact	0	0.0	----	0	0	1	1
2nd Lact	0	0.0	----	0	0	1	1
3rd+ Lacts	0	0.0	----	0	0	3	3
All Lacts	0	0.0	----	0	0	5	5

Lactation Profile

		Stage of Lactation (Days)				
		1 - 40	41 - 100	101 - 199	200 - 305	306 +
Number of Animals	1st Lact	0	1	0	0	0
	2nd Lact	0	0	0	0	0
	3rd+ Lacts	0	1	1	0	0
% of Milking Herd	1st Lact	0.0	33.3	0.0	0.0	0.0
	2nd Lact	0.0	0.0	0.0	0.0	0.0
	3rd+ Lacts	0.0	33.3	33.3	0.0	0.0
Avg Daily Milk	1st Lact	0.0	11.1	0.0	0.0	0.0
	2nd Lact	0.0	0.0	0.0	0.0	0.0
	3rd+ Lacts	0.0	9.7	8.5	0.0	0.0
Avg Daily SCC	1st Lact	0.0	2.3	0.0	0.0	0.0
	2nd Lact	0.0	0.0	0.0	0.0	0.0
	3rd+ Lacts	0.0	6.1	7.5	0.0	0.0

Reproduction Profile

	D O @ 1st Serv			Avg 1st Serv	Serv / Preg		Proj Min		Total Services Per Goat	Total Services
	< VWP	VWP - 100	> 100		Preg Does	All Does	Kidding Int	Days Open		
1st Lact	0	0	0	0	1	1	10.8	47		
2nd Lact	0	0	0	0	1	1	0	0		
3rd+ Lacts	0	0	0	0	1	1	12.4	96		
All Lacts	0	0	0	0	1	1	11.9	79.3		

Culling Summary

	Left Herd		Add		Profile of Animals Leaving the Herd							
	# Left	% Left	# Add	% Add	Left Dairy	Low Prod	Left Repro	Dis/ Inj	# Died	Mast/ Udd	Feet/ Legs	# Other
1st Lact	0	0	0	0	0	0	0	0	0	0	0	0
2nd Lact	0	0	0	0	0	0	0	0	0	0	0	0
3rd+ Lacts	0	0	0	0	0	0	0	0	0	0	0	0
All Lacts	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Report: FORM DMS210

Your Name Here
Your address here
Unkown
Your City

Herd Code: 11005000 Test Date:

BREED	Sire ID / REGISTRATION OR EARTAG NO.	STRING/ PEN NUM.	INDEX NUMBER / Barn Name	LCT NO / Age	Status / Date	Status / Code	CAR / DAYS IN MILK	SOMATIC CELL COUNT SCORE, MILK WEIGHTS, %PROTEIN, AND %FAT BY TEST DAY: TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY SCCS MILK	TEST DAY %PROT %FAT	LACTATION TO DATE: MILK POUNDS	%PROT / %FAT	PROTEIN / Fat	ME: Fat / Milk	Breeding Information: REPRO / # Serv	SERVICE SIRE IDENTIFICATION: BREEDING DATE	HEAT OR DUE DATE	NO DAYS DRY / NO DAYS OPEN	BODY WT./ SCORE
	10987345		1	4																0	0	F			0	
A	10876432	0	MARY ANN	57	10/15/99	I	0											0		0	0	0			3084	
	123098754		12	2																0	0	F			0	
A	187309867	1	CREAM	22	2/5/99	I	0											0		0	0	0			3336	
	180796534		109	1															3.3	15	118	F			0	
E	091876456	1	BUCKETS		4/14/99	I	46											460	3.3	15	4075	0		6/7/99	3268	
	190876539		124	3																0	0	F			0	
A	187630298	1	LILLIAN	33	1/1/99	I	0											0		0	0	0			3371	
	165093847		334	3																0	0	F			0	
A	109873245	1	GINGER	33	1/1/99	I	0											0		0	0	0			3371	

ADGA Production Required for Advanced Registry: (+) 75%, (*) 90%.

STATUS CODES
D: DRY
I: IN MILK
X: UNKNOWN

Removal Codes
Reason:
1: Dairy Reason
2: Production
3: Reproduction
4: Disease/Inj
5: Mast/Udder
6: Feet/Legs
7: Unknown

CAR CODES

A: Abnormal	I: Injected
E: Estimated	L: Lab Est. Fat
F: Sup. Est. Fat	M: Milked 3X
H:In Heat	X: No 305D Rec.
	U: Unofficial

SSC Score to Acutal SCC Conversion Chart

SCCS	Cell Count (1000)	SCCS	Cellcount (1000)
0	0-18	5	284-565
1	19-35	6	566-1,130
2	36-71	7	1,131-2,262
3	72-141	8	2,263-4,523
4	141-283	9	4,524-9,999

Repro Codes

A: ABORT	P: PREGNANT
B: BRED	R: REPRO. CULL
H: IN HEAT	F: FRESHENED
O: OPEN	V: VIRGIN

Doe Page

11005000
Your Name Here
Your address here
Unkown
Your City

Dam Information

Index: PTA Milk:
Dam ID: 190832198 PTA BFat:
Name: MISSY PTA Protein:
Breed: A

Sire Information

Sire ID: 10987345 Breed: A
Name: ROBIN

Index No.: 1
Name: MARY ANN
Registration: 10876432 PTA Milk: 0
Breed: A PTA BFat: 0
Date of Birth: 1/1/95 PTA Protein: 0

Kidding Date	Lactation Num.
10/15/99	4

Current Lactation

Production Status	Reproduction Status	Body Wt./ Score	Last Test Date	Last Test Day		Current Lactation to Date									
				Milk Wt	% Fat	DIM	Milk	Fat	PROTEIN	305d Milk	305d Fat	305d Prot	ME Milk	ME Fat	ME Protein
In Milk	Fresh	0		0.0	0	0	0	0	0						

Completed Lactations on Record

Kidding Date	Age at Kidding	Dry Date	Lactation Num.	305 Day Lactation					Complete Lactation				Avg. SCCS for Lact.	ME Lactation		
				Milk	%FAT	Fat	%PROT	PROTEIN	DAYS IN MILK	Milk	Fat	PROTEIN		Milk	Fat	PROTEIN
				0	0.0	0	0.0	0	0	0	0	0	0.0	0	0	0

Lifetime Milk
0

Breeding Information

Lact	Kidding Date	Prev Days Dry	No. Br.	Last Breeding or Preg Date	Sire Identity	Calf ID #1	Sex	Calf ID #2	Sex	Calf ID #3	Sex
4	10/15/99	0				-		-		-	

Test Day Data

Lactation Number	1st Test Day		2nd Test Day		3rd Test Day		4th Test Day		5th Test Day		6th Test Day		7th Test Day		8th Test Day		9th Test Day		10th Test Day		11th Test Day		12th Test Day	
	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat	SCCS Milk	%Prot. %Fat

Langston DHIA
Invoice

Herd Code # _____

Herd Owner _____

Verification Test YES NO

Service Affiliate Fee
DMS 201 _____x $.08 _____

Herd Processing Fee 01 – 20 does = $6.00 _____
21 – 40 does = $7.00
41 – 60 does = $8.00
61 – 80 does = $9.00
81 – 100 does = $10.00

Milk Analysis Fee
Total Samples _____ x $1.15 _____

Accounting Fee ……..$2.00

Total _____

HERD OWNERS:
YOU MUST RETURN THIS SHEET BEFORE YOUR HERD WILL BE PROCESSED!
THIS SHEET MUST BE FILLED OUT BY THE HERDOWNER!

Number of Does dried this month _____

Number of Does freshened this month _____

Does Dried:

INDEX # DRY DATE

Does Freshened:

INDEX # FRESH DATE

(COPY THIS SHEET IF MORE SPACE IS NEEDED)

2008 Langston DHI Supervisor Test

Date: _____ Supervisor #_____

Where you previously certified by Langston to be a supervisor? ___ ____

Yes No

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____

Who do you test for?_____

1. When enrolling Does for DHI testing, you do not need the animal's registration number.

   True_____ False_____

2. Langston University DHI can conduct scale calibrations.

   True_____ False_____

3. What do you write on the lid of the sample vial?
   a. Doe's name
   b. Registration number for Doe
   c. DHI number for Doe
   d. Index number for Doe

4. When a sample is spoiled or spilled, the year to date pounds of fat on the DMS210 for that doe will…
   a. Increase
   b. Decrease
   c. Remain the same
   d. Be zero

5. The best method of obtaining a representative sample is to stir the milk with the ladle before taking the sample.

   True_____ False_____

6. Milk samples must be refrigerated before shipping....

    a. so they don't spoil.
    b. Because they will be cool and not spill easy.
    c. So the butter fat will be on top.
    d. None of the above.

7. I must always ask for Doe Pages if I want them.

    True_____ False_____

8. Explain the difference between a transfer doe and a new doe entering the herd.

9. Do the vials have to have a pill inside?

10. How many days after a doe freshens, may the herd owner wait and still have an official test?
    a. 30 days
    b. 45 days
    c. 65 days
    d. 75 days

11. The $.08 charge on the invoice is for each sample submitted.

    True_____ False_____

12. I do not need to contact the Langston DHI if something is not right on the paperwork. Eva will catch the mistake.

    True_____ False_____

13. I do not need to put the date of when I dry or freshen a Doe.

    True _____ False_____

14. If you have any questions or comments , Please feel free to write here.

The proper citation for this article is:

Vasquez, E. 2008. DHI Training. Pages 90-121 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

Benefits of USDA Programs

Mr. Dwight Guy, Mr. Phil Estes, Mr. Robert Dukes, Ms. Sally Vielma

USDA

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

Who We Are

Fact Sheet

September 2006

Natural Resources Conservation Service

Helping People Help the Land

With the mission of "Helping People Help the Land," the Natural Resources Conservation Service (NRCS) provides products and services that enable people to be good stewards of the Nation's soil, water, and related natural resources on non-Federal lands. With our help, people are better able to conserve, maintain, or improve their natural resources. As a result of our technical and financial assistance, land managers and communities take a comprehensive approach to the use and protection of natural resources in rural, suburban, urban, and developing areas.

A Partnership Approach

Since the Dust Bowl of the 1930's, NRCS has worked with conservation districts and others throughout the U.S. to help landowners, as well as Federal, State, Tribal, and local governments and community groups.

NRCS has six mission goals: high quality, productive soils; clean and abundant water; healthy plant and animal communities; clean air; an adequate energy supply; and working farms and ranchlands. To achieve these goals, the Agency implements these strategies:

- Cooperative conservation: seeking and promoting cooperative efforts to achieve conservation goals.
- Watershed approach: providing information and assistance to encourage and enable locally-led, watershed-scale conservation.
- Market-based approach: facilitating the growth of market-based opportunities that encourage the private sector to invest in conservation on private lands.

Conservation Assistance

Our locally-based NRCS staff works directly with farmers, ranchers, and others, to provide technical and financial conservation assistance. Our guiding principles are service, partnership, and technical excellence.

NRCS helps landowners develop conservation plans and provides advice on the design, layout, construction, management, operation, maintenance, and evaluation of the recommended, voluntary conservation practices. NRCS activities include farmland protection, upstream flood prevention, emergency watershed protection, urban conservation, and local community projects designed to improve social, economic, and environmental conditions.

NRCS conducts soil surveys, conservation needs assessments, and the National Resources Inventory to provide a basis for resource conservation planning activities and to provide an accurate assessment of the condition of the Nation's private lands.

As the leading source of technology as it applies to natural resource conservation on private lands, NRCS develops technical guides and other Web-based tools to help enhance natural resource conservation efforts.

For More Information

Please contact NRCS at your local USDA Service Center, listed in phone directories under U.S. Government, or visit our Web site at: http://www.nrcs.usda.gov.

Helping People Help the Land

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- Conservation Programs
- Direct and Counter-Cyclical Program
- Disaster Assistance Programs
- Economic and Policy Analysis
- Environmental and Cultural Resource Compliance
- Farm Loan Programs
- Laws and Regulations
- Outreach and Education
- Price Support
- Tobacco

About FSA

Office of the Administrator

The Farm Service Agency (FSA) administers and manages farm commodity, credit, conservation, disaster and loan programs as laid out by Congress through a network of federal, state and county offices.

These programs are designed to improve the economic stability of the agricultural industry and to help farmers adjust production to meet demand. Economically, the desired result of these programs is a steady price range for agricultural commodities for both farmers and consumers.

In the Eisenhower administration, the Congress split the functions of the Triple A committees, creating the state and county office system to take care of administrative functions and kept the farmer county committee to oversee implementation of federal programs in their county.

State and county offices directly administer FSA programs. These offices certify farmers for farm programs and pay out farm subsidies and disaster payments. Currently, there are 2,346 FSA county offices in the continental states. FSA also has offices in Hawaii, and a few American territories.

More than 8,000 farmer county committee members serve in FSA county offices nationwide. Committee members are the local authorities responsible for fairly and equitably resolving local issues while remaining dually and directly accountable to the Secretary of Agriculture and local producers though the elective process. They operate within official regulations designed to carry out Federal laws and provide a necessary and important voice in Federal decisions affecting their counties and communities.

Committee members make decisions affecting which FSA programs are implemented county-wide, the establishment of allotment and yields, commodity price support loans and payments, conservation programs, incentive, indemnity, and disaster payments for commodities, and other farm disaster assistance.

Structure & Organization

Provides contact information as well as a listing of the programs and offices that make up the Farm Service Agency.

FSA Biographies

Includes biographies of the Farm Service Agency leadership.

History & Mission

Provides a history of the agency and describes its vision and mission.

Budget & Performance

Includes information about the budget, the strategic plan, and efforts to ensure that activities are managed efficiently.

Related Topics
- Structure and Organization
- FSA Biographies
- History and Mission
- Budget and Performance Management
- Human Resources
- Customer Perspectives

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Farm Loan Programs

Background

FSA makes direct and guaranteed farm ownership (FO) and operating loans (OL) to family-size farmers and ranchers who cannot obtain commercial credit from a bank, Farm Credit System institution, or other lender. FSA loans can be used to purchase land, livestock, equipment, feed, seed, and supplies. Our loans can also be used to construct buildings or make farm improvements. See our loan information chart which describes maximum loan amounts, rates, term, and use of proceeds.

Many FSA loan application forms are available on our website! We also encourage you to contact your local office or USDA Service Center to learn more about our programs and the information you will need for a complete application.

Our Customers

FSA loans are often provided to beginning farmers who cannot qualify for conventional loans because they have insufficient financial resources. FSA also helps established farmers who have suffered financial setbacks from natural disasters, or whose resources are too limited to maintain profitable farming operations.

Last Modified: 10/09/2007

Related Topics
- **Beginning Farmers and Ranchers Loans**
- **Direct Farm Loans**
- **Emergency Farm Loans**
- **Funding**
- **Guaranteed Farm Loans**
- **Socially Disadvantaged Farmers and Ranchers Loans**

I Want To...
- **Find Farm Loan Program Notices**
- **Find Real Estate for Sale**

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Questions? Ask FSA

About Us

Welcome to USDA Rural Development. Rural Development is committed to helping improve the economy and quality of life in all of rural America. Through our programs, we touch rural America in many ways.

Our financial programs support such **essential public facilities and services** as water and sewer systems, housing, health clinics, emergency service facilities and electric and telephone service. We promote **economic development** by supporting loans to businesses through banks and community-managed lending pools. We offer **technical assistance and information** to help agricultural and other cooperatives get started and improve the effectiveness of their member services. And we provide technical assistance to help communities undertake **community empowerment programs**.

We have an $86 billion dollar portfolio of loans and we will administer nearly $16 billion in program loans, loan guarantees, and grants through our programs.

Rural Development achieves its mission by helping rural individuals, communities and businesses obtain the financial and technical assistance needed to address their diverse and unique needs. Rural Development works to make sure that rural citizens can participate fully in the global economy.

Business Loans and Grants
Cooperative Grants and Other Programs
Single Family Housing Loans and Grants
Multi Family Housing Loans and Grants
Community Facilities Loans and Grans
Electric Loans and Other Programs
Telecommunications Loans and Grants
Water Loans and Grants
Community Development Programs

The proper citation for this article is:

Guy, D., P. Estes, R. Dukes, and S. Vielma. 2008. Benefits of USDA Programs. Pages 122-126 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

Body Condition Scores in Goats

Mr. Glenn Detweiler, Dr. Terry Gipson, Dr. Roger Merkel, Dr. Arthur Goetsch, and Dr. Tilahun Sahlu

Langston University

Introduction

Every goat producer has animals that are either too thin (under-conditioned) or too fat (over-conditioned). Failure to recognize these animals and take corrective actions will cost dearly in terms of decreased fertility, increased disease or internal parasite incidence, decreased milk production, and increased operating costs. Thus, goats need to be maintained with a moderate amount of body condition. When overall body condition starts to decrease in the herd, it is a sign that managerial intervention is needed such as supplemental feeding, deworming, pasture rotation, etc. Conversely, when overall body condition starts to increase in the herd, it is a sign that the producer should reduce supplemental feeding. Ignoring an animal's body condition and waiting to intervene until goats become either too thin or too fat may result in production and(or) animal losses or decreased profits from overfeeding. Therefore, producers need to develop skills in assessing body condition of their goats so that a desired moderate body condition can be maintained.

Body condition score (BCS) has been shown to be an important practical tool in assessing the body condition of cattle, sheep, and goats because BCS is the best simple indicator of available fat reserves which can be used by the animal in periods of high energy demand, stress, or suboptimal nutrition.

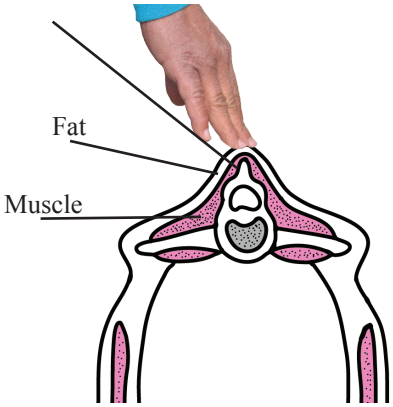
Scoring is performed in goats using a BCS ranging from 1.0 to 5.0, with 0.5 increments. Examples of BCS of 1.0, 2.0, 3.0, 4.0, and 5.0 are given using photographs and written descriptions. Assigning the 0.5 score increment is done when the animal being evaluated is intermediate to the BCS described. A BCS of 1.0 is an extremely thin goat with no fat reserves and a BCS of 5.0 is a very over-conditioned (obese) goat. In most cases, healthy goats should have a BCS of 2.5 to 4.0. BCS of 1.0 , 1.5, or 2.0 indicate a management or health problem. A BCS of 4.5 or 5 is almost never observed in goats under normal management conditions; however, these BCS can sometimes be observed in show goats.

It is important to note that BCS cannot be assigned by simply looking at an animal. Instead, the animal must be touched and felt. The first body area to feel in determining BCS is the lumbar area, which is the area of the back behind the ribs containing the loin. Scoring in this area is based on determining the amount of muscle and fat over and around the vertebrae. Lumbar vertebrae have a vertical protrusion (spinous process) and two horizontal protrusions (transverse process). Both processes are used in determining BCS. You should run your hand over this area and try to grasp these processes with your fingertips and hand. The second body area to feel is the fat covering on the sternum (breastbone). Scoring in this area is based upon the amount of fat that can be pinched. A third area is the rib cage and fat cover on the ribs and intercostal (between ribs) spaces.

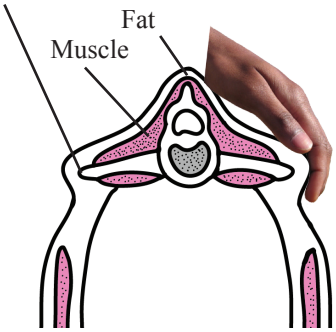
With practice, evaluating the BCS of an animal will only take about 10-15 seconds. By adding BCS as a regular part of your management program, you can more effectively monitor your feeding and herd health program for a healthy and productive herd.

Lumbar Region

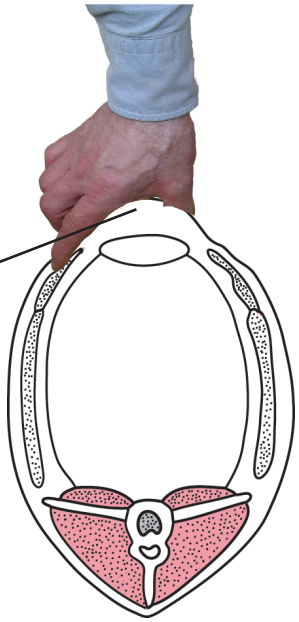
Spinous process



Transverse process



Sternum



Fat

BCS 1.0

Visual aspect of the goat: Emaciated and weak animal, the backbone is highly visible and forms a continuous ridge. The flank is hollow. Ribs are clearly visible. There is no fat cover and fingers easily penetrate into intercostal spaces (between ribs).

The spinous process of the lumbar vertebrae can be grasped easily between the thumb and forefinger; the spinous process is rough, prominent, and distinct giving a saw-tooth appearance. Very little muscle and no fat can be felt between the skin and bone. There is a deep depression in the transition from the spinous to transverse process.

The hand can easily grasp the transverse processes of the lumbar vertebrae which are very prominent. Clearly half of the length of the transverse process is discernible.

Diagrams adapted from Edmonson, et. al, 1989. J. Dairy Science, 72:68-78. Used with permission from the American Dairy Science Association.

Sternal fat can be easily grasped between thumb and fingers and moved from side to side. The cartilage and joints joining ribs and sternum are easily felt.

BCS 2.0

Visual aspect of the goat: Slightly raw-boned, the backbone is still visible with a continuous ridge. Some ribs can be seen and there is a small amount of fat cover. Ribs are still felt. Intercostal spaces are smooth but can still be penetrated.

The spinous process of the lumbar vertebrae is evident and can still be grasped between the thumb and forefinger; however, a muscle mass can be felt between the skin and bone. There is an obvious depression in the transition from the spinous to transverse process.

The hand can grasp the transverse process but the outline of the transverse process is difficult to see. About one-third to one-half of the length of the transverse process is discernible.

Sternal fat is wider and thicker but can still be grasped and lifted by the thumb and forefinger. The fat layer can still be moved slightly from side to side. Joints are less evident.

BCS 3.0

Visual aspect of the goat: The backbone is not prominent. Ribs are barely discernible; an even layer of fat covers them. Intercostal spaces are felt using pressure.

The spinous process of the lumbar vertebrae cannot be easily grasped because the tissue layer covering the vertebrae is thick. When running a finger over the spinous process, a slight hollow is felt. There is a smooth slope in the transition from the spinous to transverse process.

The outline of the transverse process of the lumbar vertebrae is slightly discernible. Less than one-quarter of the length of the transverse process is discernible.

Sternal fat is wide and thick. It can still be grasped but has very little movement. Joints joining cartilage and ribs are barely felt.

BCS 4.0

Visual aspect of the goat: The backbone cannot be seen. Ribs are not seen. The side of the animal is sleek in appearance.

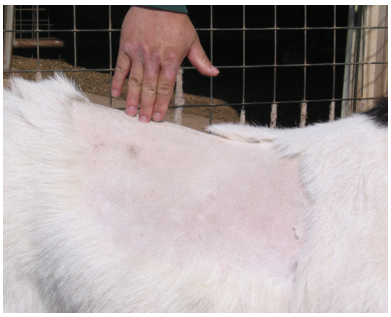
It is impossible to grasp the spinous process of the lumbar vertebrae, which is wrapped in a thick layer of muscle and fat. The spinous process forms a continuous line. There is a rounded transition from the spinous to transverse process.

The outline of the transverse process of the lumbar vertebrae is no longer discernible. The transverse process forms a smooth, rounded edge, with no individual vertebrae discernible.

Sternal fat is difficult to grasp because of its width and depth. It cannot be moved from side to side.

BCS 5.0

Visual aspect of the goat: The backbone is buried in fat. Ribs are not visible. The rib cage is covered with excessive fat.



The thickness of the muscle and fat is so great that reference marks on the spinous process are lost. The spinous process forms a depression along the backbone and there is a bulging transition from the spinous to transverse process.

The thickness of the muscle and fat is so great that reference marks on the transverse process are also lost. It is impossible to grasp the transverse process.

The sternal fat now extends and covers the sternum, joining fat covering cartilage and ribs. It cannot be grasped.

The proper citation for this article is:

Detweiler, G., T. Gipson, R. C. Merkel, A. Goetsch, and T. Sahlu. 2008. Body Condition Scores in Goats. Pages 127-133 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

Fitting and Grooming for Youth Market Doe Shows in Oklahoma

Ms. Kay Garrett

GG's Boer Goats

www.ggsgoats.com kewlkay@hotmail.com cell: 918-686-3257

- **Remember** – ***ALWAYS SAFETY FIRST*** – Never use anything that does not appear safe. If you don't think something is right, stop and ask someone before you do it. Better to be safe than sorry.
- Never leave an animal tied up alone or on the stand alone. Learn how to tie a quick release knot. We suggest the slip knot.
- Never wash an animal in cold weather without the ability to dry them and warm them up quickly. Always wash and completely dry your animal before you start clipping to preserve the life of your clipper blades and a smoother clipping job.
- Until you feel confident in your ability to trim, never start out on your show animal, practice on an older animal or an animal that won't go to the show ring.
  - Equipment: Foot trimmers, clippers and shampoo. The rest of what we use is nice to have.
    * Halter
    * Grooming Stand
    * Clippers with #10 blade and 5/8" blade (Andis or Oster blades. I think Wahl's are coming out with a line comparable to the Andis and Oster)
    * Brushes and shedding comb
    * Coat finisher
- Start about 6 weeks out before your first show to get your animal into condition.
  - We condition our animals by worming, vaccinating, treating with a parasite control and good feed and hay. We suggest worming with Cydectin (1 cc per 10 pounds), vaccinating (CDT – Covexin 8, follow label), parasite control (Cylence 1 cc per 25 pounds along the back). We recommend and use Honor Show Feeds and high quality alfalfa hay.
- About a week before the show, wash your animal and trim it's feet. This will give the animal time to adjust to it's new "shoes" (feet). A couple of days before the show, rewash and finish trimming.
- A rule of thumb, if you cut long at first, then you can trim out faults. If you start short, you have no way to correct mistakes.
- We start with a # 10 and trim the wild hairs on the following places:
  - Ears
  - Chest floor
  - Front legs, dew claw, pasterns and hoof band
  - Belly
  - Tail
  - Hip
  - Hock
- We will change blades and use the 5/8 blade on the belly and hip depending on the hair length, type and quality. We will also use the shedding blade along the neck, topline and hip to smooth it out.

The proper citation for this article is:

Garrett, K. 2008. Fitting and Grooming for Youth Market Doe Shows in Oklahoma. Page 134 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

Fitting and Grooming for Youth Market Wether Shows in Oklahoma

Ms. Kay Garrett

GG's Boer Goats

www.ggsgoats.com kewlkay@hotmail.com cell: 918-686-3257

- **Remember** – ***ALWAYS SAFETY FIRST*** – Never use anything that does not appear safe. If you don't think something is right, stop and ask someone before you do it. Better to be safe than sorry.
- Never leave an animal tied up alone or on the stand alone. Learn how to tie a quick release knot. We suggest the slip knot.
- Never wash an animal in cold weather without the ability to dry them and warm them up quickly. Always wash and completely dry your animal before you start clipping to preserve the life of your clipper blades and a smoother clipping job.
    - Equipment: Foot trimmers, Lister Stablemate clippers and shampoo. Some other equipment that we like to use:
        * Halter
        * Grooming Stand
        * Slick sweater
        * Body blanket
        * Small clippers with #10 blade for small areas
            ◊ Head, Feet, Trim legs, Horn base, Tail
- The wethers are completely slick shorn above the hocks. It is not wise to leave hair on the wethers. Leaving lots of hair on wethers make the wethers to appear fat and overly conditioned and finished when the judge handles them and analyzes them at a show.
- To trim below the hocks and tail, be very careful. You do not want to slick shear the legs. You only need to trim up the wild hair. You want to leave as much hair on as possible. You do not want the animal to appear "deer like". You will want to trim the hoof band and slick up the tail. The head needs to be slick sheared paying special attention under the chin and around the horns. Leave no hair on in the head area. I suggest using a small clipper such as the doe clippers around the head, leg and tail area with a number 10 blade. The tail should be trimmed up close but not completely sheared.
- Keep the blades oiled every 10 minutes or every time you switch sides on an animal.
- If the weather is cold, be sure to cover up your animal with blankets and slickies and use a heat lamp if necessary.
- Never, Never, Never, Never, Never, Never, Never, Never, Never, Never, Never, Never trim a doe in this fashion unless you plan on showing her with wethers for her show career. She will not compete in a regular doe show if she is slick sheared.
- Some suppliers that we use and are reputable dealers.
    - Outback Laboratories - www.outbacklabs.com - 405-527-6355
    - Hoegger Caprine Supply - 1800-221-4628 – www.thegoatstore.com
    - Jeffers – 1800-533-3377 – www.jefferslivestock.com
    - Mid-State – 1800-835-9665 – www.midstatewoolgrowers.com

The proper citation for this article is:

Garrett, K. 2008. Fitting and Grooming for Youth Market Wether Shows in Oklahoma. Page 135 in Proc. 23rd Ann. Goat Field Day, Langston University, Langston, OK.

Extension Overview

Terry A. Gipson

Goat Extension Leader

The year 2007 was a busy year for the Langston Goat Extension program. The goat extension specialists have answered innumerable producer requests for goat production and product information via the telephone, letters and e-mail, have given numerous presentations at several state, regional, national and international goat conferences for potential, novice and veteran goat producers, and have produced a quarterly newsletter. They have also been busy with several major extension activities. These activities include the annual Goat Field Day, Langston Goat Dairy Herd Improvement (DHI) Program, grazing demonstrations, the eighth annual meat buck performance test and various goat workshops on artificial insemination and on internal parasite control.

Goat Field Day

Our annual Goat Field Day was held on Saturday, April 28, 2007 at the Langston University Goat Farm. This year's theme was Herd Health - Old, New, and Emerging Issues.

Adult Activity (morning session): This year, our featured speakers was Dr. Bruce Olcott of Louisiana State University, who spoke on Goat Herd Health Procedures and Prevention with Emphasis on Biosecurity, and Dr. Lionel Dawson of Oklahoma State University, who spoke on Common and Uncommon Diseases of the Goat.

Dr. Bruce Olcott, DVM, MS, MBA is an Associate Professor at the Louisiana State University School of Veterinary Medicine. He received his BS from William & Mary in 1974 and his DVM from the University of Georgia in 1978. Dr. Olcott received his Master's degree from Washington State University in 1981 and his MBA from Louisiana State University in 1995. He and his wife, Dr. Donya Olcott, operate a farm with 250 goats and sheep.

Dr. Lionel Dawson, DVM, MS is a faculty member in the Department of Veterinary Medicine and Surgery in the College of Veterinary Medicine of Oklahoma State University. He received his undergraduate degree at Madras Christian College and professional degree at the Madras Veterinary College. After completing veterinary school, Dr. Dawson moved to Iowa where he did graduate work in Theriogenology at the School of Veterinary Medicine at Iowa State University. Dr. Dawson is board certified with the American College of Theriogenologists. In July of 1998, Dr. Dawson received a joint appointment between Oklahoma State University and Langston University.

Adult Activity (afternoon session): In the afternoon session, participants broke into small-group workshops. There were a total of thirteen workshops:

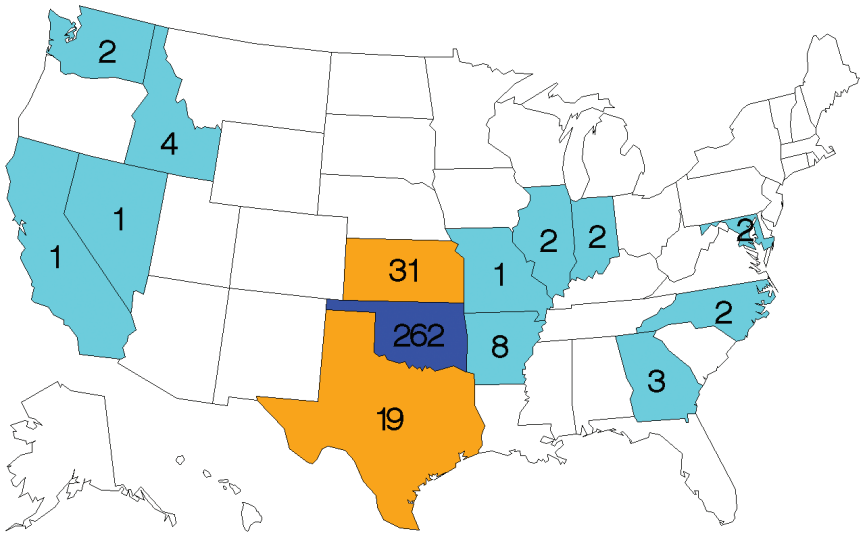
1. Continued Biosecurity/Prevention session with Dr. Bruce Olcott,
2. Continued Goat Diseases session with Dr. Lionel Dawson,
3. Basic Goat Husbandry - hoof trimming, injection sites, farm management calendar, disbudding, etc. with Mr. Jerry Hayes,
4. Nutrition for Health and Production - calculation of energy, protein and feed intake requirements and ration balancing using our Internet-based calculation system with Dr. Steve Hart,
5. Cheesemaking Overview - basics of cheesemaking with Dr. Steve Zeng,
6. Tanning Goat Hides - demonstration of basic goat hide tanning techniques with Dr. Roger Merkel,

7. Body Condition Score as a Management Tool - overview/hands-on of conducting body condition scoring for management use in meat, dairy or fiber goat production with Dr. Maristela Rovai,
8. Managing External Pests - control of external parasites and pests on goats with Dr. Justin Talley,
9. Internal Parasite Control - sustainable internal parasite control program with Dr. Dave Sparks,
10. Introduction to Goat Barbecue - overview of how to prepare goat barbecue with Mr. Willy Young,
11. USDA Government Programs - overview of USDA Natural Resource Conservation Service's work with goats and its cost-sharing program with Mr. Dwight Guy,
12. DHI Training - supervisor/tester training for dairy goat producers including scale certification with Ms. Eva Vasquez,
13. Fitting and Showing for Youth and Adults - tips and pointers on fitting and show ring etiquette with Ms. Kay Garrett.

All Day Youth Activity: Ms. Sheila Stevenson hosted a full day of activities for youth ages 5-12 in the Fun Tent. This allowed the parents and older teens to enjoy the workshops knowing that their little ones were having fun in a safe environment. Last year, some activities included goat education (i.e., goat petting area, goat bingo), pony and horseback riding, fishing, pot your own plant, and many other activities.

Half Day Youth Activity (morning): The Oklahoma Goat Producers Association sponsored three contests (Poster, Speech and PowerPoint) during the 2007 Langston University Goat Field Day. There were two age divisions for each contest. Junior division is 12 and under and senior division is 13 to 18. Cash prizes were awarded for 1st, 2nd, and 3rd place for each division and contest. The theme for the poster contest was "Why Goat Products Are Good For You". Speech and PowerPoint contestants were allowed to present their speech on any aspect of the goat industry. Contestants who are entering the speech contest were allowed to use any props or visual aids of any kind.

2007 Goat Field Day Pre-Registration



Half Day Youth Activity (afternoon): Other youth and interested adults were able to participate in a half-day clipping, fitting, and showing workshop conducted by Ms. Kay Garrett of the Oklahoma Meat Goat Association. Participants had the opportunity to have hands-on practice of clipping and fitting a goat and then show it before a judge in the show ring.

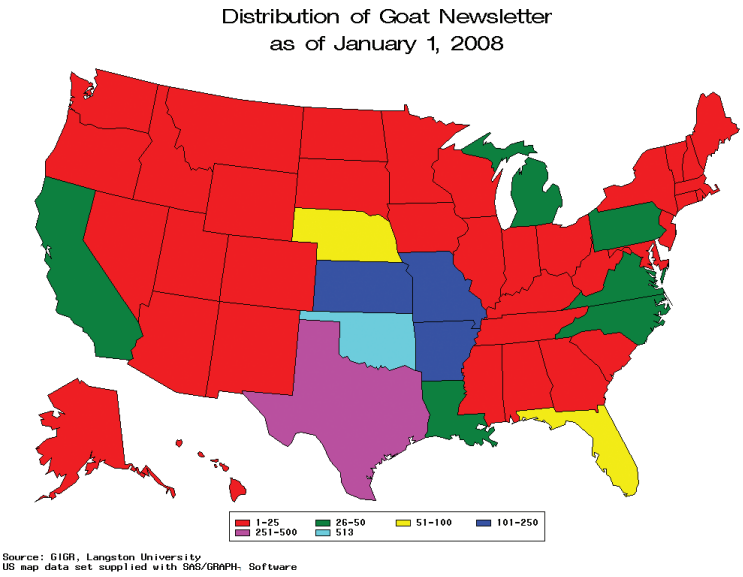
Attendance at the Goat Field Day continues to increase. This year 316 people pre-registered. The breakdown of participants by state of residence is shown in the figure to the left.

Goat DHI Laboratory

The Langston Goat Dairy Herd Improvement (DHI) Program is housed at the dairy farm, west of campus, operates under the umbrella of the Texas DHIA. In February 1998, the Langston DHI program became the first DHI program to introduce forms and reports in goat terminology to dairy goat producers in the United States. A national Dairy Herd Improvement Association (DHIA) has been in existence for a number of years.

However, until 1996 DHIA catered only to cow dairies. The Langston DHI program has been very popular with dairy goat producers and has grown significantly since its establishment in 1996. Goat producers are now able to get records for there animals that reflect accurate information with the correct language. Currently we are serving a 27 state area that includes a majority of the eastern states. We have over 100 herds in these 27 states enrolled in the Langston Goat Dairy DHI Program. Langston University continues to serve the very small-scale dairy goat producer. The average herds size on test with Langston University is 10 animals. This is significantly smaller than the herd size average for the five other processing centers.

For those interested in becoming a Langston goat DHI tester, training is available either in a formal classroom setting or through a 35-minute video tape. Every tester is required to attend the DHI training session or view the tape and take a test. Upon completion of the DHI training, the milk tester can start performing monthly herd tests.



Goat Newsletter

The Goat Extension program published four issues of the 8-page Goat Newsletter in 2007. Interest in the newsletter has grown and we currently have over 3400 subscribers to our free quarterly Goat Newsletter and the subscription list continues to increase every year. The Goat Newsletter is mailed to every state in the nation and to 10 countries overseas. Ninety-seven percent of the mailings go to American households. At least one newsletter is mailed to a household in every state in the nation. Fifty percent of the newsletters are mailed to Oklahoma households. An additional thirty percent of the newsletters are mailed to households to state adjacent to Oklahoma.

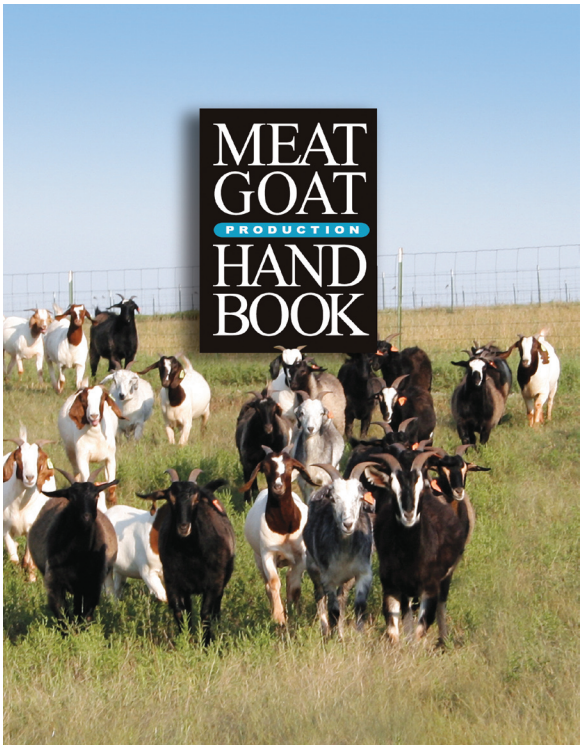
Artificial Insemination Workshop

The use of superior sires is imperative in improving the genetic composition of breeding stock. Artificial insemination has long been used in the dairy cattle industry and is a simple technology that goat producers can acquire. However, opportunities for goat producers to the necessary skills via formal and practical instruction are not widespread. Langston University has instituted a practical workshop for instruction in artificial insemination in goats. Producers are instructed in the anatomy and physiology of the female goat, estrus detection and handling and storage of semen. Producers participate in a hands-on insemination exercise. An understanding of the anatomy and physiology enable the producer to devise seasonal breeding plans and to troubleshoot problem breeders. An understanding of estrus detection enables the producer to effective time inseminations for favorable conditions for conception and to effectively utilize semen. An understanding of semen handling and storage enables the producer to safeguard semen supplies, which can be scarce and costly. The experience of actually inseminating a female goat enables the producer to practice the knowledge that they have gained. The acquisition of these inseminating skill will allow producers the use of genetically superior sires in their herds that they normally would not have access to. It also allows producers to save money by conducting the inseminating themselves instead of hiring an inseminator. In 2007, AI workshops were held in September at the Langston University campus and in October at the county fairgrounds in Tahlequah and the county fairgrounds in Antlers.

	Number of Participants by State					
	AL	AR	KS	OK	TX	VA
Langston, OK	14		5	9		1
Tahlequah, OK		2		5	5	
Antlers, OK				8	6	
Total	14	2	5	22	11	1

United States Cheese Championship

Dr. Steve Zeng, our Dairy Product Specialist/Associate Professor at the E (Kika) de la Garza American Institute for Goat Research, was invited as an Official Judge to the 2007 United States Cheese Championship in Milwaukee, WI March 11-14, 2007. The judge panel consisted of 12 university professors and industry experts. It was the first time that a professor from an 1890 Land Grant university/college such as Langston University has been invited to participate in this national prestigious cheese contest. During this championship, a total of 1,158 cheese entries were presented. In all, 53 classes of cheese varieties were judged. Among them were 89 goat milk cheese entries along with 10 sheep milk cheeses. Goat cheese entries were put into five classes: plain soft cheese, flavored soft cheese, semi-soft cheese, hard cheese and mixed milk cheese. As an official judge, Dr. Zeng was able to taste and judge many varieties of cheeses from all over the nation. He was totally impressed how good the overall quality of all the cheeses was and believed that the U.S. cheese industry has established its own identity. In addition, all the judges were optimistic that goat milk cheese is not only getting popular as a specialty cheese but also becoming a favorite cheese to American consumers, especially in the northern states, the east and west coasts. As a goat cheese enthusiast, Dr. Zeng encourages goat cheese makers to actively participate in similar national and regional competitions. Dr. Zeng says "Submit your cheese entries to the contests and take a full advantage these contests have to offer. If you are an experienced cheese maker and have a potential award-winning cheese, the competition will validate the quality of your cheese and expend market for you. It's like a 'free' national advertisement. If you are a new cheese maker, you will get some expert advice as you will receive judges' original Score Cards and specific comments on cheese defects and can improve the overall quality of your cheese in the future."



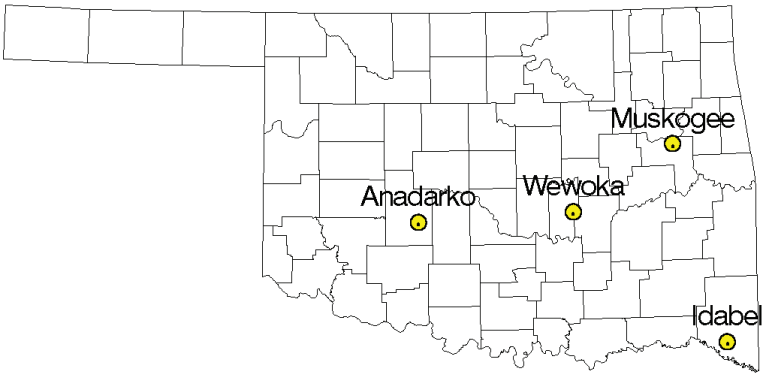
Meat Goat Production Handbook

The Meat Goat Production Handbook, which is a companion to the Web-based Training and Certification Program, both of which were funded through an USDA/FSIS grant. The 400-plus page Meat Goat Production Handbook is an answer to the paucity of information, especially on the aspect of quality assurance, which will be a key production element as the meat goat industry grows and evolves. A quality assurance program ensures the production of a safe, healthy product that satisfies consumers and increases profit for the production industry. Conventional topics such as herd health, nutrition, herd management, and many others are covered comprehensively, yet remain clear and easy-to-read. Additional topics generally not covered in conventional handbooks are also included, topics such as disaster preparedness, legal issues,

and organic meat goat production. Even though Langston University has taken the lead in this project, this handbook is not the product of one person nor of a single university. Our collaborating project institutions/organizations, which include Alcorn State University, American Boer Goat Association, American Meat Goat Association, Florida A&M University, Fort Valley State University, Kentucky State University, Langston University, Prairie View A&M University, Southern University, Tennessee Goat Producers Association, Tennessee State University, Tuskegee University, United States Boer Goat Association, University of Arkansas Pine Bluff, and Virginia State University. Handbook contributing institutions/organizations include Allen Veterinary Clinic, American Boer Goat Association, American Meat Goat Association, BIO-Genics, Ltd., Bountiful Farm, Cornell University, Fort Valley State University, Kentucky State University, Langston University, Law Office of Wheeler and Mueller, Louisiana State University, Louisiana State University AgCenter, NCAT / ATTRA National Sustainable Agriculture Information Service, North Carolina State University, Oklahoma State University, Texas A & M University, United States Boer Goat Association, and Virginia State University.

Small Farmer Goat Management Workshops

Dr. Chongo Mundende, coordinator of of Langston's Outreach Program, was awarded a Risk Management grant to deliver a series of management workshops for socially-disadvantaged farmers. These workshops were conducted through the local outreach offices located in Anandako, Idabel, Muskogee, and Wewoka, as indicated on the map to the right. Topic that were presented are indicated in the table below. Successful participants were given a Meat Goat Production Handbook as a resource for the seminars.



Date	Topic	Presenters
February	General Introduction, Fencing and Housing, Quality Assurance	Steve Hart
March	Breeding and Kidding Management, Selection of Breeding Stock, Traits to Consider	Terry Gipson
April	Nutrition and feeding, Pastures, Vegetation Management, Body Condition Scoring	Steve Hart
May	General Goat Management, Internal Parasites, , Predator Control, Livestock Guarding Dogs	Steve Hart
June	Herd Health, Biosecurity	Terry Gipson
July	Marketing, Budgets, Recordkeeping	Roger Sahs and Steve Hart
August	Reproduction, Genetics, Acquisition of Breeding Stock	Terry Gipson

Controlling Internal Parasites Workshop

In 2007, Langston University conducted seven workshops on controlling internal parasites with more than 200 participants in total.. Controlling internal parasites is the number two cost of production for goat producers. Many of the anthelmintics on the market are not labeled for goats and there is considerable confusion about effective control programs among goat producers. Goat producers tend to underdose and overuse anthelmintics; both hasten anthelmintic resistance. Langston University initiated a workshop to help goat producers develop a sustainable control program for internal parasites. In the workshops, goat producers learn about the life cycles of the most common and the most pathogenic parasites, various families of anthelmintics, correct dosage and dosing procedures and how to collect fecal samples and how to conduct fecal egg counts. An understanding of life cycles enables the goat producer to devise seasonal control strategies. An understanding of anthelmintics enables the goat producer to rotate anthelmintics for more efficacious control and to follow withdrawal times. An understanding of correct dosage and dosing procedures enables the goat producer to administer anthelmintics to achieve optimal efficacy. The ability to conduct fecal egg counts allows producers to deworm their goats on an as-needed basis instead of a calendar or other equally unreliable bases. A decrease of just one deworming will save the goat producer $1.20 per goat, slow anthelmintic resistance and better ensure a wholesome product.

Workshop location	Number of participants
Antlers, OK	22
Butler County, KS	25
Tulsa, OK	24
Atoka, OK	30
Pawnee, OK	35
Claremore, Ok	22
Ada, OK	60
Total	218

Nutrient Requirements of Goats

Under a research project which developed equations for energy and protein requirements for goats, as well as prediction of feed intake, an extension sub-project developed a website calculation system for "Nutrient Requirements of Goats" (http://www2.luresext.edu/goats/research/nutreqgoats.html). Most calculators were based on studies of the project reported in a Special Issue of the journal Small Ruminant Research. For calculators with score inputs (i.e., grazing and body conditions), pictures are available to aid in determining most appropriate entries. Realistic examples are given, as well as discussion of appropriate and inappropriate usage. However, for the experienced user there is an option to hide text and examples and to view only inputs and outputs.

In 2005, a calculator for calcium and phosphorus requirements was added to the existing calculators for metabolizable energy, metabolizable protein, and feed intake. for suckling, growing, mature, lactating, gestating, and Angora goats. Also in 2005, the interface of the calculators was unified into a single calculator with the English measurement system used. This will encourage the use of the calculators by American producers. The least-cost ration balancer was modified so that it incorporates the least-cost feed percentage into the diet. Also, calculators are equipped with printable version commands to obtain inputs and outputs in hard copy format. In 2007, the calcualtors were continued to be updated.

In summary, for nutrient requirement expressions to be of value, they must be readily accessible and reasonably simple. Therefore, a web-based goat nutrient requirement system was developed based on findings

of a recent project. It is hoped that this system will enjoy widespread usage and enhance feeding practices for goats.

Tanning Workshop

On November 3, 2007, Dr. Roger Merkel presented the first workshop on tanning goat hides held by AIGR. Six participants attended the one-half day workshop which consisted of a discussion of tanning methods and hands-on practice. Participants learned about skin structure and how it relates to different types of tanning – hair-on, leather and brain tanning (the traditional method of making buckskin) and different tanning chemicals and their usage. The basic steps of tanning - skinning the animal; preserving the hide; fleshing the hide; pickling and neutralizing; the actual tanning process; oiling; drying and softening; and finishing – were discussed and explained.

During the second half of the workshop participants tried some of the tanning steps on several goat hides. Preservation was done by rubbing salt on a hide to stop bacterial action that causes hair slippage. Workshop participants used a fleshing beam (a blunt, rounded edge 2 x 6 board about 5 feet long with one end resting on the ground and legs lifting the blunt edge to waist height) and fleshing knife (a blunt edged curved knife with handles on each end) to flesh, or scrape off, all the fat, meat and membrane attached to the flesh side of a raw hide.

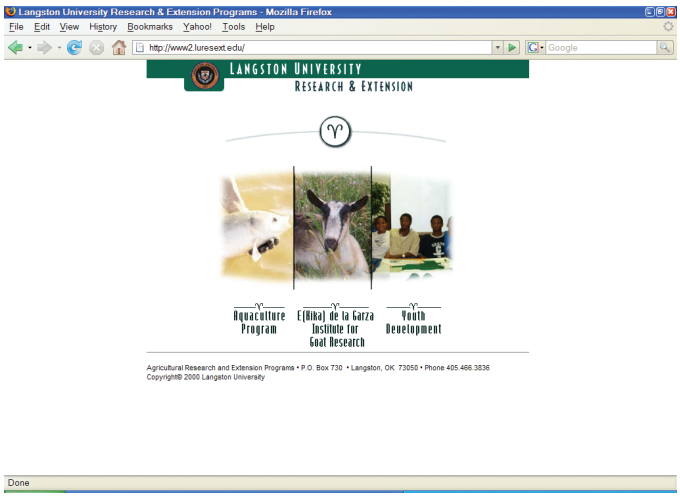
Workshop participants tanned two hides by different methods. One method used a synthetic tanning powder prepared in a solution in which the hide was placed. The second hide was tanned using a "paint-on" tan applied directly to the flesh side of the prepared hide. Care for the hides immediately after tanning and the application of oil to the hides was demonstrated. Finally, the participants all tried softening a hide that had been tanned prior to the workshop. Softening was done by pulling and stretching a tanned hide around a steel cable, hard work but worth the effort to have a soft, velvety hide.

Internet Website

http://www2.luresext.edu

The Agricultural Research and Cooperative Extension program of Langston University recently unveiled a new and improved Internet web site. The Internet address (URL) of the new web site is http://www2.luresext.edu.

Capabilities of the new web site include a document library with the complete proceedings of the annual Goat Field Day for the past three years and the quarterly newsletter for the past several years. Both the proceedings and newsletters are also available in portable document format (pdf), which allows for the viewing and printing of documents across platform and printer without loss of formatting.



Information, recent abstracts and scientific articles of completed and current research activities in dairy, fiber and meat production are available for online viewing and reading. Visitors will be able to take a Virtual Tour of the research farm and laboratories, complete with digital photos and narrative. Visitors will also be able to browse a digital Photo Album. Visitors will also be able to subscribe to our free quarterly newsletter online. Visitors will be able to test their knowledge of goats with the interactive goat quiz which covers nearly all aspects of dairy, fiber and

meat goat production. For those questions that are lacking in the interactive quiz database, visitors will be able to submit a question to be included in the database. Visitors will be able to read about research interests of faculty and will be able to contact faculty & staff via email.

Web-based Training for Meat Goat Producers

Meat goat production is one of the fastest growing sectors of the livestock industry in the United States. New producers, as well as some established ones, have an expressed need for current, correct information on how to raise goats and produce safe, wholesome products in demand by the public. As the meat goat industry grows and evolves, a quality assurance program is essential. Such a QA program ensures the production of a wholesome product that satisfies consumers and increases profit for the meat goat industry.

Langston University was awarded funding by the Food Safety and Inspection Service of USDA to develop training and certification for meat goat producers. Langston University organized and led a consortium of 1890 universities and producer associations in this project. The consortium identified the subject topics most pertinent and pressing for the instructional modules. The consortium then identified experts on the selected subject topics and pursued these experts as module authors. These authors represent the most qualified persons in their field in academia as well as in the industry. Langston University translated the sixteen instructional modules into web pages with accompanying images, and pre- and post tests for those producers wishing to pursue certification. All modules are also available in pdf for easy printing and the introductory module is available as a podchapter for downloading and listening on your favorite mp3 player. The web-site (http://www2.luresext.edu/goats/training/qa.html) was unveiled in late 2005.

Even though this web-site (http://www2.luresext.edu/goats/training/qa.html) was only unveiled in 2007, 605 producers have enrolled for certification and 52 have completed the certification process. These instructional materials will best serve meat goat producers in assisting them to produce a safe, wholesome, healthy product for the American consumer. Funding source for this project was USDA/FSIS/OPHS project #FSIS-C-10-2004 entitled "Development of a Web-based Training and Certification Program for Meat Goat Producers."

Breed Association	Number of Members Certified
American Boer Goat Association	24
American Kiko Goat Association	6
American Meat Goat Association	10
International Kiko Goat Association	2
United States Boer Goat Association	8
Alberta Goat Breeder's Association	1
None	14

The table above shows the association affiliations for the 52 certified producers. Please note that certified producers may be a member of more than one association. The table below shows the distribution of the certified producers by state.

State	Number Certified Producers
AB	1
AL	1
AR	3
BC	1
CO	1
FL	3
GA	2
IA	1
IL	1
IN	1
KS	2
KY	3
MA	1
MB	1
MN	1
MO	2
MS	2
MT	1
NV	1
OH	1
OK	4
ON	1
TN	6
TX	8
VA	1
WY	2
Total	52

Meat Buck Performance Test

Meat goat production represents the most rapidly growing animal industry in the US today, and is becoming a mainstream livestock enterprise. To further genetic progress through the identification of superior sires in the industry, Langston University and the Oklahoma Meat Goat Association established a meat goat performance test in 1997.

Entry

The eleventh annual meat buck performance test started May 5, 2007 with 23 bucks enrolled from 6 different breeders. Geographical distribution is given in the table below.

State	Bucks
MO	4
OK	3
TX	16
Total	23

Bucks were given a physical examination by Dr. Lionel Dawson, dewormed with Cydectin (moxidectin), deloused with Atroban De-Lice, given a preemptive injection of Nuflor for upper respiratory infections, and those bucks that needed booster or initial vaccinations for enterotoxemia and caseous lymphandinitis. Four weeks after check-in, all bucks were given a booster vaccination for enterotoxemia and caseous lymphandinitis.

Average age in days and entry weight are detailed in the table below.

Data	Total
Average of Entry Weight (lbs)	59.7
Average of Entry Age (days)	92

Adjustment Period

The Feed Intake Recording Equipment (FIRE) system was used for all animals. The FIRE system is a completely automated electronic feeding system, which was developed for swine but we have adapted it to goats. Animals wear an electronic eartag, which is read by an antenna in the feeder. The FIRE system automatically records body weight and feed intake. All bucks underwent an adjustment period of two weeks immediately after check-in. During the adjustment period, bucks were acclimated to the test ration and to the FIRE system.

The area immediately around FIRE feeders and waterers is concrete, however, the large majority of the inside pen is earth and is covered by pine shavings. Pine shavings were periodically added as needed to maintain fresh bedding. Bucks had free access to water provided by float-valve raised waterers. Whenever the weather was permitting, the bucks had access to the outside pens as well as the inside pens.

In 2007, we were fortunate to hire a second year veterinary student from Oklahoma State University, Ms. Janelle Blaylock. Janelle did a wonderful job with the bucks.

Ration

Nutritionists at Langston University formulated the following ration. In 1999, the amount of salt and ammonium chloride was doubled due to problems with urinary calculi the previous year. Except for the increase in salt and ammonium chloride, the ration was unchanged from that which was used in the first two meat buck performance tests. The ration was fed free-choice during the adjustment period and during the 12-week test.

Ingredient	Percentage (as fed)
Cottonseed hulls	29.07%
Alfalfa meal	19.98%
Cottonseed meal	15.99%
Ground corn	15.99%
Wheat midds	9.99%
Pellet Partner (binder)	5.00%
Ammonium chloride	1.00%
Yeast	1.00%
Calcium Carbonate	0.95%
Salt	0.50%
Trace mineral salt	0.50%
Vitamin A	0.02%
Rumensin	0.01%
TOTAL	100.00%

The crude protein content of the ration is 16% with 2.5% fat, 20.4% fiber and 60.6% TDN. Calcium phosphorus and sodium levels are .74%, .37% and 1.07%, respectively. Zinc concentration is 33.04 ppm, copper is 17.15 ppm and selenium is .21 ppm. In 2003, competitive bids were sought for the buck-test feed and Bluebonnet Feeds of Ardmore, OK was awarded the contract to supply feed for the buck performance test for 2003, 2004, 2005, 2006, and 2007.

ABGA Approved Performance Test

In early 2000, the Oklahoma performance test was designated by the American Boer Goat Association Board of Directors as an ABGA Approved Performance Test. Qualified fullblood or purebred Boer bucks will be eligible to earn points towards entry into the "Ennobled Herd Book". Candidate bucks must pass a pre-performance test inspection conducted by one (1) or more ABGA approved breeders. Ten (10) points will be awarded a Boer buck who shows an average daily weight gain (ADG) in the top five percent (5%) of the animals on test. Five (5) points will be awarded a Boer buck who shows an average daily weight gain (ADG) in the next fifteen percent (15%) of the animals on test. All bucks must gain at least three-tenths (.3) pounds per day to be awarded any points.

International Boer Goat Association, Inc. Sanctioned Test

In 2003, the Oklahoma buck performance test was sanctioned by the International Boer Goat Association, Inc.

The Oklahoma performance test continues to grow and to serve the meat goat industry.

Gain

The official performance test started on May 23 after the adjustment period was finished. Weights at the beginning of the test averaged 64 lbs with a range of 42 to 82 lbs. Weights at the end of the test averaged 116 lbs with a range of 85 to 140 lbs. Weight gain for the test averaged 52 lbs with a range of 29 to 72 lbs.

Average Daily Gain (ADG)

For the test, the bucks gained on averaged 0.62 lbs/day with a range of 0.35 lbs/day to 0.86 lbs/day.

Feed Efficiency (Feed Conversion Ratio)

For the test, the bucks consumed an average of 332 lbs of feed with a range of 223 to 400 lbs.

For the test, the bucks averaged a feed efficiency of 6.69 (feed efficiency is defined as the number of lbs. of feed needed for one lbs. of gain), with a range of 4.95 to 11.14.

Muscling

The average loin eye area as determined by ultrasonography was 1.79 square inches with a range of 1.18 to 2.12 square inches and the average left rear leg circumference was 14.9 inches with a range of 13.0 to 17.5 inches.

Index

For 2007, the index was calculated using the following parameters:

- 30% on efficiency (units of feed per units of gain)
-
- 30% on average daily gain
-
- 20% on area of longissimus muscle (loin) at the first lumbar site as measured by real time ultrasound adjusted by the goat's metabolic body weight:

$$\frac{\text{area of longissimus muscle (loin)}}{BW0.75}$$

- 20% circumference around the widest part of the hind left leg as measured with a tailor's tape adjusted by the goat's metabolic body weight:

$$\frac{\text{circumference of hind left leg}}{BW0.75}$$

The adjustment to metabolic body weight gives lighter weight goats a fair comparison of muscling to heavier goats.

The deviation from the average of the parameters measured from the goats in the performance test was used in the index calculation. Thus, the average index score for bucks on-test was 100%. Bucks that are above average have indices above 100% and those below average have index scores below 100%.

Congratulations

The Oklahoma Meat Goat Association and the Agricultural Research and Extension Program at Langston University congratulate:

- Mr. Ralph Webb of Monroe, OK
  for having the Top-Indexing buck
  in the 2007 Oklahoma Meat Buck Performance Test

Also, deserving congratulations are:

- Mr. Marvin Shurley of Sonora, TX
  for having the #1 Fastest-Gaining buck

- Mr. Marvin Shurley of Sonora, TX
  for having the #2 Fastest-Gaining buck

- Mr. Ralph Webb of Monroe, OK
  for having the #3 (tie) Fastest-Gaining buck

- Mr. AL Paul of Aubrey, TX
  for having the #3 (tie) Fastest-Gaining buck

- Mr. AL Paul of Aubrey, TX
  for having the #5 (tie) Fastest-Gaining buck

- Mr. AL Paul of Aubrey, TX
  for having the #5 (tie) Fastest-Gaining buck

- Mr. Mr. AL Paul of Aubrey, TX
  for having the Most-Feed-Efficient buck

- Mr. Mr. Ralph Webb of Monroe, OK
  for having the Most-Heavily-Muscled buck

Acknowledgments

The Buck Test supervisor wishes to acknowledge Dr. Lionel Dawson of Oklahoma State University for his contributions as the admitting and on-call veterinarian, Ms. Janelle Blaylock for their management and oversight of the day-to-day activities, Mr. Jerry Hayes and Mr. Erick Loetz of Langston University for aid and supervision, Mr. Les Hutchens and his associates at Reproductive Enterprises, Inc. for conducting the ultrasound measurements for the loin eye area, and Bluebonnet Feeds of Ardmore, OK for custom mixing the feed.

Table 1. Bucks sorted by Index score.

Owner	ID	Owner ID	Breed	Birth date	Weights (lbs)			Gain	ADG	Intake	FE*	LEA	RLC	Index
					Entry	Start	End	(lbs)	(lb/d)	(lb)		(in2)	(in)	
Ralph Webb	66	648	Boer	02/26/07	52	60	121	61	0.73	322.4	5.29	2.09	17.5	101.01
Al Paul	48	21	Boer	03/03/07	47	63	123	60	0.71	318.3	5.30	2.03	16.5	100.79
Marvin Shurley	55	285	Boer	01/24/07	55	68	140	72	0.86	367.8	5.11	1.66	14.0	100.69
Al Paul	45	10	Boer	02/11/07	45	57	118	61	0.73	367.9	6.03	1.97	15.5	100.65
Al Paul	47	20	Boer	03/03/07	36	44	101	57	0.68	282.1	4.95	1.58	14.0	100.63
Al Paul	46	15	Boer	02/11/07	69	73	133	60	0.71	345.3	5.75	2.03	17.0	100.58
Martin Peters	49	07	Boer	02/15/07	32	42	89	47	0.56	238.8	5.08	1.52	13.5	100.35
Marvin Shurley	51	259	Boer	01/22/07	43	60	113	53	0.63	317.7	5.99	1.94	15.0	100.35
Marvin Shurley	57	296	Boer	01/27/07	59	72	128	56	0.67	344.6	6.15	2.02	16.0	100.34
Marvin Shurley	60	249	Boer	01/21/07	54	68	131	63	0.75	383.2	6.08	1.77	14.5	100.31
Carrie Carmen	67	4	Boer	03/01/07	62	65	121	56	0.67	400.1	7.14	2.03	17.0	100.30
Orlin Scrivener	62	93	Boer	01/22/07	65	82	135	53	0.63	359.0	6.77	2.12	17.5	100.13
Marvin Shurley	58	246	Boer	01/21/07	56	70	122	52	0.62	329.5	6.34	1.92	15.0	100.07
Marvin Shurley	53	299	Boer	01/26/07	57	60	105	45	0.54	223.2	4.96	1.47	13.5	99.97
Marvin Shurley	59	257	Boer	01/22/07	46	68	123	55	0.65	371.1	6.75	1.83	14.5	99.96
Orlin Scrivener	64	18	Boer	12/26/06	45	60	112	52	0.62	346.0	6.65	1.74	14.0	99.95
Marvin Shurley	52	294	Boer	01/24/07	52	67	121	54	0.64	340.7	6.31	1.72	14.0	99.95
Orlin Scrivener	61	92	Boer	01/22/07	58	74	123	49	0.58	366.9	7.49	1.89	15.0	99.64
Orlin Scrivener	63	92	Boer	12/20/06	58	76	120	44	0.52	320.9	7.29	1.92	15.0	99.55
Martin Peters	50	06	Boer	02/15/07	48	65	105	40	0.48	292.4	7.31	1.66	14.0	99.40
Marvin Shurley	56	416	Boer	02/15/07	57	56	96	40	0.48	351.2	8.78	1.60	14.0	99.18
Ralph Webb	65	637	Boer	02/22/07	55	62	92	30	0.36	334.3	11.14	1.53	13.5	98.20
Marvin Shurley	54	295	Boer	01/27/07	53	56	85	29	0.35	321.5	11.08	1.18	13.0	98.00
	Average				52.3	63.8	115.5	51.7	0.62	332.4	6.69	1.79	14.9	100.0

* lbs of feed for one lb. of gain.

Table 2. Bucks sorted by Gain (ADG).

Owner	ID	Owner ID	Breed	Birth date	Weights (lbs)			Gain	ADG	Intake	FE*	LEA	RLC	Index
					Entry	Start	End	(lbs)	(lb/d)	(lb)		(in2)	(in)	
Marvin Shurley	55	285	Boer	01/24/07	55	68	140	72	0.86	367.8	5.11	1.66	14.0	100.69
Marvin Shurley	60	249	Boer	01/21/07	54	68	131	63	0.75	383.2	6.08	1.77	14.5	100.31
Ralph Webb	66	648	Boer	02/26/07	52	60	121	61	0.73	322.4	5.29	2.09	17.5	101.01
Al Paul	45	10	Boer	02/11/07	45	57	118	61	0.73	367.9	6.03	1.97	15.5	100.65
Al Paul	48	21	Boer	03/03/07	47	63	123	60	0.71	318.3	5.30	2.03	16.5	100.79
Al Paul	46	15	Boer	02/11/07	69	73	133	60	0.71	345.3	5.75	2.03	17.0	100.58
Al Paul	47	20	Boer	03/03/07	36	44	101	57	0.68	282.1	4.95	1.58	14.0	100.63
Marvin Shurley	57	296	Boer	01/27/07	59	72	128	56	0.67	344.6	6.15	2.02	16.0	100.34
Carrie Carmen	67	4	Boer	03/01/07	62	65	121	56	0.67	400.1	7.14	2.03	17.0	100.30
Marvin Shurley	59	257	Boer	01/22/07	46	68	123	55	0.65	371.1	6.75	1.83	14.5	99.96
Marvin Shurley	52	294	Boer	01/24/07	52	67	121	54	0.64	340.7	6.31	1.72	14.0	99.95
Marvin Shurley	51	259	Boer	01/22/07	43	60	113	53	0.63	317.7	5.99	1.94	15.0	100.35
Orlin Scrivener	62	93	Boer	01/22/07	65	82	135	53	0.63	359.0	6.77	2.12	17.5	100.13
Marvin Shurley	58	246	Boer	01/21/07	56	70	122	52	0.62	329.5	6.34	1.92	15.0	100.07
Orlin Scrivener	64	18	Boer	12/26/06	45	60	112	52	0.62	346.0	6.65	1.74	14.0	99.95
Orlin Scrivener	61	92	Boer	01/22/07	58	74	123	49	0.58	366.9	7.49	1.89	15.0	99.64
Martin Peters	49	07	Boer	02/15/07	32	42	89	47	0.56	238.8	5.08	1.52	13.5	100.35
Marvin Shurley	53	299	Boer	01/26/07	57	60	105	45	0.54	223.2	4.96	1.47	13.5	99.97
Orlin Scrivener	63	92	Boer	12/20/06	58	76	120	44	0.52	320.9	7.29	1.92	15.0	99.55
Martin Peters	50	06	Boer	02/15/07	48	65	105	40	0.48	292.4	7.31	1.66	14.0	99.40
Marvin Shurley	56	416	Boer	02/15/07	57	56	96	40	0.48	351.2	8.78	1.60	14.0	99.18
Ralph Webb	65	637	Boer	02/22/07	55	62	92	30	0.36	334.3	11.14	1.53	13.5	98.20
Marvin Shurley	54	295	Boer	01/27/07	53	56	85	29	0.35	321.5	11.08	1.18	13.0	98.00
	Average				52.3	63.8	115.5	51.7	0.62	332.4	6.69	1.79	14.9	100.0

* lbs of feed for one lb. of gain.

Table 3. Bucks sorted by Feed Efficiency.

Owner	ID	Owner ID	Breed	Birth date	Weights (lbs)			Gain	ADG	Intake	FE*	LEA	RLC	Index
					Entry	Start	End	(lbs)	(lb/d)	(lb)		(in2)	(in)	
Al Paul	47	20	Boer	03/03/07	36	44	101	57	0.68	282.1	4.95	1.58	14.0	100.63
Marvin Shurley	53	299	Boer	01/26/07	57	60	105	45	0.54	223.2	4.96	1.47	13.5	99.97
Martin Peters	49	07	Boer	02/15/07	32	42	89	47	0.56	238.8	5.08	1.52	13.5	100.35
Marvin Shurley	55	285	Boer	01/24/07	55	68	140	72	0.86	367.8	5.11	1.66	14.0	100.69
Ralph Webb	66	648	Boer	02/26/07	52	60	121	61	0.73	322.4	5.29	2.09	17.5	101.01
Al Paul	48	21	Boer	03/03/07	47	63	123	60	0.71	318.3	5.30	2.03	16.5	100.79
Al Paul	46	15	Boer	02/11/07	69	73	133	60	0.71	345.3	5.75	2.03	17.0	100.58
Marvin Shurley	51	259	Boer	01/22/07	43	60	113	53	0.63	317.7	5.99	1.94	15.0	100.35
Al Paul	45	10	Boer	02/11/07	45	57	118	61	0.73	367.9	6.03	1.97	15.5	100.65
Marvin Shurley	60	249	Boer	01/21/07	54	68	131	63	0.75	383.2	6.08	1.77	14.5	100.31
Marvin Shurley	57	296	Boer	01/27/07	59	72	128	56	0.67	344.6	6.15	2.02	16.0	100.34
Marvin Shurley	52	294	Boer	01/24/07	52	67	121	54	0.64	340.7	6.31	1.72	14.0	99.95
Marvin Shurley	58	246	Boer	01/21/07	56	70	122	52	0.62	329.5	6.34	1.92	15.0	100.07
Orlin Scrivener	64	18	Boer	12/26/06	45	60	112	52	0.62	346.0	6.65	1.74	14.0	99.95
Marvin Shurley	59	257	Boer	01/22/07	46	68	123	55	0.65	371.1	6.75	1.83	14.5	99.96
Orlin Scrivener	62	93	Boer	01/22/07	65	82	135	53	0.63	359.0	6.77	2.12	17.5	100.13
Carrie Carmen	67	4	Boer	03/01/07	62	65	121	56	0.67	400.1	7.14	2.03	17.0	100.30
Orlin Scrivener	63	92	Boer	12/20/06	58	76	120	44	0.52	320.9	7.29	1.92	15.0	99.55
Martin Peters	50	06	Boer	02/15/07	48	65	105	40	0.48	292.4	7.31	1.66	14.0	99.40
Orlin Scrivener	61	92	Boer	01/22/07	58	74	123	49	0.58	366.9	7.49	1.89	15.0	99.64
Marvin Shurley	56	416	Boer	02/15/07	57	56	96	40	0.48	351.2	8.78	1.60	14.0	99.18
Marvin Shurley	54	295	Boer	01/27/07	53	56	85	29	0.35	321.5	11.08	1.18	13.0	98.00
Ralph Webb	65	637	Boer	02/22/07	55	62	92	30	0.36	334.3	11.14	1.53	13.5	98.20
	Average				52.3	63.8	115.5	51.7	0.62	332.4	6.69	1.79	14.9	100.0

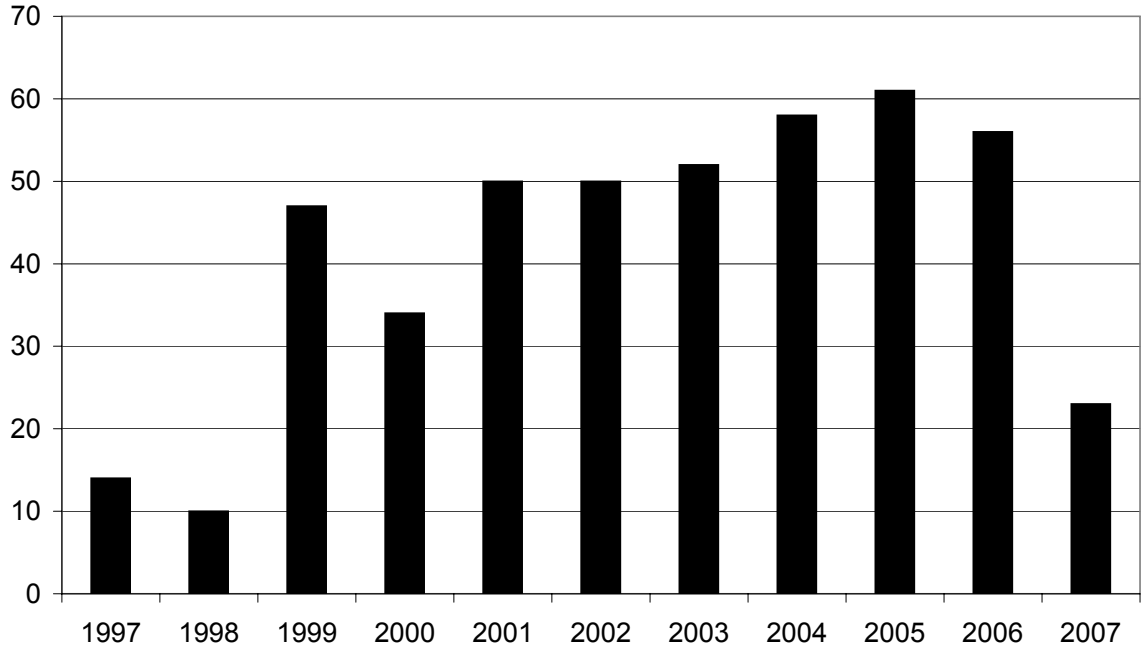
* lbs of feed for one lb. of gain.

Table 4. Estimated weights (at 120, 150, and 180 days of age) and age (at 60, 80, and 100 lbs).

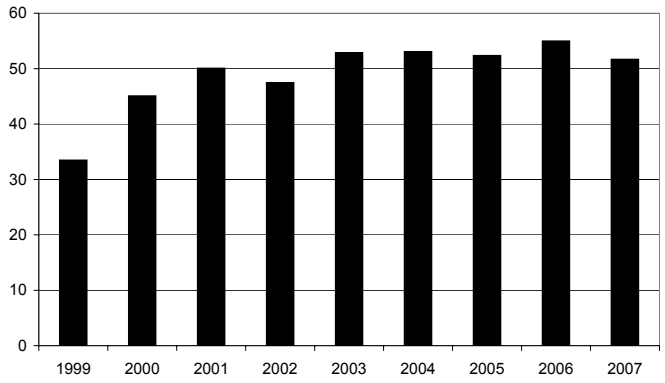
ID	BREED	WT 120D	WT 150D	WT 180D	AGE 60W	AGE 80W	AGE 100	AGE	Beg wt	Mid wt	adg*
45	Boer	76	99	123	100	125	151	101	57	90	0.78
46	Boer	89	112	134	81	108	134	101	73	99	0.75
47	Boer	73	94	116	103	130	158	81	44	69	0.73
48	Boer	96	120	144	75	100	125	81	63	94	0.80
49	Boer	56	73	90	127	162	198	97	42	64	0.57
50	Boer	74	90	107	95	131	167	97	65	82	0.56
51	Boer	59	81	102	121	149	178	121	60	87	0.71
52	Boer	71	89	108	103	135	167	119	67	91	0.63
53	Boer	58	75	92	124	159	195	117	60	66	0.57
54	Boer	58	69	81	126	178	229	116	56	57	0.39
55	Boer	74	100	126	104	127	150	119	68	99	0.87
56	Boer	69	83	98	101	143	185	97	56	70	0.48
57	Boer	76	97	117	97	126	155	116	72	97	0.69
58	Boer	71	91	110	104	134	164	122	70	92	0.66
59	Boer	70	91	112	105	134	163	121	68	98	0.70
60	Boer	70	95	120	107	132	156	122	68	102	0.83
61	Boer	76	96	115	94	126	157	121	74	104	0.64
62	Boer	83	103	122	84	115	146	121	82	103	0.64
63	Boer	60	76	92	120	158	195	154	76	96	0.53
64	Boer	38	59	81	151	179	206	148	60	89	0.72
65	Boer	71	83	96	95	143	191	90	62	64	0.42
66	Boer	89	112	134	82	108	135	86	60	85	0.76
67	Boer	93	116	138	75	102	129	83	65	95	0.74

* adg estimated by regression analysis and therefore may differ from ADG in other tables.

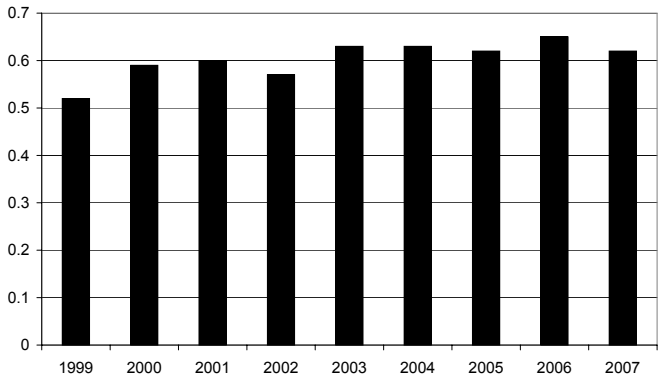
Bucks enrolled



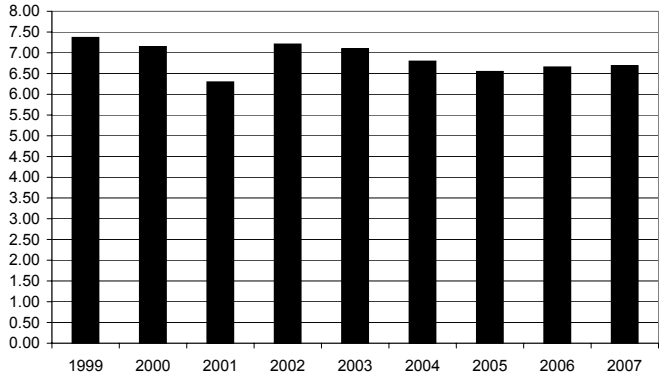
Gain (lb)



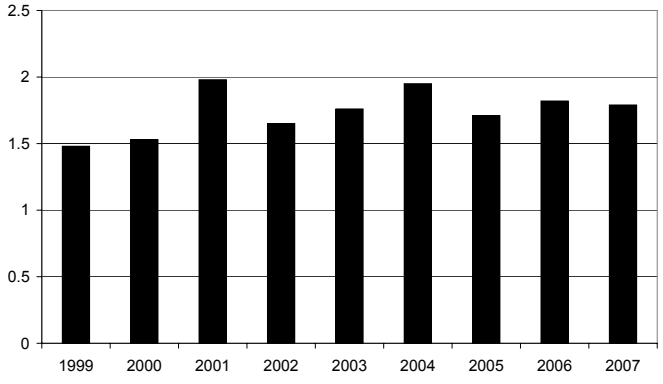
ADG (lb/day)



Feed Efficiency



Loin Eye Area (sq. in)



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International Overview

Roger Merkel
International Program Leader

Objectives

Part of the mission of the American Institute for Goat Research is to effect positive change in goat production throughout the world. To fulfill this aspect, the Institute has developed and maintains many strong ties with research and academic institutions around the world. In addition to collaborative work with foreign institutions, the Institute hosts visiting scientists from over 20 foreign countries to conduct research. Training for foreign livestock workers and scientists as well as for U.S.-based persons who will travel and work overseas are other ways in which the Institute is active in the international arena. General objectives of the Institute's international program are to: 1) increase our knowledge of goat production systems worldwide and current constraints to increased production; 2) build human capacity through training foreign scientists and agricultural workers in goat production thereby allowing them to more effectively carry out their missions of teaching, research, and extension; 3) increase Langston University and the Institute's involvement in agricultural development and impact on human welfare; and 4) enhance the Institute's knowledge of development and development issues. As recognition of the impact that the Institute has had on international development, five Langston University scientists, Drs. Terry Gipson, Arthur Goetsch, Roger Merkel, Tilahun Sahlu, and Steve Zeng, were jointly awarded the 2006 George Carver Agricultural Excellence Award of USAID for their efforts and positive impact on international agriculture.

International Research

While most international projects conducted by the Institute have aspects of research, training, and extension, some are more research oriented. Many of these types of grants are typified by a number of projects with countries in the Middle East.

Egypt, Israel, Jordan, Al-Quds University in the West Bank (Palestinian Authority)

The grant "Multinational Approaches to Enhance Goat Production in the Middle East" supported by the Middle East Regional Cooperation program of USAID, officially began in October, 2000. The program promotes collaborative research, training, and extension activities among Langston University, the Desert Research Center of Egypt, the Volcani Center in Israel, Al-Quds University in East Jerusalem working in the West Bank, and the Jordan University of Science and Technology. The project ends in the fall of 2008. The research being conducted and knowledge being transferred to goat farmers and users of goat milk products in the Middle East offer great potential to improve food security and economic conditions of people of the region.

There have been a number of training functions involving participants from the different locations. In June, 2002 a 2-week training activity was held at Langston University on milk hygiene and processing, along with seminars and discussions by primary project personnel. Furthermore, in September, 2002, training on goat heath management was provided in Jordan over a 5-day period. In September, 2004, a 1-week training activity was held at the Desert Research Center in Cairo, Egypt on the use of a software package developed at the Animal Production Research Institute of Egypt. There were attendees from Jordan University of Science and Technology, Desert Research Center and Animal Production Research Institute of Egypt, and Al-Quds University of East Jerusalem for the Palestinian Authority.

Activities in Egypt include monitoring production of 18 herds to characterize the three prevalent types of production systems, i.e., extensive, semi-intensive, and intensive. This was preceded by use of a questionnaire with a larger number of farms in part to identify those to be worked with throughout the project. There were a large number of advanced technology packages being transferred to farms in North Sinai. Seventeen farms located at Rafah, El-Sheikh, Zoyied, and Al-Arish are participating in an activity of concentrate feeding to fatten young goats while at the same time lessening the number of grazing animals. Four farms in Al-Arish were involved in an outreach activity of improving the quality of crop residues such as tomatoes, cantaloupe, and maize stock. Four farms in Al-Arish also cooperated in the making of new feed blocks, which offer potential to decrease feed waste, preserve feed for long periods of time, and are easily transported. Damascus bucks were distributed to 15 Bedouin farmers in areas near Rafah, Sheikh Zowaied, Arish, and Nekla. They were used for crossbreeding with local goats. In addition, DNA techniques (e.g., RAPD) were being used to genetically define the goat populations in the Sinai region.

Work in Israel has involved the prevalence of intramammary infection and bacteriological status in goats on farms of intensive and semi-intensive production systems. A relatively large number of udder halves on study farms were found to be infected. This is of major importance, since quality of milk from infected mammary glands is low. Such milk tends to bacteriologically deteriorate rapidly, develop off-flavors due to enzymatic activity, and results in poor cheese because of a high number of somatic cells. Future research will address the possibility of identifying markers to serve as indicators for early detection of subclinical mastitic udders.

In Jordan, goat milk chemistry and microbiological status at many different farms were characterized in different stages of lactation. For extension activities, 18 goat flocks were subjected to veterinary monitoring. A household goat farmer questionnaire was developed to study and understand all aspects of goat production in the region. There were numerous other technology transfer activities, such as a goat farmer field day, cheese making/milk processing workshops at Rajeb town, Ajloun city, Ein Jana town, Ebin, and Al Muager town and numerous meetings with local goat farmers. Cheese making workshops included training in producing yogurt, Jameed (hard dry cheese made from whey), Keshk (boiled dry wheat grits and whey), Labaneh, fresh frozen butter, chocolate-flavored milk, ghee, and white brined and white boiled cheese from goat milk.

Activities in the West Bank of the Palestinian Authority are being conducted by Al-Quds University of East Jerusalem. There are two districts being addressed: Hebron and Jericho.

More than 150 goat milk samples were collected from Jericho, Hebron, and Ezzeria. Three samples were collected from each goat, the first one for microbiological tests to detect the bacterial agents of intramamary infection that affect the milk yield and its composition. The second sample was for measuring milk composition, which was examined in duplicate using a Milkscan analyzer. Constituents measured included fat, solids, protein, solids-not-fat, lactose, freezing point, etc. The third sample was used for DNA analysis after extraction by various methods based on PCR-RFLP and the Reverse Dot Blot technique.

In regard to samples analyzed for milk composition, there were 500 samples from Hebron and 170 samples from Jericho. Differences were clear between the two studied geographical areas. Mean protein and fat concentrations in Hebron were 3.27 and 5.59%, respectively, and levels in Jericho were 4.0 and 4.15%, respectively.

Primers were designed in a laboratory to detect the gene for characterization of goat casein CSN3, for the two variants A and B, and to study the polymorphism in Palestinian goat breeds. Variant B showed the highest frequency and was predominant among all breeds from different areas, reaching 83.2%, while the heterozygote genotype AB was 15.3% and A 1.5%.

Other research grants with Middle Eastern Institutions

The Institute is conducting two additional grants having research collaboration with institutions in the Middle East. The first of these entails collaboration with the Newe Ya'ar Research Center of the Agricultural Research Organization in Israel on a grant entitled "Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier." The second grant continues the collaborative research relationship between the Institute and the Desert Research Center of Egypt through researching "Effects of Acclimatization on Energy Requirements of Goats." Both of these research grants deal with important aspects of energy expenditure by goats.

Jordan, China, Mexico, Rwanda, Ivory Coast

A third grant involving a Middle Eastern institute also includes institutions in three other regions of the world. The grant "International Collaboration in Goat Research and Production Web-based Support Aids" partners the American Institute for Goat Research with Jordan University of Science and Technology, Northwest Science-Technology University in China, National University of Rwanda, Centre National Recherche Agronomique in Cote d'Ivoire, and University of Chapingo in Mexico. This grant expands usage of the interactive, web-based nutrient calculator for goats and the goat production simulation program developed by Institute scientists through translation into Arabic, Chinese, French, and Spanish. Having the web-based nutrient calculator in these languages will increase the number of producers and scientists who will be able to utilize the unique features of the calculator and enhance its usefulness. Beta versions of these sites are on-line or nearing completion. All sites should become operational in 2008.

Training and Program Support

International Collaboration in Goat Research and Production in China

In June/July 2007, Drs. Marvin Burns, Dean of School of Agriculture and Applied Sciences, Tilahun Sahlu, Director of the America Institute for Goat Research, and Steve Zeng, Associate Professor/Dairy Product Specialist traveled to several Chinese agricultural universities to conduct or establish collaborative activities in goat research and production. At the China Agricultural University, the team assisted graduate students with experimental design and conduct, English manuscript preparation, conducted a cheese processing workshop, and a dairy and cheese judging and sensory evaluation seminar. Dr. Zeng demonstrated cheese judging skills and practical techniques to professors and students. Participants evaluated ten cheese varieties from the US and ten local varieties. Discussions were held with faculty and students from the College of Food Science & Nutrition Engineering and the Key Laboratory of Functional Dairy Foods at China Agricultural University. Based on mutual interests in dairy foods, Langston University and China Agricultural University signed a Memorandum of Understanding for research and academic collaboration. Specific items of interest include but are not limited to milk quality, processing technology, analytical technique, sensory evaluation, cheese development, cheese standards, and functional dairy foods.

The Langston team then visited Northwest A&F University in Yangling, Shaanxi province, a long-time collaborator in goat research. The team toured dairy goat farms of the government-financed system and farmers' cooperative. They also discussed future research collaboration with university officials, faculty and students. Dr. Zeng gave a seminar on Dairy Herd Improvement (DHI) Laboratory Operation using the Langston DHI lab as a model to demonstrate the basics and principles of the DHI system. Both the Chinese collaborators and Langston delegation agreed that a DHI-type system will soon become a reality in China.

The final university visited was Zhejiang University, one of the top universities in China. Dr. Zeng presented a seminar on Dairy and Cheese Judging and Sensory Evaluation seminar and demonstrated cheese judging skills and practical techniques. In addition, a seminar on how to prepare English manuscripts for publication in Science-Citation-Index (SCI) journals was conducted collectively by the Langston team for

graduate students. Assistance was also provided to several Ph.D. candidates in preparation and revision of scientific manuscripts for publication in SCI cited journals.

Cheese Celebration-2007 in Italy

Dr. Steve Zeng, Associate Professor/Dairy Product Specialist, was invited to attend the bi-annual Cheese Celebration-2007 in Turin, Italy in September, 2007. This cheese conference was sponsored by the International Slow Food Organization, specifically promoting small scale, farmstead and artisanal cheese making in the world. Goat and sheep cheese makers from around the world presented their cheeses to an estimated audience of fifty thousand visitors. Dr. Zeng was one of few delegates from the U.S. Dr. Zeng gave overviews of the research and extension programs of the American Institute for Goat Research in several small settings. As a taste panel member, Dr. Zeng had the opportunities to taste thousands of artisanal cheeses of cow, goat, sheep, buffalo and yak milk. This experience provided Dr. Zeng with an opportunity to taste and experience the vast variety of unique and traditional cheeses from around the world. Goat and sheep cheeses were more highly regarded as a delicacy than cow cheese. Dr. Zeng also had the opportunity to tour farmstead cheese makers and observe the function of cooperatives to promote the dairy goat industry as a whole. Many of the practices observed could be applied to the U.S. dairy goat industry.

Agricultural Development

Ethiopian Sheep and Goat Productivity Improvement Program

In 2005 the American Institute for Goat Research of Langston University and Prairie View A&M University, Prairie View, TX were awarded a $5.5 million grant from the USAID Mission in Ethiopia for a project entitled "Ethiopia Sheep and Goat Productivity Improvement Program." This 5-year program entails collaboration with the Ministry of Agriculture and Rural Development of the Government of Ethiopia. The overall goal of the program is to conduct research and extension activities in the areas of production and marketing that will result in a sustainable increase in small ruminant productivity in Ethiopia to improve food and economic securities. The project works in six regions of Ethiopia (Tigray, Amhara, Oromia, Southern States, Afar, and Somali), and addresses a number of factors including human and institutional capacity building, research and technology transfer, and introduction of improved animal genetics.

Activities in the area of research and technology transfer have focused on demonstrations and farm use of technologies such as ammoniation of crop residues via urea and making molasses/urea blocks. Development agents are taught these techniques and participate with project staff in conducting demonstrations with village participants. Applied on-farm research on animal supplementation and improved feeding strategies, such as creep feeding, is also conducted. More detailed research on certain aspects of the Ethiopia small ruminant meat industry, such as reasons for and methods to reduce darkening of carcasses of Highland sheep, is important in assisting the growing sheep and goat meat export market.

In 2007, Boer goats and Dorper sheep were imported from South Africa into Ethiopia, the first ever importation of these animals into the country. These animals will form the backbone of a crossbreeding program designed to utilize the fast growth rate and larger carcass of these animals with the native adaptability and toughness of local breeds. The resulting crossbreds will be able to supply the export market with the desired frame size and carcass characteristics.

The training component of the project aims to enhance the knowledge and ability of village development agents to assist farmers in raising small ruminants via direct training in small ruminant productivity and by producing a handbook on small ruminant production written by Ethiopian scientists. Technical bulletins of certain aspects of sheep and goat raising have been produced and distributed to development agents and institutions throughout the country. In order to combat the problem of external parasites downgrading the quality of Ethiopian sheep and goat skins for the important leather industry, the project is training villagers

to be providers of dipping and spraying services to control these pests. As with the applied research and crossbreeding component, the training component aims to enhance the ability of Ethiopian institutions and personnel to effect sustainable, positive change in small ruminant production.

Child education grant

In 2006, the Institute was awarded a grant to work with Hawassa University on increasing the attendance of children in schools and reducing dropout rates, particularly in rural Ethiopia. Poverty and the need for children to work to support their families and assist in farming activities are main factors that prevent children from obtaining an education. This is particularly true for young girls. This grant worked with two schools to conduct surveys to determine the cause of low attendance and high dropout. Facilities at these schools were upgraded and interventions developed as a model that other Ethiopian schools could use to increase the rate of child education.

The End Result

The American Institute for Goat Research is proud of its international activities and the impact they have on strengthening human and institutional capacity of foreign institutions, providing important and relevant research results on local issues of importance, and in the assistance provided to small farmers, and particularly women, in enhancing family nutrition and income generation. These are unique activities that support the mission and goals of the Institute.

Recent International Grants

Years	2006-2007
Title	Sustainable Interventions to Increase Child Education in Ethiopia: Models for Poverty Reduction and Overcoming Child Labor Constraints
Collaborators	Langston University; Hawassa University, Hawassa, Ethiopia
Funding source	United Negro College Fund Special Programs
Funding amount	$25,000
Years	2005-2010
Title	Ethiopia Sheep and Goat Productivity Improvement Program
Collaborators	Langston University; Prairie View A & M University, Ministry of Agriculture and Rural Development of the Government of Ethiopia
Funding source	USAID Ethiopia
Funding amount	$5,500,000
Years	2005-2008
Title	International Collaboration in Goat Research and Production Web-Based Decision Support Aids
Collaborators	Langston University; Jordan University of Science and Technology; Northwest Science-Technology University, China; Département des Sciences Animales of Institut National Agronomique, France; University of Chapingo in Mexico
Funding source	USDA International Science and Education Competitive Grants Program
Funding amount	$99,959

Years	2005-2008
Title	Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier
Collaborators	Langston University; Newe Ya'ar Research Center of the Agricultural Research Organization, Israel
Funding source	United States – Israel Binational Agricultural Research and Development Fund
Funding amount	$310,000
Years	2005–2007
Title	Effects of Acclimitization on Energy Requirements of Goats.
Collaborators	Langston University; Desert Research Center, Egypt
Funding source	U.S. – Egypt Joint Science and Technology Fund
Funding amount	$58,500
Years	2003 - 2006
Title	Al-Sharaka, The Partnership. Revitalizing the Higher Education System in Iraq
Collaborators	Langston University, University of Oklahoma; Oklahoma State University; Cameron University, Lawton, OK; Al Anbar University, Ramadi City, Iraq; Babylon University, Hilla City, Iraq; Basrah University, Basrah, Iraq; Salahaddin University, Erbil, Iraq; University of Technology, Baghdad, Iraq
Funding source	USAID
Funding amount	$4,988,569
Years	2000 - 2008
Title	Multinational Approaches to Enhance Goat Production in the Middle East
Collaborators	Langston University; Desert Research Center, Cairo, Egypt; Volcani Center, Bet Dagan, Israel; Al-Quds University in East Jerusalem working in the West Bank; Jordan University of Science and Technology, Irbid, Jordan
Funding source	USAID/Middle East Regional Cooperation Program
Funding amount	$1,199,725

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Research Overview

Arthur Goetsch

Goat Research Leader

There has been and is a wide array of research areas addressed by our program. All major types of goats produced in the US are considered, i.e., ones raised for meat, milk, and(or) fiber, both cashmere and mohair. The increasing demand for goat meat and decline in the mohair industry in recent years have resulted in an expansion of research topics with meat goats, but because the future is unknown, all goat industries will continue to receive attention. The Institute has and will in the future conduct research to increase levels and efficiencies of goat production, enhance utilization of goat products, and improve use of goats for specific purposes such as vegetation management. There is intent to increase economic returns to those raising goats or processing their products, as well as providing other benefits such as enhanced sustainability of livestock production systems.

A large proportion of the Institute's research program is made possible by grants, many of which are through USDA programs. Although dissemination of information generated from all of these projects occurs, some entail strong extension components. Likewise, there are projects listed in our international section that entail significant research components.

To provide an idea about our research program since the last Field Day, listed below are research projects and experiments we have been involved with in 2007, abstracts for 2008, and summaries of scientific articles that were published in 2007 or currently are "in press" to appear in 2008 journals.

Standard Abbreviations Used

BW = body weight
CP = crude protein
dL = decaliter
DMI = dry matter intake
kg = kilogram
M = mole
MEI = ME intake
mm = millimeters
ng = nanogram
OM = organic matter
SE = standard error
wt = weight
vs = versus
cm = centimeters
d = day
DM = dry matter
g = gram
L = liter
ME = metabolizable energy
mL = milliliter
mo = month
NDF = neutral detergent fiber
P = probability
TDN = total digestible nutrients
vol = volume
μ = micro

Research Projects

Current Research Projects (2007-2008)

Title:	Enhanced Goat Production and Products in the South-Central U.S.
Type:	CSREES project
Project Number:	OKLX-SAHLU
Period:	2006-2011
Investigators:	T. Sahlu, A. L. Goetsch, R. Puchala, R. C. Merkel, T. A. Gipson, S. P. Hart, S. Zeng, and Z. Wang
Institution:	Langston University
Objective:	Study goat feeding and management, relevant health issues, and milk product technologies in order to increase the level and efficiency of goat productivity for increased profitability from goat production and lower costs to consumers of goat products.
Title:	Characterization of the Energy Requirement for Activity by Grazing Ruminants
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2005-38814-16352
Period:	2005-2008
Investigators:	T. Sahlu[1], R. Puchala[1], A. L. Goetsch[1], T. A. Gipson[1], K. E. Turner[2], and B. Kouakou3
Institutions:	[1]Langston University, [2]Applachian Farming Systems Research Center, and [3]Fort Valley State University
Objectives:	Develop and evaluate a system to predict the grazing activity energy cost for ruminants by determining effects of animal and dietary conditions on energy expenditure, metabolizable energy intake, the grazing activity energy cost, grazing and walking times, and horizontal and vertical distances traveled.
Title:	The Ability of Goats to Withstand Harsh Nutritional Environments
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2005-38814-16353
Period:	2005-2008
Investigators:	A. L. Goetsch[1], R. Puchala[1], T. Sahlu[1], and H. C. Freetly[2]
Institutions:	[1]Langston University and [2]Meat Animal Research Center
Objectives:	Determine if there are differences between goats and sheep and between meat goat species of the US in the ability to utilize diets with limited supplies of nitrogen and energy and to characterize the physiological bases of any such differences.

Title:	International Collaboration in Goat Research and Production Web-Based Decision Support Aids
Type:	USDA International Science and Education Competitive Grants Program
Project Number:	2005-51160-02281
Period:	2005-2009
Investigators:	A. L. Goetsch and T. A. Gipson
Institution:	Langston University
Goal:	Facilitate future collaborative research between the American Institute for Goat Research (AIGR) and institutions in Arabic-, Chinese-, French-, and Spanish-speaking countries, as well as to gain knowledge of goat research and production practices in other areas of the world.
Objectives:	Translate and adapt two web-based goat production and research decision-support tools developed at the AIGR (goat nutrient requirements and feed intake; goat production system simulation model) for use and future collaborative research in the Middle East, China, France and other French-speaking countries, and Central and South America.
Title:	Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier
Type:	United States - Israel Binational Agricultural Research and Development Fund
Project Number:	US-3694-05 R
Period:	2005-2008
Investigators:	A. L. Goetsch[1], Y. Aharoni[2], A. Brosh[2], R. Puchala[1], T. A. Gipson[1], Z. Henkin[3], and E. Ungar[4]
Institutions:	[1]Langston University, [2]Newe Ya'ar Research Center, Agricultural Research Organization, [3]MIGAL-Galilee Technology Center, and [4]Agronomy and Natural Resources, Agricultural Research Organization
Objectives:	Develop and evaluate a system(s) to predict the grazing activity energy cost of ruminants by determining effects of stocking rate (influencing available forage mass and forage quality) and animal production state and season (affecting energy demand) on energy expenditure, metabolizable energy intake, energy expended in grazing activity, grazing and walking times, horizontal and vertical distances traveled, and diet quality with grazing females of two breeds of cattle and goats.

Title:	Effects of Acclimatization on Energy Requirements of Goats
Type:	United States - Egypt Joint Science and Technology Fund Program
Project Number:	BIO9-017
Period:	2005-2008
Investigators:	A. L. Goetsch[1] and H. El Shaer[2]
Institutions:	[1]Langston University and [2]Desert Research Center
Objective:	Develop a means of adjusting the maintenance energy requirement of goats for acclimatization.
Title:	Decreased Methane Emission by Ruminants Consuming Condensed Tannins
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2004-38814-02606
Period:	2004-2007
Investigators:	R. Puchala[1], A. L. Goetsch[1], C. R. Krehbiel[2], and V. H. Varel[3]
Institutions:	[1]Langston University, [2]Oklahoma State University, and [3]USDA ARS Meat Animal Research Center
Objectives:	· Determine effects of consuming different condensed tannin sources on the ruminal microflora and methane emission, digestibility, nitrogen and energy balance, and energy expenditure by goats.
	· Determine effects of consuming diets with different levels of a forage containing condensed tannins on the ruminal microflora and methane emission, digestibility, nitrogen and energy balance, and energy expenditure by goats
	· Determine effects of different frequencies of consumption of a forage containing condensed tannins on the ruminal microflora and methane emission, digestibility, nitrogen and energy balance, and energy expenditure by goats.

Title:	Evaluation and Modeling Extended Lactations in Dairy Goats
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2003-38814-02579
Period:	2004-2008
Investigators:	T. A. Gipson[1], A. Capuco[2], T. Sahlu[1], L. J. Dawson[3], and S. Ellis[4]
Institutions:	[1]Langston University, [2]USDA ARS Gene Evaluation and Mapping Laboratory, [3]Oklahoma State University, and [4]Clemson University Research Center
Objectives:	· Compare extended versus standard lactations with reference to milk, fat, and protein yield, reproduction and health issues . nitrogen and energy balance, and energy expenditure by goats.
	· Mathematically model the lactation curve for extended lactations in dairy goats, with particular emphasis on the effect of extended lactations has upon the shape and scale of the lactation curve
	· Examine the physiological changes in the mammary gland over the course of an extended lactation.
Title:	Quality, Safety, and Shelf-Life of Dairy Goat Products in the U.S. Market
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2003-38814-02587
Period:	2004-2008
Investigators:	S. S. Zeng[1], M. Perdue[2], and S. E. Gilliland[3]
Institutions:	[1]Langston University, [2]USDA ARS Environmental Microbial Safety Laboratory, and [3]Oklahoma State University
Objectives:	· Establish a comprehensive database of dairy goat product safety, quality and shelf-life on the store shelves.
	· Identify the unique values such as CLA of dairy goat products.
	· Develop and implement biological, biochemical and/or physical interventions to control undesirable microbes.
	· Enhance the marketability and profitability of goat milk and dairy products by improving product microbiological and sensory quality, and by prolonging shelf-life of finished products
	· Assist store managers and personnel handling goat milk and dairy products by providing information and techniques to maximize product quality and shelf-life

Title:	Nutrient Requirements of Goats: Composition of Tissue Gain and Loss
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2003-38814-13923
Period:	2003-2006
Investigators:	T. Sahlu[1], A. L. Goetsch[1], C. L. Ferrell[2], and C. R. Krehbiel[3]
Institutions:	[1]Langston University, [2]USDA ARS Meat Animal Research Center, and [3]Oklahoma State University
Objective:	· Determine the composition of tissue gain by growing Boer crossbred and Spanish meat goats consuming different quality diets from weaning to 1 year of age
	· Determine the composition of tissue loss and gain by mature meat goats
	· Determine the composition of tissue loss and gain by lactating dairy goats.
	· Develop equations to predict body composition of growing and mature meat goats and lactating dairy goats based on shrunk body weight and urea space
Title:	The Grazing Activity Energy Cost of Goats
Type:	United States - Egypt Joint Science and Technology Fund Program
Project Number:	BIO11-001-005
Period:	2007-2009
Investigators:	A. L. Goetsch[1], R. Puchala[1], T. A. Gipson[1], H. El Shaer[2], and A. Helal[2]
Institutions:	[1]Langston University and [2]Desert Research Center
Objective:	· Determine the magnitude of the grazing activity energy cost of goats under different common production settings in an arid region of Egypt and in the south-central U.S.
	· Develop simple means of predicting the grazing activity energy cost of goats based on factors relatively easily estimable by farmers

Title:	Impact of Sub-Clinical Mastitis on Production and Quality of Goat Milk and Cheese
Type:	USDA 1890 Institution Research Capacity Building
Project Number:	2007-38814-18474
Period:	2007-2010
Investigators:	S. S. Zeng[1], D. Bannerman[2], and L. Spicer[3]
Institutions:	[1]Langston University, [2]USDA ARS Bovine Functional Genomics Laboratory, and [3]Oklahoma State University
Objective:	· Assess prevalence of subclinical mastitis in dairy goats during a year-round lactation in Oklahoma
	· Quantify and qualify losses in milk yield and cheese production associated with subclinical mastitis test the impact of major types of CNS bacteria
	· Test the impact of major types of CNS bacteria species causing IMI (S. epidermidis, S. simulans, S. caprae, and S. chromogenes) on the inflammatory response in milk and to relate it to caseinolysis, coagulation properties, and cheese yield
	· Study the mechanism by which CNS affects caseinolysis and in turn the coagulation properties
	· Investigate changes in PL and SCC of milk caused by subclinical mastitis and their effects on milk coagulation, and cheese yield and texture

Experiments in 2007/2008

Title:	The relationship between fasting heat production and maintenance energy expenditure and age in Boer and Spanish goats
Experiment Number:	AB-07-01
Project Number:	US-3694-05 R
Investigators:	A. Beker, A. L. Goetsch, R. Puchala, and T. Sahlu
Objectives:	Characterize patterns of change with advancing age in the maintenance energy requirement of Boer and Spanish goats
Title:	Interplay in energy use by splanchnic and extra-splanchnic tissues of locomotion and forage ingestion
Experiment Number:	AA-07-02
Project Number:	OKLX-SAHLU
Investigators:	I. Tovar-Luna, A. Asmare, R. Puchala, G. Detweiler, K. Tesfai, L. J. Dawson, T. Sahlu, and A. L. Goetsch
Objectives:	1) Determine influences on and interactions in whole body, splanchnic, and extra-splanchnic energy expenditure of meal size and walking.
	2) Determine influences on whole body, splanchnic, and extra-splanchnic energy expenditure of walking and walking speed before, during, and after forage ingestion.
Title:	Effects of genotype, body condition score, and concentrate supplementation on the grazing activity energy cost of goats
Experiment Number:	AAR-07-03
Project Number:	2005-38814-16352
Investigators:	A. Askar, A. L. Goetsch, A. Asmare, A. Beker, R. Puchala, T. Sahlu, T. A. Gipson, G. Detweiler, and K. Tesfai
Objectives:	Overall objective: Develop and evaluate a system to predict the energy cost for grazing activity for ruminants.
	Specific objectives: Determine effects of meat goat breed (Boer and Spanish), low vs high initial body condition score, and concentrate supplementation on energy expenditure, metabolizable energy (ME) intake, ME used for grazing activity, grazing and walking times, and horizontal and vertical distances traveled

Title:	Evaluation in Georgia of methods to predict the grazing activity energy cost of goats
Experiment Number:	AG-07-04
Project Number:	2005-38814-16352
Investigators:	A. L. Goetsch, B. Kouakou, R. Puchala, L. J. Dawson, and T. Sahlu
Objectives:	Evaluate equations to predict the grazing activity energy cost of goats developed at Langston University in a different environment in Georgia at Fort Valley State University
Title:	Metabolism of sheep and two goat breeds in response to limited feed intake
Experiment Number:	AA-07-05
Project Number:	2005-38814-16353
Investigators:	A. Asmare, A. L. Goetsch, R. Puchala, A. Askar, A. Beker, T. A. Gipson, L. J. Dawson, T. Sahlu, H. C. Freetly, and K. Tesfai
Objectives:	Determine potential differences between goats and sheep and between two goat genotypes in the ability to utilize low-energy diets by measurements, made with energy-adequate and -limiting forage-based diet, of: net flux across splanchnic tissues of nitrogen-containing metabolites as well as other metabolites such as glucose, volatile fatty acids, and oxygen to assess gut and liver energy use; whole body nitrogen and energy balances; extra-splanchnic tissue energy use; and whole body energy expenditure as the feeding period progresses
Title:	Evaluating bolus features and rumen pH on retention rate of ruminal boluses for the electronic identification of different goat breeds under U.S. conditions
Experiment Number:	SC-07-06
Project Number:	OKLX-SAHLU
Investigators:	S. Carne, T. A. M. Rovai, L. J. Dawson, and G. Caja
Objectives:	The general goal of the project is to evaluate the influence of physical features of ruminal boluses on their retention rate in different goat breeds raised in diverse production systems.
	Specific objectives are to 1) assess the influence of volume, weight, and specific gravity of boluses on their retention rate into the reticulo-rumen; 2) evaluate the influence of a breed factor on the retention rate of ruminal boluses; and 3) determine the relationship between retention rate of ruminal boluses and the ruminal environment dependent on feeding management.

Title:	Copper oxide wire particles as a goat dewormer
Experiment Number:	SH-07-07
Project Number:	OKLX-SAHLU
Investigators:	S. Hart and Z. Wang
Objectives:	Compare copper oxide wire capsules and Cydectin as dewormers in goat kids compared with no treatment
Title:	Copper oxide wire particles as a goat dewormer
Experiment Number:	SH-07-08
Project Number:	OKLX-SAHLU
Investigators:	S. Hart, Z. Wang, and J. F. S. Ferreira
Objectives:	1) Investigate the level of Sericia lespedeza required for anthelmintic activity
	2) Investigate the anthelmintic potential of two Artimesia species
Title:	The effect of dietary protein on tissue GSH concentration and cytokine expression in goats
Experiment Number:	ZW-07-09
Project Number:	OKLX-SAHLU
Investigators:	Z. Wang, S. Hart, R. C. Merkel, L. J. Dawson, T. Craig, A. L. Goetsch, and T. Sahlu
Objectives:	To determine the effect of fish meal supplementation in goats on 1) GSH contents in spleen, mesenteric lymph nodes, liver, blood, abomasum, and intestines; and 2) gene expression of cytokines (IL-2, -4, -5, -10, -13, and IFN- γ), glutathione S-transferase, and growth factors (TGF-β and IGF-I) in lymph nodes and spleen
Title:	Characterization of cytokine gene expression in PBMC stimulated by H. Contortus antigens
Experiment Number:	ZW-07-10
Project Number:	OKLX-SAHLU
Investigators:	Z. Wang, A. L. Goetsch, T. Sahlu, and T. M. Craig
Objectives:	Characterize the profile of cytokine gene expression in peripheral blood mononuclear cells (PBMC) stimulated by H. contortus antigens, and to demonstrate the effects of garlic on expressions of these genes

Title:	Effects of garlic on immunity in male and female goats infected with nematode parasites
Experiment Number:	ZW-07-11
Project Number:	OKLX-SAHLU
Investigators:	Z. Wang, S. P. Har, A. L. Goetsch, and T. Sahlu
Objectives:	To determine effects of garlic on 1) fecundity of Haemonchus contortus in the gastrointestinal tract of goats; 2) immune responses of goats, measured by concentrations of antibodies (IgA, IgM, and IgG); and 3) cytokine gene expression
Title:	Effect of length of pasture access on the grazing activity energy cost in Boer does during different stages of production
Experiment Number:	ITL-08-01
Project Number:	US-Egypt S&T 58-3148-7-154
Investigators:	I. Tovar-Luna, A. L. Goetsch, R. Puchala, T. A. Gipson, G. D. Detweiler, L. J. Dawson, K. Tesfai, and T. Sahlu
Objectives:	1) Determine effects of 'night-locking' or length of pasture access on the grazing activity energy cost of Boer goats in different stages of production (i.e., pregnant, lactating, dry, breeding periods) during a 1-year period
	2) Develop a simple means of predicting the grazing activity energy cost of goats based on factors relatively easily estimable by goat producers.

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Abstracts

2008 National Meetings of the American Society of Animal Science (Journal of Animal Science, Volume 86, Supplement 1; the American Society of Animal Science has copyright ownership and the Journal of Animal Science is the source of this information) and the 2008 9th International Conference on Goats

Effects of acclimatization on energy expenditure by meat goats

A. K. Patra, R. Puchala, G. Animut, T. A. Gipson, T. Sahlu, and A. L. Goetsch
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Seven Spanish and seven Boer yearling wethers were used to assess relationships between energy expenditure (EE) and temperature (Temp), relative humidity (Hum), and temperature-humidity index (THI). Animals were confined with minimal environmental control. EE was determined over 2-d periods 13 times during a 1-yr period based on EE:heart rate (HR) measured at 13-wk intervals. Climate variables were averaged over 2, 4, 6, and 8 wk preceding EE measurement. Wethers were fed for the maintenance energy requirement (MEm). Mean, minimum, and maximum values during the 2 wk preceding EE determination were 19.9, 7.9, and 31.8 °C for Temp and 53.6, 36.1, and 62.5% Hum, respectively. Neither Temp nor THI were correlated with or had significant effects in regression equations to predict the difference between EE at measurement times and the 1-yr mean (EEdiff). Conversely, Hum was correlated ($P < 0.01$) with EEdiff. When the 13 HR measurement times were assigned to Cool and Warm periods, EEdiff was affected ($P < 0.01$) by a genotype x period interaction. Nonetheless, the effect of Hum in models including genotype, period, and genotype x period was significant for 2, 4, 6, and 8 weeks ($P < 0.01$). The R2 of linear regressions of EEdiff against Hum were slightly greater for 2 and 4 vs 6 and 8 wk (0.11, 0.10, 0.08, and 0.07, respectively); regression coefficients for 2 and 4 wk were 1.265 and 1.163 kJ/kg BW0.75/1% Hum, respectively. With a median Hum of 50%, average regression coefficient of 1.2 kJ/kg BW0.75/1% HUM, and average MEm of 390 kJ/kg BW0.75, predicted MEm is 374 and 406 kJ/kg BW0.75 at minimum and maximum Hum, respectively. In conclusion, without extremes eliciting cold or heat stress, Hum appears to have a slight effect on MEm of meat goats in both cool and warm periods of the year.

The effect of garlic on Haemonchus contortus infection in goats

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Garlic has been used in some countries as an ingredient in deworming remedies for humans and animals for many years. The study reported here determined the efficacy of garlic for treatment of H. contortus infection and effect on immune responses in goats. Twelve Spanish wethers (1.5 yr, 35 ± 1.5 kg BW) naturally infected with H. contortus were allocated to two groups of six each and housed individually. Goats were fed hay-based diets (ME = 8.7 MJ/kg DM; CP = 10%) without or with 2% of garlic powder. The diets were offered for 4 wk at a maintenance level of intake. The initial mean fecal egg counts (FEC) were 4,983 ± 1,973/g (range of 1,125 to 13,652/g) for the Control group and 8,654 ± 3,548/g (range of 2,050 to 22,225/g) for the Garlic group. There was not a time x treatment interaction in FEC ($P > 0.05$). With initial FEC as a covariate, the garlic treatment reduced FEC (geometric mean: 7,872 ± 38.6/g for Control and 699 ± 38.4/g for Garlic, respectively; $P < 0.001$) during the experimental period. Serum concentrations of IgA, IgE, and IgG on d 0, 14, and 28 were not affected ($P > 0.05$) by garlic intake. The BW of goats did not change during

the experiment and was not affected by treatment ($P > 0.05$). These data suggest that the decline in FEC may be attributable to cell mediated immunity rather than a humoral immune reaction or direct garlic toxicity to the parasites. The results demonstrate that garlic is a potent anthelmintic herb and warrant more work to elucidate the mechanism.

Classification tree analysis of grazing behavior in goats

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Electronic monitoring equipment may allow for characterization of grazing behavior without potential effects of human visual observation. Translating equipment output into specific activities, however, is challenging. Therefore, this study was conducted to develop means of predicting grazing behavior based on visual observation from output of currently available electronic monitoring systems. There were 1,538 5-min observations of grazing activity (G = grazing; RL = resting, lying; RS = resting, standing; W = walking) at two locations collected by four observers on 28 goats over 4-d periods. There were 390, 627, 478, and 43 observations for G, RL, RS, and W, respectively. Goats were fitted with GPS collars (GPS 3300, Lotek, Newmarket, Ontario, Canada) to ascertain distance between consecutive GPS fixes. Collars were equipped with left-right (X-activity), forward-backward (Y-activity), and head-down motion sensors. A leg activity/position sensing system (IceTag, IceRobotics, Midlothian, Scotland, UK) was employed to determine stepping, standing, and lying. Classification tree analysis was conducted using CART® software. A decision tree, which is a diagram representing a classification system, with a minimum relative cost criterion of 0.560 yielded 18 terminal nodes. Prediction success rate for G was 70.3% (i.e., 274, 35, 48, and 33 G observations were classified into G, RL, RS, and W terminal nodes, respectively). Success rate for RL was 74.0% (57, 87, and 19 RL observations classified as G, RS, and W, respectively). Success rate for RS was 48.5% (93, 106, and 47 RS observations classified as G, RL, and W, respectively). Success rate for W was 83.7% (5, 1, and 1 W observations classified as G, RL, and RS, respectively). Output from currently available electronic monitoring equipment systems can be used to predict grazing behavior of goats based on visual observation; however, prediction success rate is less than optimal. Other potential monitoring equipment should be evaluated to improve success rate.

Impact of animal science research on U.S. goat production and predictions for the future

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Goat research in the U.S. has increased but at a rate less than that in production. Research on goat meat includes nutritional quality, packaging, color, sensory characteristics, and preharvest management. Goat skins have value for leather, yet quality of goat leather has not been extensively studied. Research in the production, quality, antibiotic residues, and sensory characteristics of goat milk and its products has aided development of the U.S. dairy goat industry. Limited progress has been made in genetic improvement of milk or meat production. There is need to explore applications of genomics and proteomics and improve consistency in texture and functionality of goat cheeses. New goat meat and milk products are needed to

increase demand and meet the diverse tastes of the American public. Despite research progress in control of mohair and cashmere growth, erratic prices and sale of raw materials have contributed to further declines in U.S. production. Innovative and cooperative ventures are needed for profit sharing up to the consumer level. Internal parasites pose the greatest challenge to goat production in humid areas largely because of anthelmintic resistance. Study of alternative controls is needed, including immunity enhancement via nutrition, vaccination, pasture management such as co-grazing with cattle, and genetic resistance. Similarly, the importance of health management is increasing related in part to a lack of effective vaccines for many diseases. Nutrition research should address requirements for vitamins and minerals, efficiencies of protein utilization, adjusting energy requirements for nutritional plane, acclimatization, and grazing conditions, feed intake prediction, and management practices for rapid-growth 'feedlot' production systems. Moreover, efficient technology transfer methods are needed to disseminate current knowledge and that gained in future research.

Considerations for on-farm research and demonstration of useful feeding/nutrition practices for small ruminants in Ethiopia

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Many funding organizations view on-farm research as having greater impact than 'on-station' trials, a feeling shared by farmers because of the opportunity to see and evaluate findings first-hand. Langston University provides technical assistance in a 5-year project supported by USAID, entitled Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP), which includes on-farm research and demonstration of useful feeding/nutrition practices. ESGPIP partners with research and extension entities throughout Ethiopia in implementing specific activities. The wide arrays of feeding/nutrition topics and activities range from providing materials and training for ammoniation of crop residues with associated field days to collaboration with export abattoirs in testing pre-slaughter management practices to extend shelf-life of carcasses from Highland areas. One effective strategy for on-farm research/demonstration used by some partners involves Farming Research Groups (FRG). The first such activity was conducted by the Adami Tulu Agricultural Research Center (ATARC). Five FRG were formed, each consisting of 9 or 10 farmers contributing 3 or 6 young male goats. Materials and funds were provided to each FRG to construct a simple barn with three pens. Ten young goats were supplemented and resided in pens at night, with 1 or 2 animals per farmer subjected to three different supplemental concentrate treatments. ATARC personnel closely monitored activities, with a minimum of two weekly visits. This approach allows for statistical analysis of data, desirable for publication of the findings and, perhaps more importantly, true value or meaning of any differences noted. With use of farmer-owned animals, it may not be feasible to impose negative control treatments, but an appropriate common or standard supplemental feedstuff treatment allows for an adequate basis of comparison. This implementation method is but one of many that can be effectively employed for on-farm research, each with unique advantages and disadvantages to be considered. Notable challenges exist in conducting on-farm research, although there are tradeoffs such as lesser facility and labor needs on-station. Numerous technologies are ready to be taken to on-farm settings, but it should also be realized that in some instances on-station research is first required to ascertain how best to implement a particular technology on-farm.

Ruminal methane emission by goats consuming dry hay of condensed tannin-containing lespedeza with or without polyethylene glycol, alfalfa, or sorghum-sudangrass

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Twenty-four yearling Boer × Spanish wethers (initial BW of 37.7 ± 1.09) were used to assess effects of different sources of dry hay on ruminal methane emission. Treatments were a legume (Sericea lespedeza, Lespedeza cuneata) high in condensed tannins (CT; 15.3%) without (S) or with (P) polyethylene glycol (25 g/d mixed with 50 g/d of ground corn), a legume without appreciable CT (alfalfa, Medicago sativa, 0.2% CT; A), and also a grass low in CT (sorghum-sudangrass, Sorghum bicolor, 0.2% CT; G). Hay was fed at approximately 1.3 times the maintenance energy requirement. The experiment lasted 15 days, with the first 7 days for adaptation. Intake of DM was 849, 937, 732, and 655 g/day for S, P, A, and G, respectively (SE = 50.5). There were differences ($P < 0.05$) in OM digestibility (54.5, 60.1, 62.7, and 62.6%; SE = 1.29), digested OM (438, 534, 429, and 378 g/day; SE = 33.7), and energy expenditure (370, 435, 459, and 405 kJ/kg BW0.75 for S, P, A, and G, respectively; SE = 16.4). Methane emission was 14.3, 19.5, 19.8, and 17.9 l/day for S, P, A, and G, respectively (SE = 1.05), being lowest among treatments for S ($P < 0.05$). Similarly, methane emission relative to digested OM was lowest ($P < 0.05$) for S (43.5, 55.4, 60.7, and 62.8 l/kg for S, P, A, and G, respectively; SE = 4.17). Treatment differences also existed ($P < 0.05$) in vitro methane release by ruminal fluid incubated for 3 weeks with conditions promoting activity by methanogens (7.8, 11.7, 13.1, and 13.5 ml for S, P, A, and G, respectively; SE = 1.23). Findings in a previous experiment with fresh forage were similar (15.8, 20.2, 21.3, and 21.6 l of methane/day; 35.2, 45.4, 48.6, and 45.2 l of methane/kg digested OM; 12.9, 21.8, 25.3, and 28.5 ml in vitro methane release for S, P, A, and G, respectively). In summary, effects of CT in S in depressing ruminal methane emission by goats appear similar with dry hay and fresh forage.

Effects of trans-10, cis-12 conjugated linoleic acid dietary supplementation on quality and texture profile of semi-hard goat milk cheese

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Dietary supplementation of trans-10, cis-12 conjugated linoleic acid (CLA) has been reported to affect milk composition by milk fat depression in dairy cows, sheep, and goats. In this study, effects of trans-10, cis-12 CLA dietary supplementation on quality and texture profile of semi-hard goat milk cheese were investigated. Thirty Alpine does were randomly assigned into three groups and fed diets supplemented with lipid-encapsulated trans-10, cis-12 CLA at dosages of 0 (control), 3 (CLA-1), and 6 g/d per doe (CLA-2). A three-period (each period was 2-wk, followed by 2-wk between periods) experiment was conducted using a 3 x 3 Latin square design. Bulk milk was collected from evening and morning milkings for cheese manufacture after 3 and 13 d of treatment in each period. A total of 18 batches of semi-hard cheese were made and cheese samples were collected on Day 1 (fresh) and Day 60 (aged) for the analyses of yield, composition, sensory score, and texture profile. Longer treatment (13 d) and the highest dosage of CLA (6 g/d per doe) resulted in 10.0% lower cheese moisture and 10.2% lower cheese yield as compared with the

control. However, the lower dosage (3 g/d per doe) and shorter treatment (3 d) of CLA supplementation did not significantly affect cheese yield, composition, or fresh cheese texture profile. CLA supplementation also had significant effects on cheese fat and fatty acids recovery but not on cheese sensory scores. Hardness, springiness, and chewiness of cheeses increased while cohesiveness and adhesiveness decreased when milk fat was reduced by trans-10, cis-12 CLA supplementation. It is concluded that dietary supplementation of trans-10, cis-12 CLA with an adaptation period between 3 and 13 d and a minimum level of between 3 and 6 g/d per doe were needed to affect quality and texture profile of semi-hard goat milk cheese.

Comparison of electronic versus direct microscopic somatic cell counting of goat milk

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Twenty-three individual and four bulk tank goat milk samples were collected from the Langston University Grade-A goat farm to compare the SomaScope electronic somatic cell counter (ESCC) against the pyronin-Y methyl green (PYMG) direct microscopic somatic cell count (DMSCC) method. The PYMG method is considered the standard confirmatory test for somatic cell counts in goat milk for regulatory purposes. The electronic method is used for screening purposes and a conversion factor must be used if the ESCC is calibrated with standards other than that of goat milk matrices. The SomaScope electronic counting device was calibrated using goat milk SCC standards prepared by a certified third party. Instrument SCC of all goat milk samples were obtained following the manufacturer's instructions using the FDA 2400 form and the DMSCC with PYMG were conducted immediately after instrument analysis. All samples were analyzed in duplicate. Data were transformed into log base 10 format and statistically analyzed using a Student t-Test. Results indicated that there was no significant difference in SCC between the electronic and the PYMG direct microscopic methods ($P>0.05$) with means of 5.4227± 0.3124 and 5.4196±0.3457, respectively. Further statistical analysis showed that these two methods had a correlation coefficient of 0.9292. The data indicated that the SomaScope ESCC and PYMG DMSCC methods are comparable and the SomaScope instrument may be used to determine SCC in goat milk when calibrated with goat milk standards.

Effect of time of day, ambient temperature, and relative humidity on feeding behavior of growing meat goats

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Heat stress decreases feed intake in livestock. However, little information on feeding behavior and heat stress is known in goats. The objective of this research was to examine the effects of time of day and heat stress on feeding behavior in growing meat bucks. In a 12-wk buck performance test, feed intake of 55 bucks (27 in 2005 and 28 in 2006) was recorded using a completely automated electronic feeding system, which records feed intake of each individual animal's visit. Dry matter intake (DMI), feeding duration (DUR), and consumption rate (RATE) were calculated for daytime (06:00 to 18:00 h) and nighttime (18:00 to 06:00 h) feeding behavior. Relative humidity and ambient temperature were recorded every 10 min and an average temperature-humidity index (THI) calculated for the corresponding period. Heat stress was classified according to THI; NO stress (THI < 72), MILD stress (72 < THI < 78), and SEVERE stress (79 <

THI < 89). A repeated measures design using mixed model methodology was employed to analyze feeding behavior. DMI, DUR, and RATE were dependent variables. Independent variables included year (2005 or 2006), time of day (day or night), and heat stress level (NO, MILD, or SEVERE) as classification variables and the linear and quadratic effects of age in days. Night DMI was less (P<0.05) than day DMI (528g vs. 700g) and NO was greater (P<.05) than MILD or SEVERE (650g vs. 591 and 602 g, respectively). DMI during night was 558, 507, and 520 g and during day was 742, 676, and 684 for NO, MILD, and SEVERE, respectively. DUR was less (P<0.05) during night than day (29 min vs. 41 min) and greater (P<0.05) for NO than for MILD or SEVERE (37 min vs. 35 and 35, respectively). DUR at night was 32, 28, and 29 min and during day was 42, 41, and 41 min for NO, MILD, and SEVERE, respectively. RATE (20 g/min) was not affected (P>0.05) by time of day or stress level. Generally, time of day and heat stress level significantly affected the feeding behavior of growing meat bucks.

Effects of protein supplementation on Haemonchus contortus infection in goats

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Protein supplementation may enhance host immunity to parasites. However, the mechanisms by which supplemented protein augments immunity are not clear. The study reported here determined effects of varied protein intake on immune responses in goats infected with Haemonchus contortus. Thirty-six Boer x Spanish goats (3 yr, 46 ± 5.9 kg BW) were dewormed and allocated to six groups of six animals each, housed in group-pens, and fed individually with a Calan gate feeding system. The treatment arrangement was a 2 x 3 factorial. Goats were fed hay-based iso-caloric (ME = 8.0 MJ/kg DM) diets containing 0, 5%, or 10% fish meal (FM). The dietary CP was 6.6%, 9.5%, or 12.4%, respectively. Thirty days after being fed the diets, goats allocated to infected groups were administered with 10,000 H. contortus infective larvae per animal, and all animals remained on the experimental diets for 4 additional weeks. We found that worm eggs appeared in feces from the goats fed diets with 0 or 5% FM in week 3 but were not detectable in goats fed the 10% FM diet until week 4 post-infection. The infection of H. contortus induced increases (P < 0.01) in blood eosinophil and tissue mast cells. The numbers of mast cells in spleen and mesenteric lymph nodes from the infected goats were lower (P < 0.05) in animals fed the 10% FM diet. The number of eosinophils was not affected (P > 0.05) by protein supplementation. Serum concentration of IgA increased (P < 0.01) after infection but was not affected by dietary protein. Serum IgG in infected goats increased (P < 0.05) with dietary protein 7 days post infection but declined thereafter. Worm burden was not affected by dietary protein. The results suggest that protein supplementation in goats transiently inhibits worm fecundity through enhanced IgG expression.

Suitability of an on-line certification program for goat producers

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In 2006, a Langston University-led consortium of 11 universities and 5 meat goat producer groups unveiled an on-line training and certification program (http://www2.luresext.edu/training/qa.html). The program consists of 22 learning modules. Participants take pre- and post-tests to pass the 16 required and a minimum of 3 elective modules for certification. As of November, 2007, 416 participants from 12 countries (US – 385,

Canada – 12, India – 4, Malaysia – 2, Pakistan – 2, Australia, Jamaica, Mexico, Nigeria, Peoples Republic of China, Romania, and Zimbabwe – 1 each) have registered for the program. Forty-four states are represented with the top 6 states representing 51% of total participants (OK – 76, MO – 35, TX – 35, TN – 23, KS – 16 and AR – 12). Thirty-nine participants have been certified. Of those certified 37 are from the USA and 2 from Canada. The states with the largest number of certified producers are TX and TN with 5 each and OK with 4. Of those certified, 16 respondents farm 5 – 20 acres (2 -8 ha), 5 respondents farmed either 21 – 40 acres (8 – 16 ha) or 161 – 320 acres (64 – 128 ha). Two respondents farmed less than 5 acres (2 ha). Twenty-seven respondents (69%) owned less than 50 goats and only 1 producer had over 250 animals. Of these certified responding, 20 reported that goats provide less than 10% of their total income and only one reported that goats are responsible for a majority of their annual income (76% or above). The farm and herd sizes of producers receiving certification is indicative of the current US goat industry. Results indicate that goat producers will access production information in a web-based format. Such a format is one method to reach large numbers of people and can successfully augment a more traditional extension/outreach component of one-on-one interaction of extension specialists and producer.

Gender differences in an on-line certification program for goat producers

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In 2006, a Langston University-led consortium of 11 universities and 5 meat goat producer groups unveiled an on-line training and certification program (http://www2.luresext.edu/training/qa.html). The program consists of 22 learning modules. Participants take pre- and post-tests and must record a minimum score of 85% to pass the 16 required and a minimum of 3 elective modules for certification. Should a score of 85% be achieved on the pre-test, the participant has no need to take a post-test. As of November, 2007, 416 participants had registered for the program and 39 had completed the requirements for certification. A greater proportion of males (230) than females (186) enrolled in the certification program (2=4.65; P<0.05). The same gender proportion of enrolled participants also existed for those becoming certified, 24 males vs 15 females, (2=0.45; P=0.45). For those responding to a question concerning employment, a greater proportion of females than males enrolled in the program were engaged in full-time farming compared to part-time farming 51 vs 36 and 113 vs 145 for females and males engaged in full- and part-time farming, respectively, (2=5.73; P<0.02). However, this trend did not hold for the certified participants and more certified females than males responded as being full-time farmers, 7 vs 4 and 6 vs 15 for females and males engaged in full- and part-time farming, respectively, (2=3.67; P<0.06). No differences were found between males and female participants in farm size (2=8.29; P=0.30) or herd size (2=2.22; P=0.70). Females tended to score higher on pre-tests than males (85.4 vs 80.3%, P<0.06) and a proportionately higher percentage of males than females were required to take post-tests (2=6.94; P<0.01). There was no difference in post-test scores between genders. Males tended to record a greater difference between pre- and post-test scores than females (11.0 vs 5.2%, P<0.06). Results show that women goat farmers will actively participate in an on-line certification program. Pre-test scores show that the knowledge of women producers was on par or above that of male producers. The similarity in post-test scores is an indicator of the effectiveness of the training modules.

Summaries of Recent Journal Articles
(2008 and In Press)

Effects of pasture inclusion of mimosa on growth by sheep and goats co-grazing grass/forb pastures
Animut, G., A. L. Goetsch, G. E. Aiken, R. Puchala, G. Detweiler, C. R. Krehbiel, R. C. Merkel, T. Sahlu, and L. J. Dawson
Journal of Applied Animal Research 31:1-10. 2007

Effects of mimosa alley-cropped in grass/forb pastures on growth performance of co-grazing sheep and goat wethers were determined. Eighteen sheep (Katahdin) and eighteen goats (> 75% Boer blood), with BW of 22 ± 0.3 and 21 ± 0.2 kg, respectively, and age of 4 to 5 months were used. Wethers grazed 0.4-ha pastures of grasses and forbs for 16 weeks. Three pastures with alley-cropped mimosa (W) and three without (WO) were divided into four paddocks for 2-week rotational grazing. Based on mimosa leaf mass at the beginning of grazing periods and animal days, daily consumption of mimosa leaf DM averaged 47 g per animal, although mimosa leaf harvest was complete long before the end of the grazing periods. Mimosa leaf samples averaged 2.81, 37.8, and 85.9% N, NDF and in vitro true DM digestibility (IVDMD), respectively. Forage mass (grass and forbs) was similar between treatments before (2928 and 2695 kg/ha) and after grazing (1507 and 1452 kg/ha for WO and W, respectively). Pre-grazed forage concentrations of N (1.25 and 1.24%) and NDF (64.5 and 63.8%) and IVDMD (52.9 and 56.2% for WO and W, respectively) were similar between treatments, as was also true post-grazing. ADG was numerically greater (P=0.17) for W vs. WO (70 vs. 51 g/d; SE = 7.7). In summary, alley-cropped mimosa increased nutritive value of the forage available for consumption. Nonetheless, mimosa had limited effect on growth performance of co-grazing sheep and goats perhaps because of decreasing mimosa leaf availability as 2-week grazing periods advanced or overall relatively low intake of mimosa leaf.

Factors influencing urea space estimates in goats
Asmare, A., L. J. Dawson, R. Puchala, T. A. Gipson, M. Villaquiran, I. Tovar-Luna, G. Animut, T. Ngwa, T. Sahlu, R. C. Merkel, and A. L. Goetsch
Small Ruminant Research 73:235-241. 2007

Female Alpine goats, 18 approximately 17 mo of age (yearling) and 18 5-mo-old (growing), were used in an experiment to determine effects of animal age, urea dose (100, 130, and 160 mg/kg BW), and time without feed and water (shrink; 0, 16, and 24 h) on urea space estimates. A 20% (wt/vol) urea solution was infused into a jugular vein, with blood sampled before infusion and every 3 min to 21 min. BW was 49.8, 47.4, and 47.0 kg for yearlings and 26.1, 24.6, and 23.9 kg for growing animals after 0, 16, and 24 h shrinks, respectively (SE = 0.80). Time of urea equilibration with body water, determined by a grafted polynomial quadratic-linear model, was affected by a dose x age x shrink interaction ($P < 0.05$); yearling means did not differ (ranging from 7.3 to 10.8 min), although those for growing animals were greater ($P < 0.05$) for 0 h:130 mg (13.0 min) and 24 h:130 mg (13.2 min) compared with 24 h:100 mg (7.6 min) and 16 h:130 mg (7.1 min). Based on these times, 12-min samples were used to determine urea space. Urea space was influenced by an age x shrink interaction ($P < 0.05$), being similar among shrink times for yearlings (17.8, 18.8, and 18.9 kg) and greater ($P < 0.05$) for growing animals after 0 than 24 h shrink (12.9, 11.3, and 10.0

kg for 0, 16, and 24 h, respectively). Hemoglobin concentration in plasma, as an index of hemolysis, was lower ($P < 0.05$) for growing than for yearling animals (1.16 vs. 1.86%), lowest among doses ($P < 0.05$) for 100 mg (1.05, 1.74, and 1.75% for 100, 130, and 160 mg, respectively), and highest among shrink times ($P < 0.05$) for 24 h (1.46, 1.42, and 1.61% for 0, 16, and 24 h, respectively). In conclusion, effects of and interactions involving some of the factors studied and high variability in the time of urea equilibration with body water indicate that, regardless of the particular urea space procedures chosen, relatively high numbers of observations are warranted.

Effects of feeding method, diet nutritive value, and physical form and phenotype on feed intake, feeding behavior, and growth performance by meat goats

Gipson, T. A., A. L. Goetsch, G. Detweiler, and T. Sahlu
Small Ruminant Research 71:170-178. 2007

Thirty-two F1 Boer x Spanish (28.7 ± 0.49 kg) and 40 3/4 Boer-1/4 Spanish (31.9 ± 0.47 kg) wethers, approximately 5 months of age, were used to compare feeding systems with different dietary treatments. Feeding systems were Calan gates and automated feeding units allowing one animal to consume feed at a time. Two diets included concentrate (C) and two were dehydrated alfalfa (A), fed pelletized (P) or loose (L). The main effect of feeding method was not significant for any variable. There was an interaction in DM intake (DMI) involving feeding method, diet, and genotype, which indicated that with a concentrate diet, regardless of physical form, DMI was not influenced by feeding method. Main effect dietary treatment means (1.78, 1.67, 2.04, and 1.70 kg for C-P, C-L, A-P, and A-L, respectively; SE = 0.030) indicated that pelletizing had a slightly greater effect on DMI with A vs. C. ADG was lowest among treatments for A-L (212, 205, 190, and 157 g for C-P, C-L, A-P, and A-L, respectively; SE = 8.9), and ADG:DMI was greater for C vs. A (127, 120, 94, and 94 g/kg for C-P, C-L, A-P, and A-L, respectively; SE = 7.8). For wethers subjected to automated feeding units, the number of feeder visits was lowest among diets ($P < 0.05$) for C-P (23.1, 31.2, 35.7, and 35.7 per day; SE = 2.00); total feeder occupancy time per animal ranked ($P < 0.05$) C-P < A-P < C-L and A-L (74, 130, 105, and 122 min/day; SE = 6.8), and rate of DMI was greater for P than for L diets (24.6, 12.9, 22.0, and 13.7 g/min for C-P, C-L, A-P, and A-L, respectively; SE = 3.89). In summary, meat goats can markedly vary feeding behaviors in response to different diet types and forms; however, there appear limits to such changes, as exemplified by lowest ADG for A-L. Calan gates and automated feeding systems appear similar in the ability to compare growth performance with treatments such as the concentrate-containing diets and genotypes of this experiment. Most performance benefit in growing progeny from Boer crossbreeding may be achieved in F1 animals, with little further improvement realized from the first backcross of F1 females. Pelletizing does not seem to affect on growth performance with diets consisting of appreciable concentrate. Effects of pelletizing on growth performance of meat goats consuming forage diets may be attributable to change in level of feed intake, without impact on efficiency of feed utilization.

Effects of fertilization, leguminous trees, and supplementation on performance of meat goat does and their kids grazing grass/forb pastures

Goetsch, A. L., G. Detweiler, R. C. Merkel, T. A. Gipson, T. Sahlu, and G. E. Aiken
Professional Animal Scientist 23:164-169. 2007

Thirty-nine Spanish does and their twin kids, approximately 4-wk old initially, were used in a 112-d experiment. Twelve grass/forb 0.4-ha pastures were subdivided into four paddocks and rotationally grazed for 2-wk periods in two 8-wk phases. Treatments were Control, Fertilization, Mimosa, and Supplementation, with three pastures per treatment. Three does with six kids grazed each of the Control, Supplementation, and Mimosa pastures, and four does with eight kids grazed Fertilization pastures. Fertilization pastures received a N, P, and K application 3 weeks before the experiment, and Supplementation animals received ad libitum access to a commercially available block containing 20% CP, with DM consumption averaging 116 g/d on a per doe basis. Mimosa leaf DM available at the beginning of each 2-wk period averaged 174 and 139 kg/ha in phase 1 and 2, respectively, although consumption was complete within the first few days of grazing periods. Fertilization increased prevalence of bermudagrass at the beginning of grazing periods (23.2, 43.6, 20.3, and 28.2% before grazing and 63.5, 58.9, 42.9, and 55.8% after the experiment for Control, Fertilization, Mimosa, and Supplementation, respectively; SE =5.70). Forage DM mass (excluding mimosa leaf DM) was similar among treatments (1,491, 1,554, 1,386, and 1,430 kg/ha; SE = 69.0); the concentration of CP in hand-plucked forage samples was 12.9, 14.7, 14.3, and 13.1% for Control, Fertilization, Mimosa, and Supplementation, respectively (SE = 1.12). Doe ADG was similar among treatments (-55, -56, -29, and -59 g/d; SE = 10.9), and kid ADG was greater ($P < 0.05$) for Mimosa vs. Supplementation (133, 130, 146, and 118 g/d Control, Fertilization, Mimosa, and Supplementation, respectively; SE = 5.8). In conclusion, a supplemental protein block may not be beneficial for grazing meat goat does with nursing twin kids unless forage is very low in protein. Fertilization can allow an increased stocking rate to elevate production per unit of land area. Leguminous trees in grass/forb pastures deserve further study as a means of nutrient supplementation, although methods of management to facilitate leaf availability throughout the grazing period or on most days should be given attention.

Performance of Spanish and Boer x Spanish doelings consuming diets with different levels of broiler litter

Negesse, T., A. K. Patra, L. J. Dawson, A. Tolera, R. C. Merkel, T. Sahlu, and A. L. Goetsch
Small Ruminant Research 69:187-197. 2007

Sixty Spanish (S) and 40 Boer x Spanish (BS) doelings (14.9 ± 3.8 and 21.9 ± 3.8 kg initial BW, respectively, and approximately 6 months of age) were used in an experiment with four 3-week periods to determine effects of dietary broiler litter (L) level on growth performance. There were two groups per treatment with six S and four BS doelings in each. Dietary treatments were 20% coarsely ground millet hay and 80% concentrate, which consisted of 0 (0L), 20 (20L), 40 (40L), or 60% L (60L; total dietary level). An additional treatment was 80% hay and 20% concentrate (80F). Concentrate (primarily corn and L when included) DM intake (DMI) was 700, 593, 652, 387, and 165 g/d (SE = 20.3) and total DMI was 883, 755, 825, 490, and 696 g/d (SE = 35.5) for 0L, 20L, 40L, 60L, and 80F, respectively. There was a dietary treatment x period interaction in ADG (period 1: 104, 29, 36, -44, and 47 g; period 2: 124, 102, 53, -74, and 12 g; period 3: 175, 126, 126, 87, and 80 g; period 4: 161, 151, 136, 66, and 51 g for 0L, 20L, 40L, 60L, and 80F, respectively (SE = 12.2)). Treatment and genotype also interacted in ADG (S: 107, 85, 72, 8, and 36 g; BS: 174,

118, 103, 10, and 60 g for for 0L, 20L, 40L, 60L, and 80F, respectively (SE = 9.2)). ADG:DMI ranked ($P < 0.06$) 0L > 20L > 40L > 80F > 60L (152, 130, 102, 18, and 65 g/kg for 0L, 20L, 40L, 60L, and 80F, respectively; SE = 6.12). The acetate:propionate ratio in ruminal fluid was greater ($P < 0.05$) for 60L and 80F than for other treatments (1.60, 1.73, 2.18, 3.80, and 3.67 for 0L, 20L, 40L, 60L, and 80F, respectively; SE = 0.27). Liver Cu concentration at the end of the experiment was influenced by dietary treatment (88, 275, 478, 286, and 47 ppm for 0L, 20L, 40L, 60L, and 80F, respectively; SE = 53.2). In conclusion, L can be effectively used in diets for growing meat goats, but high levels, such as above 40% of dietary DM, may restrict performance primarily via limited feed intake. However, the level of L below this threshold impacts efficiency of feed utilization.

Effect of initial body condition of Boer x Spanish yearling wethers and level of nutrient intake on body composition

Ngwa, A. T., L. J. Dawson, R. Puchala, G. Detweiler, R. C. Merkel, I. Tovar-Luna, T. Sahlu, C. L. Ferrell, and A. L.Goetsch

Small Ruminant Research 73:13-26. 2007

Yearling Boer x Spanish goat wethers were used to assess effects of initial body condition and subsequent level of feed intake on body composition. Before the experiment, 21 wethers were fed to achieve high body condition score (BCS; 1 to 5, with 1 = extremely thin and 5 = extremely fat) and BW (initially fat; I-F) and 27 were fed for low BCS and BW (initially thin; I-T). During the experiment, I-F wethers were fed low amounts of a pelletized diet and I-T wethers received high amounts. Harvest measures were determined before the experiment (wk 0) and after 12 and 24 wk, with seven animals per initial body condition and time. BCS in Experiment 1 was 3.8, 3.2, 2.6, 1.9, 2.8, and 3.5 (SE = 0.11) and live BW was 53.3, 46.2, 42.4, 36.6, 40.1, and 48.2 kg (SE = 2.03) for I-F:wk 0, I-F:wk 12, I-F:wk 24, I-T:wk 0, I-T:wk 1, and I-T:wk 2, respectively. There were substantial declines in mass of many internal organs with advancing time for I-F compared with relatively small change for I-T. Examples include the reticulo-rumen (1.03, 0.59, 0.52, 0.87, 0.78, and 0.73 kg; SE = 0.041), small intestine (0.59, 0.27, 0.23, 0.55, 0.33, and 0.36 kg; SE = 0.021), large intestine (0.40, 0.24, 0.24, 0.33, 0.33, and 0.26 kg; SE = 0.017), and liver (0.86, 0.45, 0.42, 0.56, 0.60, and 0.67 kg for I-F:wk 0, I-F:wk 12, I-F:wk 24, I-T:wk 0, I-T:wk 12, and I-T:wk 24, respectively; SE = 0.031). Conversely, change in internal or non-carcass fat mass was much greater for I-T vs. I-F (5.7, 3.9, 2.8, 0.6, 2.5, and 5.1 kg for I-F-wk 0, I-F-wk 12, I-F-wk 24, I-T-wk 0, I-T-wk 12, and I-T-wk 24, respectively; SE = 0.33). Changes in carcass mass of protein (-5.9, -5.3, 7.0, and 5.8 g/day; SE = 0.89) and fat (-1.9, 0.2, 21.4, and 26.6 g/day; SE = 2.35) were greater ($P < 0.05$) for I-T vs. I-F, as was also true for non-carcass protein (6.1, 0.0, 14.5, and 6.3 g/day; SE = 0.91) and fat (-16.3, -10.4, 13.6, and 26.3 g/day for for I-F:wk 1-12, I-F:wk 1-24, I-T:wk 1-12, and I-T:wk 1-24, respectively; SE = 2.49). Based on energy concentrations in empty body tissue lost or gained in wk 1-12 and 1-24 (14.8, 12.1, 19.9, and 26.4 MJ/kg for I-F:wk 1-12, I-F:wk 1-24, I-T:wk 1-12, and I-T:wk 1-24, respectively; SE = 2.13), the energy concentration in wk 13-24 was 9.4 and 32.9 MJ/kg for I-F and I-T, respectively. In conclusion, the energy concentration in tissue mobilized or accreted by yearling meat goats within certain body condition ranges may not necessarily be the same and appears influenced by initial animal characteristics and subsequent feeding conditions.

Urea space and body condition score to predict body composition of meat goats
Ngwa, A. T., L. J. Dawson, R. Puchala, G. Detweiler, R. C. Merkel, I. Tovar-Luna, T. Sahlu, C. L. Ferrell, and A. L. Goetsch
Small Ruminant Research 73:27-36. 2007

Yearling Boer x Spanish goat wethers (40) were used to develop and compare body composition prediction equations for mature meat goats based on urea space (US) and body condition score (BCS). Before the experiment, one-half of the animals were managed to have high BW and BCS (1-5, with 1 being extremely thin and 5 very fat) and the others were managed to have low BW and BCS. During the 24-wk experiment, initially fat wethers were fed to lose BW and BCS and initially thin wethers were fed to increase BW and BCS. BCS, US, and whole body chemical composition were determined after 0, 12, and 24 wk. Mean, minimum, and maximum values were 42.1 (SE = 1.12), 24.5, and 59.0 kg for shrunk BW; 3.0 (SE = 0.11), 1.5, and 4.0 for BCS; 61.3 (SE = 1.01), 53.7, and 76.5% for water; 20.2 (SE = 1.11), 4.7, and 29.7% for fat; 15.6 (SE = 0.19), 13.3, and 18.1% for protein; and 2.9 (SE = 0.062), 2.2, and 3.7% for ash, respectively. For water, fat, and ash concentrations and mass, simplest equations explaining greatest variability (with independent variables of US, BCS, and(or) shrunk BW) based on BCS accounted for more variation than ones based on US, although in some cases differences were not large (i.e., water and ash concentrations and mass). Neither US nor BCS explained variability in protein concentration. Equations to predict protein mass based on shrunk BW and US or BCS were nearly identical in R2 and the root mean square error. A 1 unit change in BCS corresponded to change in full BW of 8.9 kg (full BW, kg = 17.902 + (8.9087 × BCS); R2 = 0.653), fat concentration of 7.54% (% fat = -5.076 + (7.5361 × BCS); R2 = 0.612), and energy concentration of 3.01 MJ/kg (energy, MJ/kg = 0.971 + (3.0059 × BCS); R2 = 0.615). In summary, BCS may be used as or more effectively to predict body composition of meat goats than US. The primary determinant of BCS, within the range of BCS observed in this experiment, was body fat content.

The relationship between heart rate and energy expenditure in Alpine, Angora, Boer and Spanish goat wethers goats consuming different quality diets at level of intake near maintenance or fasting
Puchala, R., I. Tovar-Luna, A. L. Goetsch, T. Sahlu, G. E. Carstens, and H. C. Freetly
Small Ruminant Research 70:183-193. 2007

Six Alpine (AL; 38.4 ± 3.0 kg), Angora (AN; 23.1 ± 2.7 kg), Boer (BO; 40.8 ± 4.5 kg) and Spanish (SP; 33.6 ± 2.2 kg) wethers (1.5 yr of age) were used to determine the effects of time of the day and potential interactions between time, genotype and diet quality on energy expenditure (EE), heart rate (HR) and EE: HR when fed near maintenance and fasting. The experiment consisted of four simultaneous crossovers, with 21 d for adaptation before measures. Diets were 60% concentrate (CON: 15% CP) and ground alfalfa hay (FOR: 23% CP), offered in two meals at 8:00 and 16:00 h. Energy expenditure was determined from O2 consumption and production of CO2 and CH4 over 2-day periods in fed and fasting states (total 4-day fasting period). Fasting EE was higher during the day than night, with values generally highest at 16:00-17:00 h. Animal within breed affected EE, HR and EE:HR ($P < 0.05$). The diurnal pattern in EE varied with diet ($P < 0.05$), although total daily EE was not different be tween diets. Before the morning meal, there were a number of hours during which EE was greater for CON than for FOR. However, at both meals the rise in EE was considerably greater for FOR versus CON, lasting for 3–4 h. The same general pattern in HR was observed, although the period of time when there was a dietary difference after the afternoon meal was shorter. For both fed and fasted goats, EE:HR differed among hours of the day ($P < 0.05$). EE:HR tended (P

< 0.09) to differ between diets (5.99 and 6.21 for CON and FOR, respectively) and to be affected (P < 0.09) by an interaction between breed and diet (AL: 5.84 and 6.38; AN: 5.91 and 5.73; BO: 6.05 and 6.58; and SP: 6.17 and 6.15 kJ/(kg BW0.75 × day):heart beats/min) for CON and FOR, respectively. In conclusion, for use of HR to predict EE by goats, it appears desirable to determine the ratio of EE:HR with a diet similar to that consumed during prediction and over an extended period of time.

Effects of moderate feed restriction on energy expenditure by 2-year-old crossbred Boer goats
Tovar-Luna, I., A. L. Goetsch, R. Puchala, T. Sahlu, T., G. E. Carstens, H. C. Freetly, and Z. B. Johnson Small Ruminant Research 72:25-32. 2007

Fourteen Boer (75%) x Spanish wether goats (51 ± 1.8 kg BW and 23 months of age) were used to determine effects of a moderate degree of nutrient restriction on heat production or energy expenditure (EE). The experiment consisted of a 26-day period (P1) followed by one of 50 days (P2). Wethers were fasted on the final 4 days of each period, with gas exchange measured on the last 2 days. Fasting was preceded by collection of feces and urine for 7 days, with the final 2 days for gas exchange. All wethers were fed a 60% concentrate diet at a level of intake near maintenance in P1 (P1-100 and P1-80 treatments). In P2, six wethers continued on this level of intake (P2-100 treatment); eight wethers also were fed at this level for 15 days but then had ME intake sequentially reduced by approximately 10 and 20% for 10 and 21 days, respectively (P2-80 treatment). Intake of ME was lowest (P < 0.05) for P2-80 (529, 535, 552 and 474 kJ/kg BW0.75 (fasted) for P1-100, P1-80, P2-100, and P2-80, respectively). Fed EE was lowest (P < 0.05) for P2-80 (495, 505, 467, and 406 kJ/kg BW0.75), whereas that while fasting was similar among treatments (287, 279, 273, and 253 kJ/kg BW0.75 for P1-100, P1-80, P2-100, and P2-80, respectively). The ME requirement for maintenance (MEm) was greater (P < 0.05) in P1 than P2 (477, 487, 421, and 376 kJ/kg BW0.75 for P1-100, P1-80, P2-100 and P2-80, respectively), and when analyzed for P2 separately MEm was lower (P < 0.10; 374 vs 425 kJ/kg BW0.75) and the efficiency of ME use for maintenance was greater (P < 0.08) for P2-80 than for P2-100 (0.689 vs 0.625). In conclusion, moderate feed intake restriction impacted EE and MEm by mature meat goats largely via decreasing EE associated with or responsive to nutrient intake or workload rather than physiological processes responsible for fasting EE.

Effects of diet quality on energy expenditure by 20-month old Alpine, Angora, Boer and Spanish wethers
Tovar-Luna, I., A. L. Goetsch, R. Puchala, T. Sahlu, G. E. Carstens, H. C. Freetly, and Z. B. Johnson Small Ruminant Research 72:18-24. 2007

Six Alpine (47.7 ± 1.36 kg initial BW), Angora (28.8 ± 1.11 kg), Boer (87.5% Boer and 12.5% Spanish; 49.3 ± 2.17 kg), and Spanish (38.7 ± 0.51 kg) wethers (initial age of 19 months) were used to determine effects of genotype and diet quality on energy expenditure (EE) when fed near maintenance and fasted. The experiment consisted of four simultaneous crossovers, with 21 d for adaptation before measures. Diets were 65% concentrate (CON) or coarsely ground alfalfa hay (FOR). EE was determined from O2 consumption and production of CO2 and CH4 with a head-box respiration calorimetry system, along with urinary N excretion, over 2-day periods in fed and fasted states (4-day fast). EE was expressed on the basis of average BW during the fasted measurement period. There were only significant interactions between genotype and diet in DM and gross energy intakes, which were due to differences in magnitude. Intake of ME was

similar among genotypes and slightly greater (P < 0.05) for CON than for FOR (450 vs. 424 kJ/kg BW0.75). Neither diet (373 and 371 kJ/kg BW0.75 for CON and FOR, respectively; SE = 5.9) nor genotype (377, 377, 361, and 373 kJ/ kg BW0.75 by Alpine, Angora, Boer, and Spanish, respectively; SE = 9.3) influenced fed EE (P > 0.10). Fasted EE was similar between diets but was greatest among genotypes (P < 0.05) for Alpine (251, 224, 217, and 225 kJ/ kg BW0.75 by Alpine, Angora, Boer, and Spanish, respectively; SE = 7.2), which may have been due to a greater level of activity exhibited by Alpine than other genotypes when fasted. Efficiency of utilization of ME for maintenance was similar (P > 0.10) between diets (0.685 and 0.657 for CON and FOR, respectively; SE = 0.0134). The ME requirement for maintenance was similar (P > 0.10) between diets (342 and 352 kJ/kg BW0.75 for CON and FOR, respectively; SE = 7.9) and among genotypes (353, 349, 326, and 362 kJ/kg BW0.75 for Alpine, Angora, Boer and Spanish, respectively; SE = 11.1). In summary, with a level of intake near maintenance, the maintenance energy requirement appears similar for Alpine, Angora, Boer and Spanish goats near 2 yr of age regardless of diet quality.

Energy expenditure by growing crossbred Boer and Spanish wethers consuming different quality diets ad libitum and near maintenance and while fasting

Tovar-Luna, I., A. L. Goetsch, R. Puchala, T. Sahlu, G. E. Carstens, H. C. Freetly, and Z. B. Johnson
Small Ruminant Research 67:20-27. 2007

Eight Boer (75%) x Spanish (BS) and eight Spanish (S) wether goats (155 ± 8 days of age and 19.2 ± 2.3 kg BW, initial) were used in a replicated crossover design experiment with a 2 x 2 factorial arrangement of treatments to determine effects of genotype and diet quality on heat production with ad libitum, near maintenance and fasting levels of feed intake. Diets were 65% concentrate (CON; 15% CP, DM basis) and coarsely ground alfalfa hay (FOR; 23% CP). There were no significant interactions between genotype and diet. ME intake was similar between genotypes and greater (P < 0.05) for CON vs. FOR both when intake was ad libitum (7.60 vs. 5.43 MJ/day) and near maintenance (4.31 vs. 4.09 MJ/day). DE concentration was greater (P < 0.05) for CON than for FOR with ad libitum (74.4 vs. 55.5%) and restricted intake (77.0 vs. 59.6%). Energy expenditure (EE), determined by respiration calorimetry, at all levels of intake was similar between genotypes. EE was greater (P < 0.05) for CON than for FOR at each of the three levels of intake, ad libitum (573 and 521 kJ/kg BW0.75 while fasting), near maintenance (426 and 400 kJ/kg BW0.75) and fasting (280 and 255 kJ/kg BW0.75). Efficiencies of ME utilization for maintenance (km) and gain (kg) and the ME requirement for maintenance (MEm) were similar between genotypes. km was similar between diets (0.705 and 0.690 for CON and FOR, respectively), although kg was greater (P < 0.05) for CON than for FOR (0.603 vs. 0.387). MEm was numerically greater (P < 0.17) for CON than for FOR (407 vs. 379 kJ/kg BW0.75), which may have involved higher ME intake with CON. In conclusion, under the conditions of this experiment energy requirements and efficiency of utilization were not different between growing Boer crossbred and Spanish goats regardless of diet quality.

Energy expenditure by crossbred Boer x Spanish does with litter size of one, two, or three
Tovar-Luna, I., A. L. Goetsch, R. Puchala, T. Sahlu, G. E. Carstens, H. C. Freetly, and Z. B. Johnson
Small Ruminant Research 71:83-91. 2007

Twenty-four Boer x Spanish does (3 yr of age, having kidded once previously and with an initial BW of 42.7 ± 1.2 kg) were used to determine the efficiency of ME utilization for pregnancy (kpreg). Six does were nonpregnant and, based on ultrasound determination on day 45 of gestation, six had a litter size (LS) of 1, 2, and 3. However, only 10 of the pregnant does delivered the expected number of kids (three, four, and three with LS of 1, 2, and 3, respectively). Does were fed a diet of approximately 50% concentrate in accordance with assumed maintenance plus pregnancy energy requirements based on estimated nonpregnancy tissue BW and LS. Recovered energy (RE) was determined by subtraction of energy expenditure (EE; respiration calorimetry) near day 80, 100, 120, and 140 of gestation from ME intake (MEI). RE was assumed attributable to pregnancy tissues (fetus, fetal fluids and membranes, uterus, and mammary gland), and ME used for pregnancy (MEpreg) was estimated by subtracting MEm determined with nonpregnant goats from MEI by those pregnant. For does with actual LS equal to that expected, the no-intercept equation for the regression of RE against MEpreg was: RE = MEpreg x 0.252 (SE = 0.030; R2 = 0.64), indicating a kpreg of 25%. Although, a regression including LS (1 vs. 2 or 3) suggested greater kpreg for LS of 1 (40.2% ± 5.6) vs. 2 or 3 (20.5% ± 3.2). Regressions for goats with LS different from expected suggested positive effects of use of energy mobilized from nonpregnancy tissues on kpreg and of use of dietary ME for energy accretion in nonpregnancy tissues on the efficiency of whole body ME utilization. In conclusion, the average efficiency of ME use for pregnancy regardless of LS in goats was near 25%, which when considering the expected proportion of all pregnancy tissues attributable to fetal or conceptus tissues implies an energy requirement for pregnancy of goats similar to common recommendations for sheep and cattle.

Effects of stocking rate and creep grazing on performance by Spanish and Boer x Spanish does with crossbred Boer kids
Yiakoulaki, M. D., A. L. Goetsch, G. Detweiler, R. C. Merkel, and T. Sahlu
Small Ruminant Research 71:234-242. 2007

26 Spanish does with twin Boer x Spanish kids and 26 Boer x Spanish does with twin 3/4 Boer-1/4 Spanish kids were used in a 76-day experiment to determine effects of stocking rate (SR) and creep grazing on pre-weaning performance. The study commenced approximately 2 months after kidding. There were four treatments, three involving SR and one creep grazing, with two animal groups or replicates for each treatment (consisting of both genotype sets) per treatment. Groups had 4 does with 8 kids for the low SR (L), 6 does with 12 kids for a moderate SR (M), and 8 does with 16 kids for both the high SR (H) and creep grazing treatment (C). Groups grazed 0.4-ha pastures of various grasses and forbs, with the most prevalent forb being ragweed (Ambrosia artemisifolia L.). Kids of C groups also had access to similar 0.4-ha pastures that contained the tree legume mimosa (Albizia julibrissin Durazz). All pastures consisted of four equal size paddocks that were sequentially grazed twice by the same animal groups (i.e., phases 1 and 2 were 48 and 28 days in length, respectively). Post-grazing forage mass decreased linearly with increasing SR ($P < 0.01$) (1902, 1454, 928, and 1150 kg/ha; SE = 51.2), and change in forage mass during the phases linearly increased ($P < 0.05$) (1078, 1247, 1746, and 1493 kg/ha for L, M, H, and C, respectively; SE = 120.6). Change (pre-grazing - post-grazing %) during the experiment in the contribution of ragweed to the sward increased linearly with increasing SR ($P < 0.05$) (-6, 12, 33, and 9% for L, M, H, and C, respectively; SE =

4.5). ADG by does (47, -16, -54, and -2 g/day; SE = 21.8) and kids (76, 61, 37, and 81 g/day; SE =6.7) linearly decreased with increasing SR ($P < 0.03$); however, kid BW gain per unit land area was similar among treatments (115, 138, 113, and 124 kg/ha for L, M, H, and C, respectively; SE = 21.7). Kid ADG was similar between genotypes but doe ADG differed ($P < 0.05$) (-47 and 34 g/day for Spanish and Boer x Spanish, respectively; SE = 11.5). In conclusion, creep grazing with high SR for does can increase ADG of does and kids but not relative to lower SR for both does and kids. Spanish does with Boer x Spanish kids may be less able to maintain or increase BW while supporting kid growth compared with Boer x Spanish does.

Effect of extended storage on microbiological quality, somatic cell count and composition of raw goat milk on farm

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Journal of Food Protection 70:1281-1285. 2007

Dairy goat herds in the U.S. are small scale, scattered around and distant from processing facilities. It is not cost-effective to collect goat milk everyday or every other day as it is with cow milk. In some areas goat milk is collected only once a week, which is in violation of regulations specified in the Pasteurized Milk Ordinance (PMO) for Grade A milk. This study was conducted to determine the effect of extended storage time up to seven days over a lactation on composition, somatic cell count (SCC), pH and microbiological quality of goat milk in refrigerated storage tank on farm. Duplicate samples were taken daily, after the morning milking, for seven consecutive days each month of the lactation season. Samples were analyzed immediately for all variables except free fatty acids (FFA). There were no significant changes ($P > 0.05$) detected in milk fat, protein, lactose, solids-non-fat, SCC or pH during the extended storage period, although effects of stage of lactation ($P < 0.05$) were observed. Mean standard plate count (SPC) in goat milk increased to 1.8x105 CFU/ml on the 6th day of the extended storage, exceeding the Grade-A limit (i.e., 1.0x105 CFU/ml). Mean psychrotrophic bacteria count increased steadily to 1.5 x 104 CFU/ml at 6 days of storage. Mean coliform count was approximately 500 CFU/ml for the first 3 d and fewer than 2,500 CFU/ml throughout 7 days of storage. No significant changes ($P > 0.05$) in FFA concentrations except for butyric and caprylic acids were observed as storage of goat milk advanced. In conclusion, when stored under refrigerated and sanitary conditions, goat milk in bulk tank on the farm could meet the Grade-A limits of both SPC and SCC within 5 days of storage but would have low quality due to growth of psychrotrophic bacteria thereafter.

Proteolytic and rheological properties of aging cheddar-like caprine milk cheeses manufactured at different times during lactation

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Journal of Food Science 72:E115-120. 2007

The effects of 24 wk of aging on the proteolytic and rheological properties of Cheddar-like cheese made from caprine milk collected at different lactation periods were evaluated. Cheddar cheese was made weekly using whole milk from Alpine goats and cheeses manufactured at wk 4, 5, 12, 14, 15, 21, 22, and 23 of lactation were evaluated for proteolytic and rheological properties at 5 d after manufacture and after 8, 16, and 24 wk of aging at 4 □C. Rheology results indicated that a minimum of 8 wk of aging was needed to stabilize the texture of the cheese and that the most uniform cheeses were made from mid lactation milk.

Cheeses manufactured at wk 12-15 of lactation were the firmest, had the least flexible protein matrix (highest values for hardness, chewiness, and shear stress and rigidity at point of fracture), and the lowest degree of proteolysis. Understanding the factors that impact the texture of cheese, such as aging and the period of lactation that cheesemilk is obtained, will help develop guidance for maintaining the production of high quality and uniform caprine milk cheeses.

Yield predictive models for goat milk cheeses using compositional variables
Zeng, S. S., K. Soryal, B. Fekadu, T. Popham, and B. Bah
Small Ruminant Research 69:180-186. 2007

Prediction of the yield and quality of different types of cheeses that could be produced from a given type and/or amount of goat milk is of great economic benefit to goat milk producers and goat cheese manufacturers. Bulk tank goat milk was used for manufacturing hard, semi-hard and soft cheeses (N = 25, 25 and 24, respectively) to develop predictive formulae of cheese yield based on milk composition. Fat, total solids, total protein and casein contents in milk and moisture-adjusted cheese yield were determined to establish relationships between milk composition and cheese yield. Soft, semi-hard and hard cheeses in this study had moisture contents of 66, 46 and 38%, respectively, which could be used as reference standards. In soft cheese, individual components of goat milk or a combination of two or three components predicted cheese yield with a reasonably high correlation coefficient (R2 = 0.73-0.81). However, correlation coefficients of predictions were lower for both semi-hard and hard cheeses. Overall, total solids of goat milk was the strongest indicator of yield in all three types of cheeses, followed by fat and total protein, while casein was not a good predictor for both semi-hard and hard cheeses. When compared with moisture-adjusted cheese yield, there was no difference ($P > 0.05$) in predicting yield of semi-hard and hard goat milk cheeses between the developed yield formulae in this study and a standard formula (the Van Slyke formula) commonly used for cow cheese. Future research will include further validation of the yield predictive formulae for hard and semi-hard cheeses of goat milk using larger data sets over several lactations, because of variation in relationships between milk components due to breed, stage of lactation, season, feeding regime, somatic cell count and differences in casein variants.

Effects of aging on functional properties of caprine milk made into Cheddar- and Colby-like cheeses
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Small Ruminant Research 70:218-227. 2007

The effects of cheese milk obtained at three times during lactation (weeks 4–5, 12–15, and 21–23) and cheese storage (up to 16 or 24 weeks) on meltability, sliceability, and color changes upon heating (232 °C for 5 min, high baking temperature, HT, or 130 °C for 75 min, low baking temperature, LT) of caprine milk cheeses were evaluated. The cheeses were manufactured from milk from Alpine goats and based on the procedures of Cheddar and Colby cheese manufacture. In Cheddar-like cheese, the sliceability (force required to slice sample) was at its highest when the cheese was made with milk from weeks 12–15 into lactation. Color change was variable although it tended to be lowest in cheese made at weeks 4–5 into lactation. In Colby-like cheeses, meltability was at its highest and sliceability was very poor (after 8 weeks of aging) when made with milk obtained later in lactation. Color changes were variable at the two different baking temperatures. As expected during aging, the meltability of the cheeses increased and the force required to

slice the cheeses decreased with the significant changes occurring within the first 16 weeks for Cheddar-like and the first 8 weeks for Colby-like cheeses. The color changes upon heating were variable for aged Cheddar-like cheeses and did not change significantly for aged Colby-like cheeses. Color changes were highly correlated with proteolysis occurring during storage. Cheese milk obtained at different times of lactation and aging of the cheese impact the functional properties of caprine milk cheeses and will affect their optimal utilization.

Co-Grazing of Sheep and Goats: A Review
Animut, G., and A. L. Goetsch
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Co-grazing of sheep and goats has been practiced throughout history and is commonplace around the world. However, its benefits may not be fully appreciated and means to maximize them have not been extensively studied. Advantages of co-grazing of sheep and goats are derived primarily from differences in preferences for particular plant species and parts, abilities or willingness to consume forages that are not highly preferred and would have greater adverse effects on the other species, and physical capabilities to gain access to specific types of vegetation. Hence, the degree to which total stocking rate or carrying capacity is greater for co- vs. mono-species grazing increases with increasing vegetation diversity and, concomitantly, decreasing dietary overlap. Perhaps the most important management decision pertaining to co-grazing is appropriate stocking rates. A simple 'baseline' or 'starting point' method of estimating co-grazing stocking rates is: (number with mono-species grazing x (100 - % overlap) / 100) + (number with mono-species grazing x (% overlap x 0.5 / 100)). The equation is applied to both sheep and goats, with values added to determine the total stocking rate. Botanical composition and available forage mass are important determinants of numbers of both sheep and goats with mono-species grazing, and factors affecting nutrient requirements such as body weight and production state, preference for or willingness to consume forages present, and desired length of grazing will have impact as well. Previous experience with the particular grazing and animal conditions will aid in projecting mono-species stocking rates. Estimates of dietary overlap when co-grazing should be based on the most accurate method available, which in many instances may be prior experience or visual observation at different times of the day and in various seasons. However, the equation noted above has limitations. It assumes that intake of forages potentially consumed by each animal species is equal, which obviously is not always true. Furthermore, interactions between stocking rates when the two species graze together vs. alone are not considered. Nonetheless, because of its simplicity, the method may have value in field settings, and illustrates the importance of browse plant species in many grazing systems and why management practices are frequently employed to maintain or increase their prevalence and vegetation diversity.

Methane emission by goats consuming diets with different levels of condensed tannins from lespedeza

Animut, G., R. Puchala, A. K. Patra, T. Sahlu, V. H. Varel, J. Wells, and A. L. Goetsch
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Twenty-four yearling Boer × Spanish wethers (7/8 Boer; initial body weight (BW) of 34.1 ± 1.02 kg) were used to determine effects on methane (CH4) emission of dietary levels of a condensed tannin (CT)-containing forage, Kobe lespedeza (Lespedeza striata; K), and a forage very low in CT, sorghum-sudangrass (Sorghum bicolor; G). Treatments were dietary K levels (dry matter (DM) basis) of 1.00, 0.67, 0.33, and 0 (100K, 67K, 33K, and 0K, respectively). Forages were harvested daily and fed at approximately 1.3 times maintenance metabolizable energy requirement. The experiment lasted 21 days, with most measures on the last 8 days. The CT concentration was 0.3 and 151 g/kg DM in G and K, respectively. DM intake was similar among treatments (i.e., 682, 675, 654, and 648 g/day; SE = 30.0) and gross energy (GE) digestibility increased linearly ($P < 0.05$) with decreasing K (0.472, 0.522, 0.606, and 0.666 for 100K, 67K, 33K, and 0K, respectively). CH4 emission changed quadratically ($P < 0.05$) with decreasing K (10.9, 13.8, 17.6, and 26.2 l/day; 32, 42, 57, and 88 kJ/MJ GE; 69, 81, 94, and 133 kJ/MJ digestible energy for 100K, 67K, 33K, and 0K, respectively). In vitro CH4 emission by incubation of ruminal fluid for 3 weeks with a medium for methanogenic bacteria and other conditions promoting activity by methanogens also was affected quadratically ($P < 0.05$) by K level (7.0, 8.1, 9.2, and 16.1 ml for 100K, 67K, 33K, and 0K, respectively). The total bacterial count of ruminal samples was similar among K levels, but the number of total protozoa increased linearly ($P < 0.05$) as K declined (8.3, 11.8, 15.6, and 27.1 x 105/ml for 100K, 67K, 33K, and 0K, respectively). The CT-containing forage K decreased CH4 emission by goats regardless of its feeding level, although the effect per unit of K increased with decreasing K. Forage type (i.e., legume vesus grass) may have contributed to the effect of K on CH4 emission, but most of the change appeared attributable to CT, which appeared to directly impact activity of methanogenic bacteria, although alterations of protozoal activity could have been involved. These findings suggest that relatively low dietary levels of CT could be employed to lessen CH4 emission without a marked detrimental effect on other conditions such as total tract protein digestion.

Methane emission by goats consuming different sources of condensed tannins

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Twenty-four yearling Boer × Spanish wethers (7/8 Boer; initial body weight (BW) of 37.5 ± 0.91 kg) were used to assess effects of different condensed tannin (CT) sources on methane (CH4) emission. Diets were Kobe lespedeza (Lespedeza striata; K), K plus quebracho providing CT at 50 g/kg dry matter (DM) intake (KQ), Sericea lespedeza (Lespedeza cuneata; S), and a 1:1 mixture of K and S (KS). Forages harvested daily were fed at 1.3 times the maintenance metabolizable energy requirement. The experiment was 51 days divided into two phases. In phase A forage diets were fed alone, and in phase B, 25 g/day of polyethylene glycol (PEG) was given mixed with 50 g/day of ground maize grain. Adaptation periods were 28 and 7 days in phases A and B, respectively. After adaptation there were 8 days for feces and urine collections, with gas exchange measured on the last 2 days. Ruminal fluid was collected at the end of the experiment via stomach tube for microbiology assays. The N concentration was 22.8 and 23.6 g/kg DM, in vitro true DM digestibility was 0.698 and 0.648, and the level of CT was 140 and 151 g/kg DM for S and K, respec-

tively. DM intake was similar among treatments in both phases (phase A: 720, 611, 745, and 719 g/day (SE = 59.0); phase B: 832, 822, 867, and 880 g/day (SE = 55.3) for K, KQ, S, and KS, respectively). N digestibility was affected by treatment in phase A ($P < 0.05$) but not in phase B (phase A: 0.514, 0.492, 0.280, and 0.413 (SE = 0.0376); phase B: 0.683, 0.650, 0.638, and 0.662 (SE = 0.0203) for K, KQ, S, and KS, respectively). Gross energy digestibility was similar among treatments in phase A (0.475, 0.407, 0.393, and 0.411 (SE = 0.0353)) but differed among treatments in phase B (0.449, 0.373, 0.353, and 0.409 for K, KQ, S, and KS, respectively (SE = 0.0221)) CH4 emission was 9.6, 6.8, 10.6, and 8.9 l/day (SE = 1.44) in phase A and 19.0, 16.6, 21.8, 19.2 l/day (SE = 1.51) in phase B for K, KQ, S, and KS, respectively (SE =1.25). When data of both phases were pooled, supplementation with PEG in phase B markedly increased ($P < 0.05$) CH4 emission (9.0 versus 19.1 l/day). In accordance, there was a substantial difference ($P < 0.05$) between phases in in vitro CH4 emission by ruminal fluid incubated for 3 weeks in a methanogenic medium and with other conditions promoting activity by methanogens (11.5 and 22.9 ml in phases A and B, respectively). Counts of total bacteria and protozoa were similar among treatments in both phases, but values were greater ($P < 0.05$) in phase B versus phase A. In summary, CT from different sources had a disparate influence on N digestion, but similar effects on ruminal microbial CH4 emission by goats, possibly by altering activity of ruminal methanogenic bacteria though change in actions of other bacteria and/or protozoa may also be involved.

Tethering meat goats grazing forage of high nutritive value and low to moderate mass
Patra, A. K., R. Puchala, G. Detweiler, L. J. Dawson, T. Sahlu, and A. L. Goetsch
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Twenty-four yearling Boer x Spanish goats were used in a crossover design experiment to determine effects of tethering on forage selection, intake and digestibility, grazing behavior and energy expenditure (EE) with forage high in nutritive value and low to moderate in mass. Objectives were to determine if tethered goats could be used as a model for study of unrestrained animals and to characterize tethering as a production practice. Four 0.72-ha pastures of wheat (Triticum aestivum) and berseem clover (Trifolium alexandrium) were grazed in December and January. Each pasture hosted six animals, three with free movement and three attached to a 4.11-m tether for access to a circular area of 53.1 m2. Tethering areas were moved each day. One animal of each treatment and pasture was used to determine forage selection, fecal output or grazing behavior and EE; therefore, there were eight observations per treatment. Mass of forage DM before grazing in Tethered areas averaged 1,280 and 1,130 kg/ha in periods 1 and 2, respectively. The CP concentration in ingesta was greater (($P < 0.05$) 239 and 209 g/kg; SE = 8.0) and the NDF level was lower ($P < 0.05$) for Free vs. Tethered animals (503 and 538 g/kg; SE = 12.0); in vitro true DM digestion was similar between treatments (0.808 and 0.807 for Free and Tethered, respectively; SE = 0.0096). Intakes of DM (1,013 and 968 g/d; SE = 78.6), NDF (511 and 521 g/d; SE = 39.9) and ME (10.9 and 10.7 MJ/d; SE = 0.90) were similar between treatments, but CP intake was greater ($P < 0.05$) for Free vs. Tethered animals (241 and 203 g/d; SE = 17.2). There were small treatment differences in in vivo apparent digestibility of OM (($P < 0.05$) 0.780 and 0.814; SE = 0.0049), CP (($P < 0.05$) 0.800 and 0.817; SE = 0.0067) and NDF (($P < 0.09$) 0.777 and 0.760 for Free and Tethered, respectively; SE = 0.0078). There were no treatment effects on time spent ruminating or grazing (346 and 347 min/d for Free and Tethered, respectively; SE = 42.5), but EE was considerably greater ($P < 0.05$) for Free vs. Tethered animals (571 and 489 kJ/kg BW0.75; SE = 8.9). In conclusion, with forage of high nutritive value and low to moderate in mass, tethering can offer a production advantage over free grazing of less energy used for activity despite similar grazing time. With forage

removal considerably less than that available for grazing, effects of tethering on chemical composition of selected forage were small and less than needed to markedly affect digestion. Tethering may offer a means of studying some aspects of grazing by ruminants, but would not seem suitable for energy metabolism.

Effects of tethering on herbage selection, intake, and digestibility, grazing behavior, and energy expenditure by Boer x Spanish goats grazing high quality herbage
Patra, A. K., R. Puchala, G. Detweiler, L. J. Dawson, T. Sahlu, and A. L. Goetsch
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Twenty-four yearling Boer x Spanish goats were used in a crossover experiment to determine effects of tethering on herbage selection, intake, and digestibility, grazing behavior, and energy expenditure (EE) with high quality herbage. Four 0.72-ha paddocks of wheat (Triticum aestivum) and berseem clover (Trifolium alexandrium) were grazed in the spring. Each paddock hosted 6 animals, 3 with free movement and 3 attached to a 3-m tether for access to an area of 28.3 m2 that was moved daily. One animal of each treatment and paddock was used to determine herbage selection, fecal output, or grazing behavior and EE. Herbage DM mass in tethered areas before grazing averaged 2,649 and 2,981 kg/ha in Periods 1 and 2, respectively. The CP concentration in ingesta was greater ($P < 0.05$; 23.1 and 20.3 ± 0.82%) for free vs tethered animals, although in vitro true DM digestion (75.7 and 76.5 ± 1.20%) did not differ ($P > 0.05$) between treatments. Intake of ME based on in vitro true DM digestion and fecal output was greater ($P < 0.05$) for free vs tethered animals (12.7 and 10.4 ± 0.89 MJ/d). No treatment effects were observed ($P > 0.05$) on time spent ruminating or grazing (405 and 366 ± 42.5 min/d, respectively), although mean EE was greater ($P < 0.05$) for free vs tethered animals (633 and 512 ± 27.4 kJ/kg BW0.75 for free and tethered, respectively), with differences ($P < 0.05$) between treatments at each hour of the day. Tethering animals may be acceptable to model ones with free movement for some measures such as ingesta composition but appears inappropriate for others, such as energy metabolism.

Goat nutrition and feeding
Goetsch, A. L., and R. C. Merkel
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Goats have been selected for different purposes, such as milk production, mohair or cashmere fiber yield, and average daily gain or meat production, resulting in different physiological conditions that affect nutrient requirements and most appropriate feeding methods. Nutrient requirements and dietary management practices are also unique for indigenous or local genotypes of goats that may not have been intensively selected by many for a particular type of production, but that have adapted to survive under specific and often harsh environmental conditions. Goats differ from other domesticated ruminant livestock species, namely beef and dairy cattle and sheep, in numerous ways; however, most notable are unique feeding behaviors. Goats generally consume a wider variety of plants when available, especially browse and foliage of woody plant species. Moreover, because of factors including mobile lips and precise tongue actions, goats exert considerable selection in the particular plant fragments and feed particles consumed. Another difference between goats vs cattle and sheep is the ingestion of relatively greater levels of many plants containing 'anti-nutritional factors' such as tannins that can influence nutrient absorption and utilization. In addition

to effects of selection on nutrient requirements and desired feeding management practices, previous plane of nutrition has impact. This can be assessed by body condition score as practiced with other ruminant species. Knowledge of body condition score and other factors influencing nutrient requirements, such as breed, gender, desired levels of production including pregnancy status, and grazing and environmental conditions, are necessary to assess specific needs for energy, protein, minerals, and vitamins. Then dietary means of meeting these requirements can be devised. For animals in confinement this might be considered a bit easier than for grazing goats, since all nutrients are provided by feedstuffs offered. Although, many times in confinement forage is fed free-choice as the basal diet, similar to forage consumed when grazing. In both cases nutrients provided by the basal diet must be projected in order to formulate a supplement to satisfy any nutrient deficits at the lowest cost. Total mixed rations are frequently used as well, particularly for dairy goats, in which case least-cost formulation procedures considering different available forage and concentrate feedstuffs will yield greatest profitability.

Visiting Scholars (2006/2007)

Mr. Getachew Animut
Native of Ethiopia
Research Project: Decreased Methane Emission by Ruminants Consuming Condensed Tannins (USDA 2004-38814-02606)
Experiments: GA-05-05, GA-05-13, GA-06-05, GA-06-11, GA-06-12

Dr. Maristela Rovai
Native of Brazil
Research Project: Evaluation and Modeling Extended Lactations in Dairy Goats (USDA 2003-38814-02579)
Experiments: MR-05-11, MR-05-12, MR-06-02, SC-07-06

Dr. Sean Chen
Native of China
Research Project: Quality, Safety, and Shelf-Life of Dairy Goat Products in the U.S. Market (USDA 2003-38814-02587)
Experiments: SZ-05-01, SZ-05-02, SC-06-01, SC-06-03

Dr. Asefa Asmare
Native of Ethiopia
Research Project: The Ability of Goats to Withstand Harsh Nutritional Environments (USDA 2005-38814-16353)
Experiments: AA-06-08, AA-07-02, AA-07-05

Dr. Adnan Beker
Native of Ethiopia
Research Project: Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier (US-3694-05 R)
Experiments: AB-06-06, AB-06-16, AB-07-01

Dr. Ahmed Askar
Native of Egypt
Research Project: Characterization of the Energy Requirement for Activity by Grazing Ruminants (USDA 2005-38814-16352)
Experiments: AAR-06-07, AAR-07-03

Dr. Ignacio Tovar-Luna
Native of Mexico
Research Project: The Grazing Activity Energy Cost of Goats (BIO11-001-005)
Experiments: AA-07-02, ITL-08-01

Dr. Lynn Wang
Native of China
Research Project: Impact of Sub-Clinical Mastitis on Production and Quality of Goat Milk and Cheese (USDA 2007-38814-18474)
Experiments: A) Prevalence of Sub-Clinical Mastitis in Dairy Goat Herds; B) Effects of Sub-Clinical Mastitis on Goat Milk Quality and Production

Mr. Li Zhang
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Training Focus: Cheese Manufacturing and Dairy Herd Improvement (DHI) Laboratory Operation