WELCOME

We deeply appreciate your attendance at this 16th Annual Goat Field Day of the E (Kika) de la Garza 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 for some of the Field Day presentations. After this information, there are highlights of research and extension 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.

In some of the past field days, we have had a general theme. However, this year there was a large variety of topics that people we serve suggested should be addressed. So, to best serve our clientele we chose to simply go with these important areas and not worry about how they fit together. Here is the exciting program planned for today that has developed from your input.

The morning program consists of:

- **Meat Goats: A Look at the Big Picture** *Rick Machen*
- **The Mastitis Problem** *Grant Tomita*

Afternoon workshops are:

- **Youth Activities** *Shirlene Hurte & Cheryl Smith*
- **Farmstead Goat Cheese** *Sara Bolton & Gretchen Stolfo*
- **Meat Goat Production - Elements for Long-Term Success** *Rick Machen*
- **Practical Mastitis Prevention** *Grant Tomita*
- **Caprine Herd Health Program** *Lionel Dawson*
- **DHI Overview and Tester Training** *Tim McKinney*
- **Types of Fencing for Goats** *Jerry Hayes*
- **International Activities of the Institute** *Roger Merkel*
- **Goat Diet/Feeding Examples** *Steve Hart*
- **Predator Control** *Kevin Grant*

Please let us know your wishes for the 2002 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 Institute for Goat Research, we thank you for your continuing interest and support.

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

MEAT GOATS: A LOOK AT THE BIG PICTURE

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Introduction

It is all about competition. Were there only one runner in a race, the winner would be obvious. Were goat the only animal protein in the retail meat case, ...

Obviously, it's not. There are several major competitors in the race to capture the consumer's attention and garnish a portion of their food dollar. The competitors are far ahead in the race. So, how did they get there?

A wise man once said "History repeats itself." If so, could there be valuable lessons for the meat goat industry in a review of the past and current situations within the major animal protein industries?

Brief History and Current Status

Poultry

Poultry has moved from a barnyard family enterprise to a vertically integrated, efficient industry dominated by a few innovative, aggressive companies. The poultry industry moved quickly from rural egg routes and selling whole chickens on ice at the retail meat counter to value-added, case-ready, branded products that met the consumer's needs. Product consistency is unsurpassed. Poultry has capitalized on the heart-healthy image of lean white meat for the diet-health conscious crowd. The industry's promotion and marketing infrastructure has lead the way in capturing consumer attention. Per capita consumption increased during the 1980's and 90's and began to level off by the turn of the century.

Lamb

Loss of the Wool Act was a significant blow to the domestic sheep industry. The Wool Act provided direct financial incentives to producers and more important, indirectly generated funds to support industry organizations such as the American Sheep Industry Association. Since 1995, domestic promotion of lamb and wool products has been severely hampered. The sheep industry's inventory, both number of operations and size of the sheep inventory, has been and continues to decline. Production limitations include predation, labor availability and cost, an ever-declining access to public

lands for grazing and a stagnant world wool market. Domestic per capita consumption of lamb has been declining since the end of World War II. Imported lamb is a significant competitor for the consumer's dollar.

Pork

Tremendous vertical integration has virtually eliminated the independent hog producer. The large corporations that now own hogs are selling branded retail products in fresh meat and deli case. The pork industry maintains an intense focus on the cost of production. Perhaps the system has become too efficient. Overproduction of pork has contributed to a decline in market prices. In an effort to distance their product from the "red" meats and more closely align with the health perceptions of lean, white chicken, the product has become too lean and has lost some palatability. In 2000, the pork industry voted to discontinue their checkoff program which generated support for the National Pork Producers Council and their efforts to promote pork.

Beef

The cattle emerging from the World War II era were too small, too early maturing and too predisposed to waste. In the 1960's and 70's, "exotic" Continental-European breeds were imported to increase size and productivity. By the late 1970's, many commercial beef cattle were too big and had lost production efficiency in the environments in which they were expected to produce. Consequently, the industry has spent the last 10-15 years trying to get back to the middle of the road; efficient females bred to bulls that compliment the cow herd to produce a branded product that fits the box and meets or exceeds the consumer's expectations. The promotion infrastructure has been very effective. Per capita consumption of beef is trending upward. Development of consumer-friendly, high quality, heat-and-eat products that fit consumer's lifestyles has exposed the tip of what could be a huge surge in beef's share of the consumer's dollar.

Goat

Without question, the meat goat industry lacks the infrastructure enjoyed by the all other competing meats. The product lacks a consumer-friendly name and is foreign to the majority of domestic consumers. Despite these facts, the meat goat industry has experienced unparalleled growth during the last decade. This growth can be attributed, in part, to: 1) importation of the Boer goat which began in 1993, 2) the decline of the ratite industry and the availability of financial resources therefrom, 3) increased land fragmentation and the suitability of meat goats for small acreage land-holdings and 4) loss of the Wool Act which shifted production from Angora goats to meat goats. Industry expansion has been both geographic and demographic. Traditional markets for the product are on the east and west coasts and in the southwest U.S. Demand for breeding animals and show prospects has been very strong since 1993.

Since 1993, commercial breeding programs have been relatively simple - the primary objective has been to increase the Boer influence. But perhaps the industry has come to (or is rapidly

approaching) the point where more Boer influence is not the best management practice. Can we get does that are too big for extensive, range/pasture production conditions? Is there a significant advantage to having more than 3/4 Boer influence in Junior Market show prospects?

Current and Future Trends

Enough about the past - there are no more opportunities there. What might the future be like? Consider these trends:

> "In the next ten years, changes in consumer behavior will result in foodservice capturing $76 billion of an expected $123 billion in new food spending in the United States. For the first time foodservice would have a larger share of the food dollar than the retail grocery industry. Foodservice will capture 62% of new growth and 51% of the $822 billion expected to be spent on food products overall by 2010." (*International Foodservice Distributors Association Foodservice 2010 Study*).

> "Full service restaurants will outpace quick serve restaurants in the decade ahead, a development heavily influenced by changing consumer demand. Convenience stores will become increasingly important venues for foodservice offerings." (*International Foodservice Distributors Association, Foodservice 2010 Study*).

> "Approximately 2/3 of all dinner decisions are made the same day. Of those, 73% don't know at 4:30 p.m. what they are going to have for dinner. (*NCBA/LB Co. Category Management Study, 1997)*

> "During the week, 40% of all households spend less than 30 minutes on meal preparation, 78% spend less than 45 minutes. Dinner meals are becoming simpler; the number of ingredients being used is at an all-time low and fewer dishes are being served." *(NPD Pantry Check, 1996)*

> "In the very near future, 80% of the meals will be prepared in 15 minutes or less." *(Lisa Williams, Texas Beef Council, Austin, TX.)*

> "In the past two years alone (1999-2000), USDA has certified 25 new beef brands. That compares to a total of 21 certified beef programs established during the entire period from 1978 through 1997. There is a clear trend toward specification and labeling." *(Tom Brink, CattleFax)*

> "Our new heat-and-serve, precooked beef patty exceeded our expectations. We anticipated $1 million in sales the first year. We went more than $1 million in sales in 45 days! *(Steve Harper, HEB Food Stores, San Antonio, TX.)*

> "The total heat-and-serve category (all proteins) grew by 22% or $134.1 million from December 1999 to December 2000." *(AC Nielsen & FreshLook Marketing)*

"Chicken holds a 63% share of the refrigerated heat-and-serve category and grew by nearly 17% from 12/99 to 12/00. Beef holds a 14% share and grew by 60% over that same time. The total refrigerated heat-and-serve beef entree category grew by 41.4% or $31.5 million." *(AC Nielsen & FreshLook Marketing)*

Observations

The carcass merit progress made by meat goat breeders in the past eight years is simply amazing, especially when you consider that the mainstream, center-of-the-plate meat industry has provided no incentive. Goat meat consumers have not asked for larger loin eyes, plumper legs or wholesale cuts with greater lean yield. It appears the cart is *before* the goat. The industry may be subscribing to the movie line "If you build it, they will come." *It* (a better product) is being built, but someone needs to tell *them* (traditional and potential consumers).

Breeding meat goat (primarily Boer) shows have sprung up all across the country. Goat shows are an advertising/marketing tool for purebred breeders, enhance the public's recognition of goats and provide a recreational experience for others. Beyond that, their direct contribution to the commercial meat goat industry and the production and merchandising of goat meat is uncertain.

The meat goat industry needs <u>one</u> industry organization around which the entire industry can rally. To date, the most active organizations have primarily concerned themselves with goat registries, goat shows and production sales. These activities are certainly important, but *in the near future*, efforts must move forward in the areas of consumer education and consumer-friendly product development and promotion.

Far be it from this author to speculate which of the existing or future organizations will serve as the rally point. But, consider this spin on a famous truth: "United we stand; divided we flounder."

Conclusion

If goat is to command a *bigger* part of the food dollar picture in the first ten years of the 21st century, several things must happen.

1. The size of the U.S. meat goat herd will preclude goat meat from competing with beef, pork or poultry for large segments of the retail meat case. Domestic goat meat supply is seasonal and there simply is not enough consumer demand or product to justify devotion of significant retail case space to goat meat.

2. Consider the consumer:
a) According to NCBA data, 50% of consumers in the 26-35 age group said their lack of cooking knowledge kept them from buying certain cuts of beef. If they do not know how to cook it, they will likely not buy it.
b) Food products that require preplanning, long preparation times and/or significant cooking

skills will struggle and fade from the picture.

Given the dollars required to accomplish large-scale consumer education efforts, retail sales are not likely a significant market share expansion opportunity for goat meat.

3. Consider foodservice and/or niche markets. The number of meals consumed outside the home continues to rise. For example, suppose a boneless, marinated goat meat product was developed and marketed as a Cabrito Fajita that could be prepared on existing fast food grills in the same time and manner as beef or chicken fajitas.

4. Product development, advertising and promotion, and consumer education are expensive efforts. If goat meat is to be advanced beyond its current position in consumer food product spending, the industry must unify its efforts and move forward with one voice that represents the entire meat goat industry. The duplication of efforts associated with several industry organizations results in the inefficient use of manpower and financial resources and is confusing to both those within and outside the industry.

The proper citation for this article is:

Machen, R. 2001. Meat Goats: A Look at the Big Picture. Pages 1-5 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

THE MASTITIS PROBLEM

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Cause of Mastitis

Mastitis is defined as an inflamation of the mammary gland. The inflamation is the result of a localized immune response to an irritant within the gland. The irritant can be in the form of pathogens, toxins, or physical trauma. The goat mounts an immune response in an attempt to destroy or neutralize the irritant, and return the mammary gland to normal function.

Mastitis implies that an infectious agent is present in the mammary gland and is nearly always caused by bacteria. Bacteria invade the udder by entering the teat orifice, multiply and die within the gland, and in the process, produce and release toxins that cause injury to secretory tissue and stimulate an immune response. Besides bacteria, other pathogens such as yeast, *Mycoplasmas*, and algae can infect the mammary gland. Bacteria which infect the mammary gland are classified into two major categories, contagious or environmental pathogens. Mastitis caused by these pathogens is generally referred to as contagious mastitis or environmental mastitis.

Contagious pathogens are spread from an infected udder to a noninfected udder during the milking process. The source of bacteria is an infected udder. The most prevalent contagious pathogens associated with mastitis are *Streptococcus agalactiae* and *Staphylococcus aureus*. As the name implies, environmental pathogens that infect the mammary gland are present in the goat's surroundings. The reservoirs for these pathogens include feces, soil, and bedding. Transmission of pathogens from the environment to the udder mainly occurs between milking, but can also occur during milking. Environmental pathogens commonly isolated from infected udders are coliform bacteria, *Streptococcus* species other than *Strep. agalactiae*, and *Staphylococcus* species other than *Staph. aureus*.

Pathogenesis, Detection, and Diagnosis of Mastitis

However, during the course of mastitis, bacteria and secretory cells within the mammary gland produce various chemical messengers that enter the blood circulation within the udder. These chemical messengers attract a specialized type of somatic cell called neutrophils to the mammary gland. Therefore, as a result of the intramammary bacterial infection, a tremendous amount of neutrophils is mobilized into the udder in order to combat the infection. The increase of this cell type within milk is the primary cause of increased milk somatic cell counts associated with mastitis.

On the farm, mastitis is usually detected by the observance of abnormal milk. The udder producing this milk may become swollen, red, feverish, and hard. This condition is known as clinical

mastitis and is observed in less than 5% of animals in a well-managed dairy herd. The nonobservable form of mastitis, such as no visible abnormalities of either the milk or the udder, is known as subclinical mastitis. In excess of 50% of animals in a herd can have subclinical mastitis at any given time. A sudden rise in milk somatic cell count observed in normal milk from normal udders may indicate the presence of subclinical mastitis. Animals which have subclinical mastitis are usually not producing milk to their full potential and can serve as a potential source of infection to heathy udders.

The best method to diagnose mastitis is to conduct a bacteriological analysis of milk samples from udder halves that were collected in a sterile manner. Milk samples should be taken from goats with clinical mastitis and goats that exhibit a substantial increase in somatic cell count. Bacterial pathogens isolated from milk samples can be accurately identified by the analysis. This allows for the determination of the source of infection, such as a contagious or environmental pathogen. The identification of the type of infective organism will help the producer make sound management decision to prevention and control mastitis.

Prevention of Mastitis

The success of a dairy is highly influenced by the prevention and control of mastitis. The dairy farmer must be conscience of the impact mastitis may have on public health issues, the economy of the farm, and the well being of the goat. Mastitis pathogens in milk pose a low threat to public health if the milk is pasteurized. However, the improper use of antibiotics to eliminate mastitis pathogens can become a public health concern. The careless application of antibiotic therapy against mastitis can lead to residues in milk and meat, the selection of antibiotic resistant strains of bacteria, and the introduction of pathogens into the mammary gland by contaminated infusion cannula. The economics of the disease must also be of a concern to the dairy farmer. Mastitis is the most economically important disease in the bovine dairy industry. Estimated losses range from $185.00 to 265.00 per cow per year. This places annual losses in excess of $2 billion or about a 10% loss of total productive capacity. Generally, sources of economic loss include reduced milk production, animal replacement due to culling, discarded milk due to antibiotic treatment, cost of treatment, veterinary service, and extra labor cost to care for the animals. Although the effect of mastitis on the economy of the dairy goat industry has not been established, the trend of lost dollars due to this disease should closely parallel what is observed in the bovine dairy industry.

The key to disease prevention is to control exposure to pathogens. In the case of mastitis, a good control program must reduce the exposure of teat ends to bacteria. Contagious pathogens are transmitted to uninfected halves at milking time, therefore, teat preparation before milking is very important. Milk only clean, dry teats. Gloved hands that have been disinfected and dried between handling of goats will decrease the likelihood of spreading bacteria from an infected goat to a noninfected goat. Decreasing the exposure of teat ends to contagious pathogens following milking can be accomplished by killing bacteria on teat skin with a postmilking teat dip. Also, maintaining healthy teat skin and teat ends are also important. Teat lesions have been shown to harbor bacteria, such as *Staphylococcus aureus* and *Streptococcus* species, that can cause mastitis.

Exposure of teat ends to environmental pathogens is more difficult to control than contagious pathogens. Sources of infection include manure, bedding material, feedstuff, dust, dirt, mud, and water. The bacteria load in those sources can increase significantly in situations where overcrowding, poor ventilation, and a damp environment exist, in other words, in situations where there is a general lack of cleanliness and poor sanitation. Therefore, reduced teat end exposure to environmental bacteria can be accomplished by providing goats with a clean and dry pasture or barn. As noted in the control of contagious pathogens, good milking time hygiene, such as milking clean and dry teats can control exposure to environmental pathogens. Predipping teats before milking may also reduce the risk of infecting udder halves with environmental pathogens. In theory, utilization of a premilking teat sanitizer will eliminate bacteria from the teat skin before the milking units are attached and therefore, reduce the risk of infecting udder halves during the milking process.

Since the elimination of environmental pathogens from the goat's surrounding is impossible to accomplish, enhancement of the animal's immune response to infection may be an alternative method of control. Immunization against coliform bacteria has been shown to be effective in reducing the number and severity of clinical coliform mastitis in dairy cows.

Other general practices to prevent contagious and environmental mastitis include the milking of infected animals last and preventing the animals from laying down after milking. This can be accomplished by feeding them immediately after milking to insure that they are standing for at least 30 minutes. This should allow enough time for the proper closure of the teat orifice.

Treatment of Mastitis

Perhaps the most commonly employed treatment of mastitis is to do nothing. This practice may be most common in cases of subclinical mastitis where the disease goes unnoticed. In most instances a spontaneous cure of the intramammary infection occurs, but at the expense of reduced milk production and possible permanent damage to milk secretory tissue in the mammary gland. Antibiotic therapy is usually prescribed when clinical symptoms of mastitis are presented. If detected early, antibiotic therapy is very effective in curing and controlling the spread of contagious pathogens. However, antibiotic therapy is not effective against environmental pathogens, especially coliform bacteria. Culling is another method of control especially when dealing with chronically infected animals. This eliminates the potential source of infection at the expense of purchasing a replacement animal.

Management of Mastitis

A sound herd health management program is needed to be successful in the control and prevention of mastitis. This would include the implementation of an udder health monitoring program such as the Dairy Herd Improvement (DHI) testing for milk somatic cell counts. In the bovine dairy industry, the milk somatic cell count serves as an excellent index to determine the status of mammary gland heath. However, the milk somatic cell count of goat milk may not be a reliable indicator of mastitis. Research in dairy cows has shown a very high degree of association between increased somatic cell counts and intramammary bacterial infection. The milk somatic cell count of the

uninfected mammary gland of cows ranges between 40,000 and 200,000 cells per milliliter of milk, and increases to more than a million cells during mastitis. However, in dairy goats, the milk somatic cell count in healthy, uninfected udder halves can vary between 50,000 and more than 1,000,000 cells per milliliter of milk. This is especially noticeable at the beginning of lactation and near dry off. Therefore, the microbiological analysis of milk collected from suspect udder halves must be conducted to determine if an increase in milk somatic cell count is due to a bacterial infection. Once the cause and source of infection (contagious or environmental pathogens) are identified, treatment strategies such as antibiotic therapy or culling can be devised and management practices can be reviewed or modified in order to prevent the spread of infection. Other management practices that can be employed to effectively control mastitis are to evaluate milking practices and routines, evaluate the housing condition of animals, and provide adequate nutrition for each stage of lactation.

Summary and Conclusion

Mastitis is a very economically important disease to the dairy industry. There are established procedures and protocols for the prevention and control of mastitis, but those procedures and protocols can only be effective if an udder health monitoring program is in place. The monitoring program will be successful if the farmer diligently manages the herd and maintains accurate records of individual animals.

There are six basic elements of an effective mastitis control program. They include: 1) proper milking procedures and milking machine function, 2) teat dipping after milking, 3) providing the goats a clean, comfortable, and dry environment between milking, 4) use antibiotic therapy at dry off to eliminate existing infection, 5) cull chronically infected goats to prevent the spread of infection, and 6) keep accurate production and health records of individual goats.

The proper citation for this article is:

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THE PROCESS FOR MAKING FRESH FARMSTEAD GOAT CHEESE

Sara Bolton and Gretchen Stolfo

Cheesemakers from Pure Luck Grade A Dairy
Dripping Springs, Texas

I. Milk Quality & Quantity
   - A. Feed/Nutrition
     1. grains
     2. hay & forage/roughage
     3. minerals
   - B. Milking Schedule
     1. regularity/consistency
     2. pleasant atmosphere
   - C. Animal Health
     1. somatic cell counts
     2. vigor/happiness
     3. biologicals/alternatives
     4. good relationship with vet
     5. animal comfort/hoof trimming, etc
     6. post milking teat dip
   - D. Milk Handling
     1. clean animal/specifically udder
     2. proper cleaning & sanitizing of equipment
     3. proper cooling of milk
     4. how your dairy inspector can work for you

II. The Process of Cheesemaking
   - A. Pasteurization
     1. when & why to pasteurize
     2. pasteurization guidelines
     3. definition of Grade A
   - B. Curd for Chèvre & Ste. Maure
     1. mesophyllic culture
     2. temperature
     3. flavor function of culture

4. rennet
5. assessing curd
6. scooping
7. salting
8. what to do with the whey

C. Flavoring & Packaging
1. herbs & flavorings
2. inoculating Ste. Maure
3. cheese wraps, etc
4. shelf life

Participants will receive copies of recipes for Chèvre & Ste. Maure as well as a resource & book list. Hands-on workshop will include scooping curd into molds.

The proper citation for this article is:

Bolton, S. and G. Stolfo. 2001. The Process for Making Fresh Farmstead Goat Cheese. Pages 10-11 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

MEAT GOAT PRODUCTION - ELEMENTS ESSENTIAL FOR LONG-TERM SUCCESS

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Introduction

Everyone has their favorite season of the year. School children and their teachers anxiously await the beginning of summer. Those who avidly pursue the whitetail deer long for the turning of the leaves and the cooler weather soon to follow. Goat breeders impatiently count the days until spring kidding begins. For some, the period from buck turnout until kidding commences rivals the length of the school year as perceived by a child. Spring brings new life and a first glimpse of the results of a carefully planned mating program - breeding the best to the best with great expectations of producing something better.

The meat goat industry continues to boom. The value of imported genetics has declined and stabilized at "real world" prices, but the interest and activity within the industry is far from status quo. Breeding stock inquiries, both domestic and international, continue to surface and the youth market wether industry has experienced growth unlike any other youth livestock program in the memorable past.

A diversity of opportunities exists; purebred seedstock, commercial replacement animals, show wethers and the list goes on. In order to experience long-term success, meat goat producers must focus on four determinants of success in a livestock enterprise. These four fundamentals must be considered in their order of priority.

#1. Must have a VIABLE MARKET for your product.

A lack thereof precludes consideration of points 2-4.

Webster defines viable as *capable of developing under favorable conditions; capable of success or continuing effectiveness*. Synonyms include: alive, feasible, practical, workable. When used in context with goat markets, terms such as accessible, stable and dependable also come to mind.

Unlike most other animal protein industries, demand for goats and goat meat far exceeds our domestic ability to supply. In some instances, demand escapes the realm of viable markets.

How? Look back at the synonyms; practical, feasible, workable. Our supply is sporadic and we are some distance from being able to fill long-term monthly requests for 10-15,000 goats or 35-40,000 pounds of meat. We need not forget the existence of these markets. However, in the short-term, conditions are not favorable for their development (limited supply) so we must press on in other areas.

Parallel to Ponder*: A neighborhood lemonade stand offers little relief to a convoy of soldiers in mid-July.*

#2. Market price must exceed COST OF PRODUCTION.

We must focus on the cost of production, not market prices.

What is a good price?

A.: It depends. In this discussion, it is assumed good and profitable are synonymous. If so, a good price is an amount greater than the cost of production on an equal unit basis (i.e. $/cwt, ¢/lb, $/head).

B. It differs across operations. Seldom could one find two meat goat operations with an identical cost of production. Therefore, neighbors discussing the market across the fence is a little ambiguous without inclusion of costs of production.

C. It is relative to the current cost of production not historical or projected market data. Most of the costs associated with producing a commercial kid are incurred by its dam: major categories include land, labor, feed and vet/health. Land and labor tend to be fixed costs while feed (including hay and cultivated forage production) and vet/health costs are more variable. The cost of doing business goes up a little each year and with each subsequent kid crop. Characterization of the price received (good or bad) implies consideration of the expense incurred to produce the product marketed.

Parallel to Ponder: *It matters not that gross income from a group of 40 lb kids is $40 per head **IF** it cost $45 per head to produce and market them. Subsequent experiences of similar magnitude will jeopardize long-term enterprise profitability/success.*

#3. The goal for REPRODUCTIVE PERFORMANCE is at least one merchantable unit per exposed female.

Brood does in a meat goat operation are the production units. The costs associated with their production or purchase and their maintenance cost (supplemental feed, hay, vet/health, equipment, facilities, etc.) represent a major portion of the cost incurred in the production of meat goats. Breeding age does generate income to offset these annual costs in one of two ways: 1) through sale of their offspring or, 2) the sale of barren/non-productive females.

The relationship between reproductive performance and the break-even price required to cover production costs is demonstrated in Table 1. Note: The true measure of reproductive performance is

% kid crop = # kids weaned/# does exposed to a buck

NOT # kids weaned/# does present at weaning. An admirable goal for an extensive production system (goats grazing larger native range, brushy or wooded pastures) would be 150% or 1.5 kids weaned for every doe bred. On the other hand, most profitable intensive production systems (does in small pens or paddocks, being fed from a sack or bale) average 175 to 200% kid crops annually.

Table 1. Relationship Between Cost of Production and Reproductive Performance

Doe Cost	Kid Crop Weaned						
$/hd/yr	**70%**	**80%**	**90%**	**100%**	**125%**	**150%**	**200%**
	Breakeven Price, $/lb*						
10	0.32	0.28	0.25	0.22	0.18	0.15	0.11
15	0.48	0.42	0.37	0.33	0.27	0.22	0.17
20	0.63	0.56	0.49	0.44	0.36	0.30	0.22
25	0.79	0.69	0.62	0.56	0.44	0.37	0.28
30	0.95	0.83	0.74	0.67	0.53	0.44	0.3
35	1.11	0.97	0.86	0.78	0.62	0.52	0.39
40	1.27	1.11	0.99	0.89	0.71	0.59	0.44
45	1.43	1.25	1.11	1.00	0.80	0.67	0.50
50	1.59	1.39	1.23	1.11	0.89	0.74	0.56
60	1.90	1.67	1.48	1.33	1.07	0.89	0.67

*Assumed market weight: 45 lb. Does bred to kid once a year.

Parallel to Ponder: *Should one doubt the significance of overlooking reproductive performance in a goat enterprise, take a brief look at the Angora industry in the absence of incentive payments.*

#4. Match GENETIC POTENTIAL FOR GROWTH with productivity of the environment.

Big, stout, fast-growing, thick-muscled, heavy-boned, eye-appealing kids - certainly an admirable goal high on the list of most meat goat producers. Why then, is it last in this prioritized list of four? Because a viable market, low cost of production and efficient reproduction are more critical to the long term success of a meat goat operation than how "good" the kids look.

In the environments where meat goats have a *competitive advantage* (native ranges, brush, etc.) and the *lowest cost of production*, genetic potential for growth is usually not the first limiting factor for growth. Nutrient availability is typically the first limiting factor for growth.

In order to optimize production efficiency, meat goats, especially replacement females, should be selected under the conditions in which they will be expected to produce. Optimum nutritional conditions (ad libitum feeding, generous supplementation or grazing warm/cool season annual forages) favor an animal with later maturity, larger mature size and greater genetic potential for growth than can be supported by the browse, forbs and grasses available in most pastures. Successful beef producers do not select their replacement heifers at the feedlot. Perhaps there is a lesson to be learned therein.

Parallel to Ponder: *The distance a rocket can travel is directly related to the fuel beneath it.*

Summary

The future of the U.S. meat goat industry is exciting. The challenge of supplying high quality goat meat to an ever increasing population that prefers goat over other animal proteins is significant and its magnitude unique. The consumer is patiently waiting at the meat counter with cash in one hand. The challenge - putting goat meat in the other for less than what they are willing to pay.

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Machen, R. 2001. Meat Goat Production – Elements Essential for Long-Term Success. Pages 12-15 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

Caprine Herd Health Program

Herd health programs have to be tailor-made to fit individual herds and will depend on the herd size, purpose for having the herd, and production goals of the owner. For the most part, goats are managed as small groups of five to 50 animals per herd. There are relatively few large commercial goat herds with up to 1,000 head. Purebred sales, showing, 4-H projects, and production of milk and meat for home use are some of the reasons for these small herds.

Large herds have the usual problems associated with high density of animals and continuous turnover. Small herds tend to have a high nonproductive/productive ratio. Small herd owners often keep animals that would normally be culled from commercial herds. Often, the net result is the maintenance of animals with chronic illnesses that may serve as reservoirs of disease.

Management practices contribute significantly to disease problems. Goat husbandry is very labor intensive, and most herds are maintained by people who earn their living away from the farm. Disease problems can often be eliminated with correct management and emphasis on proper sanitation.

I. Kids and Weanlings:

a. Dry off kids immediately after birth and provide warm, dry, clean environment. Kids may be removed from their dams at this time if they are to be bottle reared.

b. Dip the navel and soles of the feet in strong tincture of iodine immediately following birth.

c. Feed two ounces of colostrums within 30-60 minutes of birth (at least 10% of their body weight), and provide colostrums for the next three to four days.

d. Kids should be examined for congenital defects.

e. Disbud kids as soon as buttons can be detected, usually from three days to two weeks of age. Castration could be done at the same time.

f. Treat with coccidiostat when moving kids to new pens, if coccidiosis is a problem in the herd.

g. Where nutritional muscular dystrophy is a common problem, kids should receive an injection of Vitamin E/Selenium at one to two weeks of age and repeat in four weeks.

h. At one month of age, vaccinate twice at a two-week interval with *Clostridium perfringens* C & D toxoid/bacterin. Other vaccines may be started at this time as well.

i. Begin deworming at one month of age and repeat every six weeks. Tapeworms are a problem in kids so deworm them with a product that will work against tapeworms.

j. Separate doe and buck kids before three to four months of age.

II. Does

a. CMT test every doe at freshening, at dry-off, any time you are suspicious of them having mastitis.

b. Feet should be checked and trimmed monthly. Trim feet one month before the breeding season begins.

c. Vaccinate for leptospirosis, vibriosis, and chlamydiosis one month prior to the start of breeding if these diseases are important in your area or herd.

d. Pregnancy test all does between 80-100 days post-breeding by external palpation or ultrasound at 45-60 days.

e. Deworm the doe at dry-off and again one month prior to kidding.

f. Administer booster vaccinations of *Clostridium perfringens* C&D toxoid/bacterin and tetanus toxoid two to four weeks before kidding.

g. Restrict calcium intake during the dry period and be sure does are not over-conditioned upon entering the dry period.

h. Provide plenty of exercise for kidding does.

i. Provide a clean, draft-free area for maternity pen.

III. Bucks

a. Administer vaccine to the bucks at the same time does receive them.

b. Deworm every three months or as fecal exams dictate. The buck should be dewormed one month prior to the breeding season.

c. Periodically check feet and trim as needed with at least one trimming one month prior to the breeding season.

This is the basic outline for herd health programs in the goat herd. Individual herd requirements will dictate modifications of this program. The herd should have periodic fecal examinations and be treated according to findings. Goats going to shows should be quarantined upon their return to the home farm for at least 30 days.

Vaccination Protocol For Goats

A. Entertoxemia

Initially, vaccinate all goats over one month of age in the herd with *Clostridium perfringens* toxin/bacterin types C&D. A second dose of vaccine is given in two or four weeks. Booster vaccinations are given with 8-way Clostridium at three months of age, 5 ml subcutaneous, followed by 2 ml dose in six weeks. Need to booster them at least two weeks before any period of stress or every four months.

Kids that get immune colostrums are vaccinated at three to four weeks of age. Booster injections are given four weeks later and again at six months. If kids do not receive immune colostrums, vaccinate at one week of age. Boosters are required three to four weeks later and at six months.

B. Tetanus

Administer tetanus toxoid to all adult goats, beginning with two doses given two to four weeks apart and continuing with single annual boosters. Tetanus vaccine is usually incorporated with your entertoxemia vaccine.

C. Vibriosis

Vaccinate for vibriosis one month prior to the start of breeding season, if there is a problem.

D. Chlamydiosis

Does should be vaccinated one month prior to the start of breeding season.

E. Leptospirosis

Leptospirosis does not appear to be a significant cause of abortion in goats. If leptospirosis is diagnosed in a herd, vaccination of does one month prior to the start of breeding season is recommended.

F. Contagious Ecthyma

Sore mouth vaccination is only recommended in the face of an outbreak since the vaccine is a virulent live virus and remains on the premises for several years. It may be wise to vaccinate show goats one month prior to showing. Once the premises have been contaminated with vaccine virus or virus from a natural infection, vaccinations will be mandatory for subsequent generations.

Adults are vaccinated when no kids are nursing prior to kidding. Kids are vaccinated only after all does have kidded, preferably after weaning, and at least one month prior to exposing kids to other goats. Immunity appears to last for one to five years; therefore the safest plan is annual vaccination. A minimal vaccination program would include vaccinating only new kids and new acquisitions. Colostral immunity only gives partial immunity and lasts only one to two weeks. Kids are usually vaccinated at the time of castration/dehorning.

Biologicals Available for Goats

Disease	Product	Manufacturer
Entertoxemia	C&D Toxoid C&D Toxoid Vision® CD with spur® Clostridium perfringens Type C&D Toxoid Ultrabac® CD	Anchor Aspen Bayer Colorado Serum Pfizer
Enterotoxemia & Tetanus	Bar-Vac® CD/T Vision® CD/T with spur Fermicon CD/T Clostridium perfringens C&D Tetanus Toxoid Caseaus D-T™	Anchor Bayer Bio-ceutic Colorado Serum Colorado Serum
Enterotoxemia, Malignant Edema, Blackleg & Sorehead	Ultrabac® 7 Ultrabac® 8 Clostridial 7-way Clostridial 8-way Electroid® 7 Vision 7® with spur® Vision 8® with spur® Fermicon 7™	Pfizer Pfizer Agrilabs Agrilabs Schering-Plough Bayer Bayer Bio-ceutic
Entertoxemia, Malignant Edema, Blackleg, Sorehead, and Tetanus	Covexin® 8-way	Schering-Plough
Tetanus Toxoid	Tetnogen® Tetnogen® AT Ovine Tetanus Shield™ Super-Tet with Lavlogen® Tetanus Toxoid Tetanus Toxoid – concentrated Tetanus Toxoid – concentrated Tetanus Toxoid – unconcentrated Tetguard™	Fort Dodge Fort Dodge Grand Bayer Franklin Colorado Serum Professional Biological Colorado Serum Boehringer Ingelheim
Contagious Ecthyma (Soremouth)	Ovine Ecthyma Vaccine Texas A&M University at Sonora	Colorado Serum (915) 387-3168
Campylobacter/Chlamydia	Campylobacter Fetus Bacterin (Ovine) Chlamydia Psittaci Bacterin Enzabort™ (EAE-Vibrio)	Colorado Serum Colorado Serum Colorado Serum
Foot Rot	Footvax® Volar®	Schering-Plough Bayer
Leptospirosis	Leptoferm - 5®	Norden

COVEXIN® 8 VACCINE

Schering-Plough **Bacterin-Toxoid**

Clostridium chauvoei-septicum-haemolyticum-novyi-tetani-perfringens
Types C&D Bacterin-Toxoid
U.S. Vet. Lic. No. 107

Active Ingredient(s):
A formalin-inactivated, alum-precipitated bacterin-toxoid prepared from highly toxigenic cultures and culture filtrates of *Clostridium chauvoei, CL sapticum, Cl haemolyticum* (known elsewhere as *Cl novyi* Type D), *Cl novyi, Cl tetani,* and *Cl perfringens* types C and D. **COVEXIN® 8** is an Electroferm® product produced by an electronically controlled deep culture process.

The specific toxoids and/or cellular antigens required for optimal disease protection are emphasized in the growth of Electroferm® cultures. These cultures are highly concentrated and, when divided for the blending of combination vaccines, make possible the production of the low volume dose. Exacting procedures are employed to ensure that each dose of combination vaccine contains an appropriate amount of each component.

All components of each serial of the final product are tested for potency using USDA accepted laboratory and/or host animal tests.

Indications:
For the active immunization of healthy sheep against diseases caused by *Clostridium chauvoei, Cl septicum, Cl haemolyticum* (known elsewhere as *Cl novyi* type D), *Cl novyi, Cl tetani,* and *Cl perfringens* types C and D.

Although *Cl perfringens* type B is not a significant problem in the U.S.A., immunity may be provided against the beta and epsilon toxins elaborated by *Cl perfringens* type B. The immunity is derived from the combination of type C (beta) and type D (epsilon) fractions.

Dosage and Administration:
Shake well. Using aseptic technique, inject 5 mL subcutaneous followed by a 2 mL dose in six (6) weeks. Revaccinate annually with 2 mL prior to periods of extreme risk, or parturition. For *Cl novyi* and *Cl haemolyticum*, revaccinate every five (5) to six (6) months. Vaccination should be scheduled so that pregnant ewes receive their second vaccination or annual booster two (2) to six (6) weeks before lambing commences in the flock. Lambs should be given their primary course beginning at 10 to 12 weeks of age.

Precaution(s):
Store at 35°-45°F (2°-7°C). Protect from freezing.

This product has been tested under laboratory conditions and has met all federal standards for safety and ability to immunize normal healthy animals. The level of performance may be affected by conditions of use such as stress, weather, nutrition, disease, parasitism, other treatments, individual idiosyncrasies, or impaired immunological competency. These factors should be considered by the user when evaluating product performance or freedom from reactions.

Caution(s):
Use the entire contents when first opened. Anaphylactic reactions may occur following use.

Antidote(s):
Epinephrine

Warning(s):
Do not vaccinate within 21 days before slaughter.

Discussion:
The protective value of all components of **COVEXIN® 8** has been demonstrated through the most critical test procedures available. Vaccinated sheep withstood the challenge of massive doses of virulent live spores of *Cl chauvoei, Cl septicum, Cl tetani, Cl novyi* types B and D. *Cl perfringens* types C and D, for which no host animal direct-challenge test exists, were evaluated by measuring the amount of antitoxin produced by cattle, sheep, and laboratory animals.

Presentation:
50 mL and 250 mL vials.

Planning Calendar for Dairy Goats Herd Health			
Date	**Stage**	**Suggested Health Practice**	**Additional Practices**
	Pre-breeding (30-60 days before breeding)	**Bucks & Does:** Vaccinate for Chlamydia and Campylobacter if necessary. Breeding Soundness Evaluation performed.	Every month, all animals: trim feet, check for lice
	Pre-breeding (15-30 days before breeding)	**Bucks:** Be aware of heat stress. **Bucks & Does:** 2nd vaccination for Chlamydia and Campylobacter, booster vaccination for enterotoxemia and tetanus. Deworm both bucks and does.	Campylobacter and Chlamydia vaccination if necessary.
	Breeding (30-60 days)	Check for pregnancy 45-60 days after breeding with ultrasound.	
	Pre-kidding (45 days before kidding)	**Does:** Begin lead feeding - amount determined by condition, anticipated number of offspring, quality of diet.	Make sure cats are not defacating in feed to prevent toxoplasmosis.
	Pre-kidding (15-30 days before kidding)	**Does:** Booster vaccination for enterotoxemia and tetanus, and deworm (Clost CD&T). **Watch for pregnancy toxemia.**	
	Kidding	**Does:** Observe 3-5 times per day. Assist if needed. Check milk and udder, monitor temperature and uterine discharge, save and heat treat extra colostrums for later 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. **Kids:** Make sure kids are clean and dry, check for abnormalities, feed heat-treated colostrums (2-3 ounces) within one half hour after birth, dip navels with 7% iodine. Feed kids 10% of body with pasteurized colostrums. Raise kids on milk replacer or if on cow milk, supplement with iron dextran.	
	Nursing	**Does:** Those producing milk for human consumption should not have kids nurse. **Kids:** Feed kids 1 pint milk 3x/day on a routine schedule for 10-12 weeks, all feeding equipment must be cleaned after each feeding. Vaccinate kids for enterotoxemia and tetanus at four, eight, and 12 weeks of age; use appropriate coccidiosis prevention – either feed continuously or treat monthly.	

Planning Calendar for Dairy Goats Herd Health			
Date	**Stage**	**Suggested Health Practice**	**Additional Practices**
	Lactation	**Does:** Milk does on a routine 2x/day schedule, check milk each milking for abnormalities, use good milking practices, CMT weekly, teat dip every teat after every milking; milking machines should be checked frequently, pressures and vacuum should be monitored and tested at least every six months.	
	Weaning	**Kids:** At 10-12 weeks of age and once kids are drinking water and consuming large volumes of hay and grain, drop from three feedings per day to 2 feedings for three to four days; if kids maintain body weight and rate of gain, drop to one feeding milk per day for three to four days; if kids maintain body weight and rate of gain, stop feeding milk.	May want to use coccidiostat in creep feed and post weaning feed.
	Post-weaning	**Kids:** Check fecal samples for coccidian and internal parasites, monitor hair coat for lice; feed adequate diet to reach 70 lbs breeding size by fall; trim feet monthly.	
	Drying Does	At the last milking, infuse each teat with an approved "dry cow" treatment. Remove the dry goat from the milking pen. Apply teat dip 2x/day and monitor udder health and tension. Abrupt cessation of milking decreases and the incidence of mastitis and decreases trauma to the udder.	

- **Deworming may be required as often as every three weeks – VERY EXPENSIVE!!**
- **Pasture rotation and stocking rate can reduce deworming requirements to about 4x/year.**
- **Fecal worm egg counts can help keep cost down.**

Planning Calendar for Meat Goats Herd Health			
Date	**Stage**	**Suggested Health Practice**	**Additional Practices**
	Pre-breeding (30-60 days)	**Bucks:** Be aware of heat stress. Breed Soundness Evaluation done. **Does:** Vaccinate does. Campylobacter, Chlamydia, Lepto if a problem. May want to flush with good pasture or grain. Vaccinate with Clost CD&T and deworm at least two weeks before breeding	
	Breeding (30-60 days)	**Bucks:** Additional feed. Be aware of heat stress. **Does:** Observe for heat or use marking harness on bucks. Check for pregnancy at 45-60 days with ultrasound.	Make sure cats are not defecating in feed to prevent toxoplamosis.
	Pre-kidding (15-30 days)	**Does:** Booster *Clostridium perfringens* type C&D, plus Tetanus Toxoid and deworm. **Watch for pregnancy toxemia.**	
	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. Castrate males before three weeks of age. Start feeding by three weeks of age if you plan to creep.	
	Weaning	Wean at three to five months or when marketed as young kids. Checking for internal parasites. Deworm if needed. Vaccinate – *Clostridium perfringens* type C&D and Tetanus.	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. Revaccinate at two to four weeks after first injection. Reduce feed to does just before weaning. May want to reduce water availability for a day or two after weaning.	

- **Deworming may be required as often as every three weeks – VERY EXPENSIVE!!**
- **Pasture rotation and stocking rate can reduce deworming requirements to about 4x/year.**
- **Fecal worm egg counts can help keep cost down.**

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DHI OVERVIEW AND TESTER TESTING

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1. What is DHIA All About Anyway?

Dairy Herd Improvement Association (DHIA) is in the business of collecting and processing data into information for management decisions. The primary function is to record essential data on the dairy and to organize the data into reports used for management of the dairy operation. Another important function is to assemble DHIA records into a national database that is used for genetic evaluation, breed improvement programs, sire selection and testing, research, and education.

To serve the information needs of our members, it is the responsibility of DHI Associations to collect, process, and deliver high quality data that is comparable nationwide. In January 1997, DHI embarked on a new approach to ensuring comparability of DHIA records with:

- A code of Ethics
- Uniform Data Collection Procedures
- Herd Testing Profiles
- Record Standards Variables

Each component plays an important role in determining if each record is appropriate for its intended use.

The new system assures quality records that serve our producer members' needs by:

- Enhancing quality and comparability of DHI data
- Increasing responsiveness to new management practices and on-farm technology
- Keeping data collection and processing fees low
- Improving potential to expand DHI service

2. Are Does On DHI Testing Better Than Does Not Tested?

Does on DHI testing are not necessarily better than non tested animals. However, the amount of milk and it's components that a tested animal gives is a matter of record. When a producer buys a tested animal that producer can be assured that he or she is buying an animal that is capable of producing the amount of milk, fat, and protein that is indicated by the doe page. A producer that buys an untested animal only has the word of the owner on how much milk is produced and likely no idea how much fat and protein the doe produces.

3. DHI Testing with Langston and Texas

Herd Form - DMS213

Herd Identification

Herd Code Number		
ST.	CO.	Herd No.
73	425	024

SA: NONE

Type of Test: NONE

Name And Address

E (KIKA) DE LA GARZA

PO BOX 730

RESEARCH FARM/DHI LAB

4054663160
Telephone Number

LANGSTON OK 73050
St. 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 Milking	:	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

Supervisors Barn Sheet: Form DMS201

E (KIKA) DE LA GARZA
LANGSTON UNIVERSITY
PO BOX 730
LANGSTON

Herd Code	Last Test	Date of Test
73425024	11/5/98	

Str. Num	Old Status: Code / Bird	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	No. Br.	Breed Date or Heat Date Mo	Breed Date or Heat Date Day	BIRTH	Kid Identity or Sire: Kid: Tattoo, Tag, or Other / Sire:Reg. No., or Sire Name	ID Code	ID Number	Old Repro Status: # Bn. / Code	Old Repro Status: Last Bred / Breed Date or Heat Date
	D	1/7/99	7.2				362																	0	
0	A	180884425					362																	F	8/13/97
	D	1/7/99	20.5				376																	0	
0	A	180884428					376																	F	8/18/98
	D	12/1/98	2.7				391																	0	
0	A	180884408					391																	F	8/18/98
	D	12/1/98	1.5				395																	0	
0	A	180884412					395																	F	8/28/98
	I	3/25/98	1.8				397																	0	
0	A	180884414					397																	F	8/22/98
	D	1/7/99	7.3				408																	0	
0	A	180918199					408																	F	9/1/98
	D	1/7/99	3.3				411																	0	
0	A	180920982					411																	F	8/26/98
	D	1/7/99	8.9				414																	0	
0	A	180918205					414																	F	12/3/97
	D	1/7/99	2.5				416																	0	
0	A	AA0918207					416																	F	8/14/98
	D	1/7/99	2.7				427																	0	
0	A	180918216					427																	F	8/22/98
	D	1/7/99	5.3				429																	0	
0	A	180918218					429																	F	8/22/98
	D	12/1/98	8.2				454																	0	
0	A	180918241					454																	F	12/7/97
	D	1/7/99	1.3				455																	0	
0	A	180918242					455																	F	8/27/98
	D	1/7/99	11.8				457																	0	
0	A	180948519					457																	F	12/19/97
	D	12/1/98	5.5				471																	0	
0	A	180948614					471																	F	8/13/97
	D	1/7/99	3				486																	0	
0	A	180948636					486																	F	8/12/98
	D	1/7/99	8.6				503																	0	
0	A	180948673					503																	F	8/25/98
	D	1/7/99	7.7				508																	0	
0	A	180094678					508																	F	11/28/97
	D	12/1/98	6.8				514																	0	
0	A	180948689					514																	F	12/2/97
	D	12/1/98	3.7				516																	0	
0	A	180989161					516																	F	8/7/97

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; B: 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

Monthly Report: FORM DMS210

LANGSTON UNIVERSITY
PO BOX 730
RESEARCH FARM/DHI LAB
LANGSTON

Herd Code: 73425024_____ Test Date: 11/5/98

BREED	Sire ID / REGISTRATION OR BARTAG NO.	STRING/ PEN NUM.	INDEX NUMBER / Barn Name	LCT NO / Age	Status / Date	Code	CAR / DAYS IN MILK	SOMATIC CELL COUNT SCORE, MILK WEIGHTS, %PROTEIN, AND %FAT BY TEST DAY: TEST DAY	8/13 SCCS	8/13 MILK	9/17 SCCS	9/17 MILK	3/18 SCCS	3/18 MILK	4/21 SCCS	4/21 MILK	5/26 SCCS	5/26 MILK	6/30 SCCS	6/30 MILK	7/24 SCCS	7/24 MILK	8/24 SCCS	8/24 MILK	9/29 SCCS	9/29 MILK	11/5/98 SCCS	11/5/98 %PROT	11/5/98 %FAT	LACTATION TO DATE: MILK POUNDS	%PROT	PROTEIN: Fat	ME: Fat	ME: Milk	Breeding Information: RBPRO	SERVICE SIRE IDENTIFICATION: # Serv	BREEDING DATE	HEAT OR DUE DATE	NO DAYS DRY	NO DAYS OPEN	BODY WT / SCORE
	180760205		362	5					0	5.65																							F				0	
A	180884425	0	362	80	1/7/99	D	663		6.7	7.2																Dry			0		0	1339	0		8/13/97	603	140
	180760205		376	5											5	5	5	4	5	6	5									3.1	80	83	F				0	
A	180884428	0	376	80	1/7/99	D	293								7.4	6.7	4.7	3.9	3.8	4.0	Dry								2569 *	3.2	83 *	2586	0		8/18/98	233	
	180776823		391	4											5	5	5	5	5	4										3.0	29	33	F				0	
A	180884408	0	391	79	12/1/98	D	256								4.2	5.2	4.9	3.7	3.4	3.6	Dry								982	3.2	31	1039	0		8/18/98	233	
	180643086		395	4					0						3	6	6	5	6	4										2.9	28	34	F				0	
A	180884412	0	395	79	12/1/98	D	246		3.5						7.6	7.9	4.4	3.5	1.5	2.0	Dry								970	3.3	32	998	0		8/28/98	223	
	776823		397	5					0	6.13					2	3	5	5	5	5	7	3.7								2.4	33	51	F				0	
A	180884414	0	397	79	3/25/98	I	226		5.2	7	Dry				9.3	8.4	7.2	3.6	4.9	5.0	1.8	2.8							1379 +	2.8	39	1589	0		8/22/98	229	
	776823		408	5					0								3	4	4	3	5									2.5	60	80	F				0	
A	180918199	0	408	68	1/7/99	D	279		7.1						11.1	10.2	9.4	7.7	9.2	8.8	Dry								2376 *	3.3	79 *	2406	0		9/1/98	219	
	180716994		411	4					0	5.17					6	5	4	6	6	6										2.9	55	50	F				0	
A	180920982	0	411	68	1/7/99	D	285		6.8	8.9					8.6	10.7	10.3	7.1	7.2	6.1	Dry								1905 *	2.6	50 +	1873	0		8/26/98	225	
	180776823		414	3					0	4.91																						5	F				0	
A	180918205	0	414	68	1/7/99	D	551		10.7	8.9											Dry								0		0	726	0		12/3/97	491	
	AA0643086		416	6					0						3	5	4	4	3											2.8	44	45	F				0	
A	AA0918207	0	416	68	1/7/99	D	297		3.3		T.F.				8.8	9.9	5.8	4.9	4.9	3.9	Dry								1581 *	3.0	47 +	1521	0		8/14/98	237	
	180643086		427	4					0						4	4	5	5	4											2.7	36	45	F				0	
A	180918216	0	427	68	1/7/99	D	289		3.2						7.6	7.6	5.9	4.2	4.0	3.4	Dry								1329 +	3.5	46 +	1299	0		8/22/98	229	
	180643086		429	3											3	4	4	3	3	3										2.6	52	67	F				0	
A	180918218	0	429	68	1/7/99	D	289								8.5	9.2	10.4	6.1	7.0	6.8	Dry								2020 *	3.4	68 *	1986	0		8/22/98	229	
	180900735		454	3					0	4.92																						5	F				0	
A	180918241	0	454	66	12/1/98	D	510		8.3	8.2											Dry								0		0	551	0		12/7/97	487	
	180900735		455	4					0	4.94					4	5	5	4	5	5										3.1	29	26	F				0	
A	180918242	0	455	66	1/7/99	D	284		4.5	4.8					5.7	4.7	4.8	2.5	4.8	2.3	Dry								926	2.9	27	907	0		8/27/98	224	
	180760195		457	2					0	4.77																						4	F				0	
A	180948519	0	457	58	1/7/99	D	535		8.1	11.8											Dry								0		0	508	0		12/19/97	475	
	180760195		471	3					0	5.26																						0	F				0	
A	180948614	0	471	57	12/1/98	D	626		5.4	5.5											Dry								0		0	1023	0		8/13/97	603	90
	180760195		486	5					0								2	3	3	4										3.1	46	54	F				0	
A	180948636	0	486	56	1/7/99	D	299		5.1		T.F.				8.1	6.7	7.4	4.2	3.7	4.5	Dry								1495 +	3.7	56 *	1434	0		8/12/98	239	
	180760195		503	3					0	4.35							4	5	5	2	3									2.9	86	113	F				0	
A	180948673	0	503	56	1/7/99	D	286		6.7	6.7					11.7	14.6	10.4	12.8	12.9	8.7	Dry								2998 *	3.8	115 *	2983	0		8/25/98	226	
	180760195		508	2					0	3.18																						4	F				0	
A	180094678	0	508	56	1/7/99	D	556		8.6	7.7											Dry								0		0	633	0		11/28/97	496	

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
B: Estimated
F: Sup. Est. Fat
H:In Heat
I: Injected
L: Lab Est. Fat
M: Milked 3X
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

Production Summary: FORM DMS202

73425024
11/5/98

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Kidding/Milking Profile

	Milking, Dry, and Kidding (Monthly)					
Month	Dec	Jan	Feb	March	April	May
Milking	70	70	70	70	70	70
Dry	15	15	15	15	15	15
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	----	----	----	----	----	96.7	96.7	96.7	0
2nd Lact	19	219.2	0	0	19	100	100	100	0
3rd+ Lacts	24	214.8	0	0	24	100	100	100	3.6
All Lacts	43	216.7	0	0	43	98.8	98.8	98.8	1.2

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	26	26	223	6.0	1584	57	35	13	1	3	6	1
2nd Lact	23	50	283	7.1	1825	51	47	10	5	1	2	2
3rd+ Lacts	23	92	228	9.2	2356	59	50	2	4	5	6	2
All Lacts	72	53	244	7.3	1924	55	44	40	16	14	22	8

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
1/25/97	-----	111	316	0.0	9.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
2/26/97	32	113	20	0.0	7.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
3/26/97	28	139	19	0.0	57.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
4/23/97	28	140	45	0.0	57.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
7/13/97	81	142	119	0.0	63.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
8/13/97	31	139	133	5.0	54.7	2.8	3.0	3.0	947	18	20	25.0	0.0	1.0	1.0	3.0	1.7
9/17/97	35	134	126	7.1	17.9	1.3	2.9	2.9	993	16	18	17.0	0.0	2.0	2.0	3.0	0.9
3/18/98	182	70	170	6.1	80.0	1.0	3.1	3.4	1066	15	17	46.0	18.0	9.0	18.0	9.0	3.6
4/21/98	34	89	53	6.1	98.9	5.4	3.7	3.1	1075	10	11	54.0	13.0	15.0	14.0	4.0	2.9
5/26/98	35	86	88	6.7	97.7	5.8	2.6	2.8	1141	12	12	25.0	26.0	28.0	13.0	8.0	4.0
6/30/98	35	85	118	6.1	91.8	5.1	2.8	2.6	1205	13	13	6.0	28.0	39.0	13.0	14.0	4.6
7/24/98	24	85	142	4.9	90.6	4.0	2.7	2.6	1120	15	14	16.0	37.0	27.0	10.0	10.0	4.2
8/24/98	31	85	173	5.5	90.6	4.5	3.5	2.7	928	19	18	34.0	23.0	20.0	14.0	9.0	3.6
9/29/98	36	85	207	3.9	82.4	2.9	3.1	2.9	956	23	22	44.0	13.0	21.0	14.0	8.0	3.0
11/5/98	37	85	244	3.7	82.4	2.7	3.4	3.5	1042	26	25	40.0	16.0	14.0	22.0	8.0	3.2

	Milk Time	Spl
1st	3:00:00 PM	
2nd	6:00:00 AM	
3rd	12:00:59 AM	
4th	12:00:59 AM	

Test Day Production Summary

	TD Avg	RHA Avg
Total Does	85	86
GIM #	70	79
GIM %	82.4	92
Milk # (All)	2.7	1042
Fat # (All)	0.1	26
Pro # (All)	0.1	25
Milk # (GIM)	3.7	-----
Fat % (GIM)	2.5	-----
Pro % (GIM)	2.4	-----

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

# In Breeding Herd	73
Vol Wait Period (VWP)	210
Avg Days 1st Service	.0

Breeding Profile

	Open Does			Bred Does			
	VWP - 250	> 250	Diag Open	< VWP	VWP - 250	251 - 280	> 280
# Goats	64	9	0	0	0	0	0
% B. Herd	87.7	12.3	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	26	26
2nd Lact	0	0.0	----	0	0	23	23
3rd+ Lacts	0	0.0	----	0	0	23	23
All Lacts	0	0.0	----	0	0	72	72

Lactation Profile

		Stage of Lactation (Days)				
		1 - 40	41 - 100	101 - 199	200 - 305	306 +
Number of Animals	1st Lact	0	0	0	24	0
	2nd Lact	0	0	0	17	3
	3rd+ Lacts	0	0	0	19	0
% of Milking Herd	1st Lact	0.0	0.0	0.0	28.2	0.0
	2nd Lact	0.0	0.0	0.0	20.0	3.5
	3rd+ Lacts	0.0	0.0	0.0	22.4	0.0
Avg Daily Milk	1st Lact	0.0	0.0	0.0	3.0	0.0
	2nd Lact	0.0	0.0	0.0	3.5	3.8
	3rd+ Lacts	0.0	0.0	0.0	4.7	0.0
Avg Daily SCC	1st Lact	0.0	0.0	0.0	2.7	0.0
	2nd Lact	0.0	0.0	0.0	3.1	0.5
	3rd+ Lacts	0.0	0.0	0.0	4.5	0.0

Reproduction Profile

	D O @ 1st Serv			Avg 1st Serv	Serv / Preg		Proj Min		Total Services Per Goat	Total Services
	< VWP	VWP - 250	> 250		Preg Does	All Does	Kidding Int	Days Open		
1st Lact	0	0	0	0	1	1	14.5	290		
2nd Lact	0	0	0	0	1	1	18.6	416		
3rd+ Lacts	0	0	0	0	1	1	19.1	430		
All Lacts	0	0	0	0	1	1	17.2	372		

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	69	97	0	0	14	0	0	0	3	0	0	55
2nd Lact	16	22	0	0	16	0	0	0	1	0	0	0
3rd+ Lacts	49	69	0	0	103	0	0	0	5	0	0	0
All Lacts	134	188	0	0	133	0	0	0	9	0	0	55

Doe Page

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Dam Information

Index:
Dam ID: 180813301
Name: 1
Breed: A
PTA Milk:
PTA BFat:
PTA Protein:

Sire Information

Sire ID: 776823
Name: -
Breed: A

Index No.: 397
Name: 397
Registration: 180884414
Breed: A
Date of Birth: 4/17/92
PTA Milk: 0
PTA BFat: 0
PTA Protein: 0

Kidding Date	Lactation Num.
3/25/98	5

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	11/5/98	1.8	2.8	226	1379	39	33	1414	48	41	1589	51	41

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
3/13/97	60	9/3/97	4	907	0.4	4	0.3	3	175	907	4	3	3.8	1724	26	17
4/7/96	48	8/11/96	3	764	2.5	19	2.5	19	126	764	19	19	7.3	1301	37	32
2/16/95	35	2/12/96	2	1734	2.5	44	2.8	49	361	1974	52	59	4.5	1734	44	49
2/11/94	22	9/20/94	1	1260	3.6	45	2.9	37	221	1260	45	37	6.9	1900	75	56
				1166	2.3	28	2.1	27	221	1226	30	30	5.6	1665	46	39

Lifetime Milk
6284

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
5	3/25/98	204				831		832		-	
4	3/13/97	214	0		-						
3	4/7/96	55	0		Unknown						
2	2/16/95	149	0		Unknown	GIGR-H541					
1	2/11/94	0	0		Unknown						

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
	1.6	2.5	2.6	2.3	4.8	2.1	4.6	1.9	4.6	2.1	5.1	2.8	6.6	3.7										
5	9.3	3.0	8.4	2.7	7.2	2.2	3.6	2.5	4.9	3.7	5.0	3.1	1.8	2.8										
	4.2	3.2	3.3	2.9	0.0	2.9	0.0	2.5	6.1	2.8														
4	12.8	1.5	10.9	2.1	8.0	2.1	5.2	3.5	7.0	2.6														
	5.9	2.4	5.5	2.3	8.5	2.6																		
3	8.0	2.1	5.4	3.0	3.7	3.5																		
	4.3	2.5	3.1	2.7	0.0	2.5	5.2	2.5	3.8	2.4	4.6	2.4	5.3	3.5	3.7	3.7	4.0	3.8	8.6	3.6	7.1	3.6		
2	9.1	1.4	7.4	1.5	7.8	2.2	5.8	3.1	4.8	2.8	4.3	2.8	3.5	4.1	3.8	3.6	4.6	3.2	4.7	3.4	4.3	3.4		
	0.0	3.7	7.2	2.6	6.9	2.5	7.4	2.7	6.2	2.8														
1	8.0	3.9	6.0	4.8	6.0	3.7	5.0	2.9	5.0	2.0														

Kid Identity Listing

Herd Code	Date of Test
73425024	11/5/98

LANGSTON UNIVERSITY
E (KIKA) DE LA GARZA
PO BOX 730
LANGSTON OK 73050

Kids Born Since	Date Printed
2/8/95	10/15/99

Kids Identity				BREED	Sire Identity			Dam Identity				Kid's Birth Date	Kid's Estimated Transmitting Ability			Vacination, Breeding Code, Other Info
Kid Number	SEX	Kid Name	Registration or Eartag Number		Registration or Eartag Number	Br	Code Number or Code Name	Registration or Eartag Number	Br	Code Number or Code Name	Index Number		Milk	Fat	Pro.	
837	K	837	None	A	180989176	A		181028037	A			3/25/98	0	0	0	
838	K	838	None	A	180989178	A		180989180	A			3/25/98	0	0	0	
839	K	839	None	A	180989176	A		181062458	A			3/26/98	0	0	0	
840	K	840	None	A	180989184	A		180918226	A			3/26/98	0	0	0	
841	K	841	None	A	180989176	A		181062456	A			3/27/98	0	0	0	
843	K	843	None	A	180989178	A		180989172	A			3/28/98	0	0	0	
845	K	845	None	A	181029965	A		180920982	A			3/29/98	0	0	0	
847	K	847	None	A	181029965	A		181062410	A			3/31/98	0	0	0	
848	K	848	None	A	180989184	A		180884412	A			3/31/98	0	0	0	
851	K	851	None	A	180989178	A		180918199	A			4/4/98	0	0	0	
852	K	852	None	A	181029965	A		181062435	A			4/4/98	0	0	0	
853	K	853	None	A	180989184	A		181028022	A			4/6/98	0	0	0	
854	K	854	None	A	180989184	A		181062434	A			4/7/98	0	0	0	
856	K	856	None	A	180989178	A		181062449	A			4/12/98	0	0	0	
857	K	857	None	A	181029965	A		181062436	A			4/17/98	0	0	0	

Codes: D = Died, S = Sold, R = Registration Paper

4. Becoming a Testing Supervisor

A. National DHIA Code of Ethics

Effective January 1, 1997

I. Purpose. This Code of Ethics is for use by DHIA members and dairy industry representatives as an aid in determining appropriate conduct for the production, collection, and distribution of DHIA information.

II. Unethical Practices.

A. Impairing the reliability of DHIA information.

B. Not cooperating fully, or interfering, in the collection of farm information as directed by uniform data collection procedures.

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.

E. 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.

F. Permitting the collection of supervised data by a technician with a financial or family interest.

G. Any fraudulent or unethical practice as may be defined by the Board of Directors.

H. Incomplete release of production data resulting in the misrepresentation of DHIA information.

III. Remedy

Any person, corporation, or other entity, who violates 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 which will increase dairy farmers' net profit.

These basic and minimum standards are to be uniformly followed throughout the service area of National DHIA. They serve to ensure that National Dairy Herd Improvement Association (National 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 will be evaluated annually under the National DHIA Quality Certification Program to maintain and verify compliance with these standards. To be eligible to participate in this dairy record keeping program, a dairy farmer must be a member of a DHIA Service Affiliate. Special conditions affecting member eligibility and participation by others will be the responsibility of the DHIA Service Affiliate. 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. DHIA organizations at all levels and DHIA technicians and herd owners as well as persons in their employ, are individually and collectively responsible for the adherence to the procedures set forth.

Authority

These uniform data collection procedures have been developed and adopted under the direction of National DHIA. A Memorandum of Understanding with National DHIA, Agricultural Research Service of the United States Department of Agriculture (USDA), National Association of Animal Breeders (NAAB), and the Purebred Dairy Cattle Association (PDCA) exists to ensure the flow of DHIA records for industry purposes, including genetic evaluation programs.

Responsibility

DHIA Service Affiliates are responsible to uphold the uniform data collection procedures and standards defined by National DHIA.

DHIA producer-members sign an agreement to conform with these procedures and the associated Code of Ethics. A breach of the Code of Ethics may result in independent legal action by the injured party.

Definitions

Dairy Cow 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 Defined according to the following principles that are generally appropriate for herds enrolled in National DHIA record plans:

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

B. On farms with two or more distinct breeds, either a composite herd average or separate herd averages may be calculated and reported.

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

C. A single member may operate separate units under separate management systems, with no movement of cows between management units.

D. Two groups of cows may be housed as a single entity, but under different ownership with different 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.

E. On farms with two or more distinct breeds, it is acceptable to enroll one breed on test and not the other(s).

Application for herd codes that differ from the principles in A and B will be evaluated by the DHIA Service Affiliate which should encourage participation in the DHIA System for the mutual benefit of the dairy farmer and allied industry. The decision of the DHIA Service Affiliate regarding the assignment of separate herd codes shall be final.

Test Defined within the long tradition of DHIA to be the entire process of information collection at the farm. This may include some or all of the following: weighing and sampling and/or analyzing of milk during the milking process, weighing of milk only, or electronic collection of milk weights with periodic component analysis sampling. Since the actual component testing does not generally occur at the farm, this procedure should be labeled as the laboratory test or component test.

DHIA Technician/Supervisor
These equivalent terms define the person approved by the DHIA Service Affiliate to certify the production information collected at the farm.

DHIA Service Affiliate
Defined as the organization authorized by National DHIA, through Quality Certification and appropriate memoranda, to conduct DHI service. Responsibilities assigned to the DHIA Service Affiliate board of directors by these procedures may be carried out by

their designated representative.

Dairy Records Processing Center (DRPC)
Defined as the organization approved by National DHIA which contracts with, or is owned by, a DHIA Affiliate for the purpose of electronically processing DHIA records. A DRPC must comply with approved procedures and rules for records calculations. A Dairy Management System (DMS) shall be considered as a DRPC for the purpose of these procedures.

Laboratory Defined as the facility approved by National DHIA, through Quality Certification, to analyze DHIA component samples.

Meter Center Defined as the facility approved by National DHIA, through Quality Certification, to calibrate approved weighing devices.

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. Provision must also be made for collecting a sample which is representative of the milk yield of the cow at any one milking. All weighing and sampling devices must at all times be used strictly according to the manufacturer's written instructions.

A. Supervised Tests. The DHIA technician is expected to collect data as accurately as possible. All production data and animal identification will be collected in the presence of the DHIA technician. Facilities or milking processes which do not permit a single DHIA technician to handle such observation will require the addition of other DHIA technicians as necessary.

The technician should secure samples by following approved procedures outlined in the National DHIA Quality Certification Manual.

Test day data may be electronically transferred to the DRPC by the DHIA technician who has prior authorization from the DHIA Affiliate. A secure procedure will be used during the transfer of data which certifies that all uniform procedures have been followed.

B. Unsupervised Tests. The DHIA member will assume the responsibility for accurate data collection in accordance with these uniform procedures.

2. Standard Equipment and Methods

A. DHIA Service Affiliates. All equipment, owned, leased or used by DHIA Service Affiliates, and not owned by a DHIA producer-member, will be checked annually by a DHIA QC-approved meter center or a qualified manufacturers representative, using procedures specified in "The Periodic Inspection, Repair, and Recalibration of Devices Used in DHI Testing." A durable label shall be affixed to each device stating the date of certification and the DHIA Affiliate responsible. Any equipment out of tolerance must be removed from DHIA service and repaired before further use. The DHIA Service Affiliate (or member in unsupervised plans) will report the calibration status of the metering devices. This status will accompany the DHIA record used by USDA-AIPL for genetic evaluations.

B. Producer-Owned Equipment. To ensure the highest quality data, it is strongly recommended that DHIA producers owning their own equipment follow the same guidelines as DHIA Service Affiliates. These guidelines must be followed for records to be coded as using QC-certified weighing devices. In the event a producer-member chooses not to follow the guidelines outlined for certified meters, the DHIA Service Affiliate may provide service, and the records are to be coded as using uncertified meters (see 2.A.). The DHIA Service Affiliate (or member in unsupervised plans) is responsible for ensuring proper coding.

C. Tolerances and Devices. The tolerances allowed for the approval of the design of milk weighing, measuring, and sampling devices used in DHI testing plans are outlined in National DHIA procedures. These devices shall be conspicuously labeled as approved for use in DHIA. Instructions for operation and any limitations of such equipment as approved shall accompany each device. A current list of approved devices is available from National DHIA. Milk fat, protein, and other component determinations are made using National DHIA-approved procedures and equipment. Solids-not-fat (SNF) may be determined directly or through calculation based on individual components determined by approved procedures.

3. Recording Programs

DHIA offers numerous recording programs. Four commonly found programs are described.

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. The beginning and ending times for each milking shall be recorded.

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 tolerances. For these types of data collection protocols, at least one part of the milking system may or may not be equipped with a DHIA-approved milking interval recorder which provides an authentic record of the milking intervals. On test day, the DHIA technician will

determine and record the reference time at the beginning and ending of the sampled milking and the previous milking. To be acceptable for this purpose, an approved monitoring device must display or print the starting and ending times of the sampled milking and the previous milking. Monitored times are to be within 15 minutes of actual times. At the end of the sampled milking, the starting and ending times of the sampled milking and of the previous milking shall be recorded for the DRPC to use in determining the milking interval. In cases where strings or groups of cows are milked in a different order at the PM milking as compared to the AM milking, a herd may be enrolled on one of the APT or APCS plans only if the monitoring device can record milking times by string, and the DRPC can process strings or groups with different milking intervals. The same policy also applies to herds milked in strings or groups with breaks longer than 15 minutes between strings.

C. DHI-APCS-Supervised. The DHIA technician weighs the milk from each milking during a single 24-hour period. Collect samples for component testing at ONLY one milking. 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. Beginning and ending times of all milkings will be recorded to determine the milking interval for computing component credits.

D. DHI-MO and DHI-MO-AP-Supervised. The technician weighs the milk ONLY 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. Other recording programs are available through DHIA Affiliates. The off-farm use of data from these programs will be determined by the users of the records.

4. Test Interval

The test interval (number of days from the previous test day through the current test day) is divided into two equal portions. Poduction credits for the first half of the test interval are calculated from the previous 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.

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. These cows must be verified dry each test day by the DHIA technician. A certificate which identifies the cow and is signed by both the herd owner and the person performing the embryo transfer work must be filed with the DHIA Affiliate. Dry Donor Dams which 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 national uniform series eartag, VIP certificate, grade identification, or registration certificate. 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 to 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, or a cow must be identified electronically by an electronic identification system. 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 (both supervised and unsupervised collection) 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 refers to one or any combination of the following data fields: cow ID number, cow birth date, 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 three shipments immediately prior to date of test) indicating the number of milkings (or days) included in each shipment. 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 - Dry Cows - Cows Leaving the Herd

A cow fresh six or more days will have her milk weighed (and if applicable) sampled beginning

the evening milking of the sixth day after calving (morning of the seventh day for AP records), counting the day of calving as the first day. The record begins on the calving date. 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. The calendar day the cow leaves the herd counts as the last day in the herd, with production being credited for that day. Any lactating cow purchased will start receiving production credits in the new herd, one calendar day following the last day of credits.

9. Sickness or Injury

In case of severe sickness, injury or a cow in heat on test day, production will be considered abnormal. If such conditions are reported on the barn sheets at the time of milking, and the percentage decrease in total daily pounds of milk from the previous test day (from the succeeding test day if the first test day of lactation is involved) exceeds the percentage obtained with the following formula: Percentage = 27.4 plus 0.4 × days in the first test interval. As an example, for a 28-day test interval: Percentage = 27.4 + (0.4 × 28) = 27.4 + 11.2 = 38.6%, the milk weight will be considered abnormal and computations will be done only by the DRPC. Actual test day data will be reported even though the milk weights are coded abnormal. This does not apply to milk weights routinely adjusted at the beginning or end of lactation.

10. Cows Aborting, Calving Prematurely, Calving Without Going Dry, Prepartum Milking

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

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.

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.

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

11. 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 (see 13.I.).

12. Missing Milk Weights and(or) Samples

When complete milk weights or samples are not obtained 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.

(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.

13. 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 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 herds are normally milked on intervals such that the test day is other than 24 hours, the milk weight shall be adjusted to a 24-hour interval using the following procedure approved by National DHIA:

Divide 24 by the interval, then multiply by the milk weights.

As an example:
(1) For a 25-hour interval, (24/25) x 65 lbs = 62.4 lbs.
(2) For a 20-hour interval, (24/20) x 65 lbs = 78 lbs.

14. 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 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 milking schedule.

A different DHIA technician tests the herd using the regular milking schedule (i.e., no additional milkings).

Herd Profiles will 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.

15. 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.

16. 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.

17. 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.

Procedures That Apply to Dairy Goats Only

All the rules of the American Dairy Goat Association (ADGA) and all of these National DHIA rules apply to dairy goat testing, except as agreed by ADGA and National DHIA.

Refers to Procedure 1A - Dairy goat producers may use the Group Testing Program as described in dairy goat association guidelines and the NCDHIP Handbook.

Refers to Procedure 10 - 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.

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 begin.

Refers to Procedure 14 - For DHIR verification tests, when an individual doe is in milk at least 60 days, and a 305-day record is predicted on an actual basis to be 3,000 pounds of milk and 105 pounds of butterfat, or on a mature equivalent basis of 3,500 pounds of milk and 125 pounds of butterfat, and when on a 120-day basis, the mature equivalent is predicted to be 4,000 pounds of milk and 140 pounds of butterfat, a verification test is to be called by the DHIA Affiliate.

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TYPES OF FENCING FOR GOATS

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Introduction

Anyone that has goats knows that fencing them in is one of the greatest challenges of having goats. A Texas adage says that if you can see through it or blow smoke through it, it won't hold a goat. However, it is possible to keep goats in your pasture without spending a mint on your fencing. This article describes several different types of fencing that have been used to keep goats in successfully and the cost for materials. This article also covers several methods of converting 5-strand barbed wire fence to a goat fence and several types of electric fence that have been used with goats. One area of difficulty is fencing water crossings. Considerable attention must be given to this because goats unlike cattle are very good at finding gaps in the fence to escape. Most of the fence types that hold goats will also hold the debris in water and therefore will have to be a tear-away type of structure for one end to give away when debris accumulates on them, but they will have to be repaired before the water goes down enough to allow the goats to escape. Generally goats will not walk through water or get their feet wet.

One last thing to mention is that in a few cases names of particular brands of fencing materials may be mentioned. This does not imply an endorsement by the Institute of this product or that other brands might not be equally suitable.

1. Goat Net Wire Fence

Goat net wire is a net wire fence (Sheep and Goat Wire designated 10-47-10-121/2) that is topped with a strand of barbed wire. It can be put on steel or wood posts. It has been fastened to existing 5-strand barbed wire with hog rings, but if the barbed wire is rusty, it will hasten the rusting process of the net wire. The barbed wire on top is necessary to keep cows and horses from putting their heads over the fence and stretching the net wire down low enough for goats to escape. People crossing the fence will also stretch the net wire. The shorter version of sheep and goat net wire can be used (8-35-12 sheep and goat wire) can also be used in this way, but requires being topped by several strands of barbed wire. Do not use conventional field fence(8-35-6) because goats will become caught by the horns and starve or be eaten by predators. If you have this type of fence already, the only solutions are to replace it, cut every other vertical wire, or to put one strand of electric fence in front of it.

This type of fence is a very secure fence for goats, although very young small kids can escape through the holes, but they will remain close to their mothers.. It is somewhat expensive. Post spacing can range from 10-25' depending on terrain and animal pressure. The cost for 1/4 mile of this fence with one set of corners and two line braces and the list of materials needed is as follows:

4 rolls of 10-47-12 sheep and goat wire	@ $68 each	$272.
1 roll of 4 pt barbed wire	@ 35	35
105 T-posts, 7 ft long (12-ft spacing)	@ 2.83 each	297
2 line braces (wood posts and brace)	@ 28 each	56
1 corner brace	@ 43	43
Total cost of materials		*703*

2. Barbed Wire - 10-12 strand

This fence is a very secure fence that keeps goats in and is difficult for humans to cross. This tends to be one of the more predator-resistant types of fence. It is composed of a number of strands of barbed wire that are closely spaced with wire stays every 4-5 ft to hold the wires in alignment. The wires are spaced 3-3.5 inches apart at the bottom and increased to 4, 5, and 6 inches between the wires towards the top of the fence. Post spacing can be 10-15 ft. Since there are so many strands of barbed wire under tension, careful attention must be given to having a stout set of braces to hold the tension of wire. The cost for1/4 mile of this fence with one set of corners and two line braces and the list of materials needed is as follows:

12 rolls of barbed wire	@ $24.00 each	$288
105 T-posts, 6 ft long (12-ft spacing)	@ 2.83 each	297
2 line braces posts and horizontal	@ 28 each	56
1 corner brace	@ 43	43
Total cost of materials		*684*

3. Converting 5-Strand Barbed Wire Fence with Addition of 4 Strands of Barbed Wire

This is a fairly economical way to convert 5-strand barbed wire to be goat proof, but also requires considerable labor. Two strands are added to the gap between the lowest strand and the ground and 1 additional strand of barbed wire between the lowest and second strand of barbed wire and 1 additional strand of barbed wire between the second and third strand of the existing fence. Wire stays must be added every 3-5 ft. The cost for modifying 1/4 mile of this fence and the list of materials needed is as follows:

4 rolls of barbed wire, 'Gaucho'	@ $24 each	$96
7 lb of staples	@ 1.50 each	8
200 wire stays	@ 0.35 each	70
Total cost of materials		*174*

4. Converting 5-Strand Barbed Wire fence by Addition of 8-35 Net Wire Fence

In this fence conversion, the lowest strand of barbed wire is moved to ground level, the next two strands are moved to between the top wires, and net wire is used to fill the gap in between. Considerable labor is also involved in this conversion of fence, but it is a relatively secure type of fence. The cost for modifying 1/4 mile of this fence is as follows:

4 rolls of 8-35-12 sheep and goat wire	@$56 each	$224
10 lb of staples	@ 1.50 each	15
Total cost of materials		*227*

5. Converting 5-Strand Barbed Wire Fence with Addition of 1 or 2 Strands of Electric Fence

This is the cheapest and fastest method for conversion of 5-strand barbed wire fence enabling goats to be used in areas that would be prohibitively expensive to fence and use for goats otherwise. Although it is the least secure type of fence it gives acceptable levels of animal control. Young kids can escape under it, but will stay close to the doe. Electric fence does not work well for everyone's management style and can be another management problem if you do not have several years of successful use of electric fence behind you. There are three rules for successful electric fence use with goats: 1) construct it properly with quality materials; 2) train animals to electric fence before turning them out; and 3) keep the fence hot (minimum 4,500 volts) by checking it daily. Find someone who has used electric fence successfully for a long time and learn their techniques and the materials they use. Half the problems with electric fence are due to poor quality components and(or) poor construction techniques. When an animal gets his head through the electric fence before getting shocked, most likely, he will go forward and out. Therefore, it is profitable to spend a couple of days training animals in a trap or pen lined with a similar type of electric fence to what you are using. Aluminum soft drink cans can be crushed and put on the wire to attract animals to the wire. Bales of hay or feed in a trough can be used to attract animals into the fence. It only takes a couple of days to train goats. To keep fence hot, you need to put a voltmeter on the fence every day. There are some new sophisticated electric fence voltmeters which not only tell the voltage, but will tell whether the short is to the left or right of the voltmeter. When the voltage is low, get it fixed before the goats find out. Falling limbs can also short an electric fence. Vegetation can also be a problem on the fence and can be sprayed with herbicide or clipped with a weedeater. Roundup can be sprayed from a 4-wheeler to cover a lot of area fast. Also, it does not take long to discover that a high quality fence charger is worthwhile investment. Expect to pay $100-600 for a quality fence charger. Never underestimate the importance of a good ground. Follow the manufacturers directions on grounding to avoid grounding problems. Generally plug-in type fence chargers are cheaper for the amount of power and are more reliable than solar powered chargers. However, in remote areas, solar powered chargers are a necessity.

One strand of electric fence can be added to a barbed wire fence in many ways. It should be 14-16" high and have posts and insulators every 30-35 ft. It must stand out from the existing fence at least 5-6 inches or more to keep the electric fence wire from becoming entangled in the barbed wire. Many

of the stand-off insulators fitting on T posts are 5 inches long. If two strands of electric wire are to be used, they should be 8" and 18" high. This will help with predator control and is more secure than one strand of electric fence. Although, a common recommendation is to place the lowest line of electric fence wire between the ground and the first strand of barbed wire, and the second line between the first and second barbed wire strands. Quality stand-off insulators which fit on existing posts can be used. Stand-off insulators allow the fence to be weed-eated under easier. Some stand-off insulators are poor quality and subject to breakage. Good quality standoff insulators are often more expensive than using short posts. Other materials than can be used for posts include temporary step-in posts, homemade posts from 1" PVC electric conduit (stabilized against the sun), fiberglass sucker rod, or 2" × 6.5 ft posts cut in half (3 ft) and fitted with an insulator. The cost for converting1/4 mile of fence is as follows:

1/3 roll of 12 gauge high tensile wire	$55/roll	$19
PVC posts 45 posts	0.80 each	36
Wire clips, pk of 50	3.40	3.40
1/4 of a shocker and ground rod	300	75
Total cost of materials for 1-strand electric fence		*133*
Total cost of materials for 2-strand electric fence		*153*

Don't forget a quality electric fence charger, ground rod, lightning arrester, voltmeter, gate handles, and underground wire.

6. Temporary Electric Fence

Four-strand temporary electric fence on step-in posts with three strands of Maxishock (small galvanized cable from Premier) topped with Intelli-Rope, a rope that has wire conductors, gives visibility to deer to keeps them from tearing the electric fence down. This type of fence works well on keeping goats in and provides some protection from predators. Four wires spaced 8 inches apart has worked well for us. Corners and ends can be landscape timbers. The cost for 1/4 mile of this fence with one set of corners is as follows:

45 step in posts	@ $2.05 each	$92
Three strands Maxishock	@ 70 each	210
One strand Intelli-Rope	@ 62	62
One landscape timber	@ 2.60 each	3
Corner insulators (4)	@ 0.60 each	2
Total cost of materials		*369*

7. Permanent Electric Fence

Permanent electric fence is easy to put up and not under as much tension as a barbed wire fence.

It provides a significant degree of predator control. Five strands, placed 6,13, 21, 31, and 43 inches from the ground, work well for goats. Sucker rod posts ($5.15) and fiberglass T posts are expensive ($5.60); steel T posts with pinlock insulators ($3.50) and wood posts (2") with quality insulators ($2.60) are less expensive. A problem in the use of steel posts with insulators for electric fence is that when the wire gets knocked off of the insulator, the wire may contact the steel T post, causing a direct short to ground.

The cost for 1/4 mile of this fence (5-strand electric fence with sucker rod posts every 30') is as follows:

Sucker rod posts 45	@$5.15 each	$232
Wire 1 2/3 roll	55 each	91
Wire ties, 5 pk of 52	3.40 each	17
Landscape timber posts for corners, 3	2.60 each	8
1/4 of electric fence charger and grounding	300	75
Total cost of materials for 1/4 mile		*423*

8. Gallagher Electric Fence

This fence uses Insultimber posts made from Acacia wood (very hard wood) at 90' spacings with 2 wooden battens in between the posts and 5 strands of high tensile wire.

Posts, 13	@ $4.00 each	$52
Wire, 1 2/3 roll	55	91
Battens, 26	2.80 each	73
Wire clips, 5 pk of 50	3.40 each	17
Total cost of materials for 1/4 mile		*233*

9. Least-Cost Electric Fence - 4 Strands, 2"-Post Every 90', with 2 Fiberglass Battens Between

Wood posts, 13	@ $2.60 each	$34
Fiberglass battens, 26	1.20 each	31
High tensile wire, 1.25 rolls	55	70
Landscape timbers, 1.5	2.60	4
Fence clips, 2 pk of 50	3.40	7
Shocker used on 4 miles of fence	400	25
Total cost of materials for 1/4 mile		*171*

Summary

There are many fencing options and such a diversity of materials. Cost and what is available at the local store are not important factors in determining what components to use in a fence. The labor required to find and replace one poor quality insulator in a fence will cost more than the whole package of high quality insulators. The loss of one quality animal due to poor quality fencing will pay for the difference in cost of quality materials. The fencing garden at Langston is designed to expose you to these options so that you can determine what type of fencing and components are most appropriate for your farm.

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INTERNATIONAL ACTIVITIES OF THE E (KIKA) DE LA GARZA INSTITUTE FOR GOAT RESEARCH WITH TWO ETHIOPIAN UNIVERSITIES

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Why Become Involved in International Activities?

Of the 715 million goats in the world, less than 0.2% reside in the United States while over 90% can be found in countries in Asia and Africa (estimated from FAO on-line database). The E (Kika) de la Garza Institute for Goat Research (GIGR) has as its mission to develop and transfer enhanced goat production technologies at local, state, national and international levels. GIGR has many strong ties with research and academic institutions around the world and has hosted visiting scientists from over 20 foreign countries for the purpose of conducting research and demonstrations. More recently, GIGR has expanded its international activities with foreign institutions to include more aspects of training and agricultural development. These activities give GIGR unique opportunities to not only increase knowledge of foreign production systems and constraints, but also to positively impact agricultural development in foreign countries and help alleviate poverty and hunger. The objectives of GIGR'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 GIGR's involvement in agricultural development and impact on human welfare; and 4) Enhance GIGR's knowledge of development and development issues.

A Role for Goats in Development

The Food and Agricultural Organization of the United Nations estimates that there are over 790 million people in the world who are not receiving enough food to lead normal, healthy lives (FAO, 2000). Those suffering the most from chronic food shortages and malnutrition are children. The International Food Policy Research Institute estimates that in 2010 there will be over 150 million malnourished children in the world and more than 70% of those will live in South Asia and Sub-Saharan Africa (Pinstrup-Andersen et al., 1997). Malnourishment is defined as an abnormal physical condition resulting from deficiencies or imbalances in intakes of energy, protein and other nutrients and can lead to wasting (low weight for height), stunting (low height for age) and underweight (low weight for age). Anemia, poor growth, and poor motor and mental skills are conditions that can result from inadequate dietary intake of energy and protein. Of particular importance are deficiencies in micronutrients, i.e. vitamins and minerals, that play essential roles in the growth and development of children.

In many cases, low dietary micronutrient content is related to a low intake of animal products that contain high amounts of available vitamins and minerals. Currently, the Global Livestock Collaborative Research Support Program is sponsoring a Child Nutrition Project in Kenya that is assessing the role of animal foods on the improvement of diet quality and on the growth and development of Kenyan children (http://glcrsp.ucdavis.edu/project_subpages/CNP_folder/). Results from that project indicate that the intake of animal products, and particularly meat, is positively related to growth, physical activity, mental development and school performance. Additionally, the Human Nutritional Collaborative Research Support Program, in a three-country study, found that the intake of animal products positively predicted physical and development growth of children (Neumann and Harris, 1999).

The findings cited above illustrating the overwhelming benefits of animal products in the diet and the need for families in developing countries to have a source of animal products for their own consumption, typically through the ownership of livestock and family use of meat and milk. While cattle are still the preferred livestock for many farmers, goats are becoming increasingly more important for many families. Indeed, many of the women participating in the Child Nutrition Project in Kenya have expressed a desire to own goats. Goats require less feed and labor, have lower housing requirements, are less drought sensitive, have a shorter generation interval, have a lower initial investment cost and represent less economic risk per animal than cattle while still providing desired milk and meat. Additionally, due to their small size and lower feed requirements, goats are an animal within the capability of many poor smallholder farmers to provide care and feed. As the population in many developing countries increases and more land is used for crop production, the advantages of goat ownership become even more pronounced. Furthermore, for many people in the world goats fulfill social and cultural functions and are a way of amassing and storing wealth. However, of all the functions that goats fulfill none is more important than the meat and milk that they can provide their owners.

The Situation in Ethiopia

Ethiopia is the oldest independent country in Africa and is located in the Horn of Africa. The country's economy is highly dependent upon agriculture which accounts for one-half of the Ethiopia's gross domestic product, 90% of its exports and employs 80% of the population. Ethiopia's main export items are coffee, hides and skins for the leather industry, live animals and chat the immature leaves of *Catha edulis* that are chewed for a stimulatory effect. Over the past decades, Ethiopia and other countries in the Horn of Africa have suffered severely from frequent periods of drought that have devastated both crop and livestock production. During the droughts of the 1980's and 90's an estimated 37 to 42% of all cattle were lost in the Borana region of southern Ethiopia (Desta and Coppock, 2000). These drought periods coupled with an increasing population and a depressed economy have led to an increased number of people suffering from food insecurity in Ethiopia. From 1996 to 1998 it was estimated that over 45% of Ethiopia's population was undernourished (FAO, 2000). As discussed above malnourishment can be especially damaging to young children of school age and 47% of Ethiopia's 65 million inhabitants are under the age of 15 (CIA, 2000). A study of 1,338 children under the age of five in the Hararghe region of eastern Ethiopia found that 36, 45 and 14% were underweight,

stunted and wasting, respectively (Kassa, 2000).

Ethiopia covers a land area roughly twice the size of Texas and has the third largest number of goats in Africa with an estimated 17 million head. Ethiopia also possesses 35 million cattle and 22 million sheep. In addition to meat and milk from these animals, other livestock products such as hides and offal are very important culturally and economically. Milk is an important source of nutrients for families, especially children, and often a family's goats are its only milk source. Demand for goat's milk is so high that in some areas it is diluted with water for distribution to a larger number of children. Ethiopia's dense population has led to a scarcity of land for cropping and livestock activities. This land pressure has affected the livestock holdings per family and the feeding, management and production practices employed. Increasing deforestation, overgrazing, soil erosion and desertification have also led to a decreased quality and quantity of natural grazinglands. As a result, smallholder farmers are increasingly turning away from larger ruminants, typically cattle, in favor of smaller animals, such as goats.

The main feed sources for Ethiopian livestock are grasses and browse obtained from natural rangelands. In addition, crop thinnings and crop residues such as straw and stover are important feed sources. These crop residues are a locally available, inexpensive feed source for livestock farmers. However, crop residues are usually highly fibrous feeds of low digestibility that, while able to supply the basal portion of a ruminant animal's diet, require supplementation for optimum productivity. Crop residues are traditionally low to deficient in many vitamins, particularly vitamins D, E and the B complex vitamins, and in many minerals. However, feeding crop residues, along with appropriate supplements, to ruminants results in the production of milk and meat, which are very good sources of many of the same nutrients, and in particular, vitamin B_{12}, which is not present in plant tissues. The use of crop residues is also important in nutrient recycling and restoring soil fertility through the use of animal manures. Finally, using crop residues for goat feed may reduce the reliance on other harvested forage, thereby, conserving scarce natural resources and enhancing system sustainability.

Ethiopian scientists have identified several constraints to increased growth rate, milk production and reproduction of goats. These include: 1) inadequate knowledge and inefficient utilization of available feed resources, including knowledge of seasonal fluctuations in both the quantity and quality of feedstuffs, and identification of suitable and appropriate supplementation strategies; 2) lack of nutrient requirement tables applicable to local goats; 3) poor understanding of the genetic potential of indigenous goat breeds for growth and milk production and of selection strategies to realize potential; and 4) the present low state of development of extension services and capabilities.

Institutional Partnerships with Ethiopian Universities

Debub University located in Awassa, southern Ethiopia and Alemaya University in Dire Dawa, eastern Ethiopia are two of the main agricultural universities in Ethiopia. Both universities have teaching, research and extension mandates in their regions. In 1998, a partnership was begun between Langston University and Debub University under the Institutional Partnerships in Higher Education for International Development program of the Association Liaison Office for University Cooperation in

Development with funding from the United States Agency for International Development (USAID). The Institutional Partnership program was designed to support American institutions of higher learning in forming partnerships with academic institutions in developing countries to address social and development issues, strengthen the capacity of participating institutions in fulfilling their educational missions, contribute to the training of students able to work in an international marketplace and raise the level of awareness and understanding of education and development issues among institution staff.

In 1999, a partnership with Alemaya University was established through the International Development Partnership Activity of the United Negro College Fund with funds made available from USAID. The International Development Partnership Activity was established to: strengthen the ability of institutions in developing countries to meet national economic and social development needs; assist in the achievement of USAID goals and strategic objectives of country USAID Missions; and to further the international involvement of the Historically Black Colleges and Universities of the United States.

Using the above criteria, the partnerships with Debub University and Alemaya University were formed encompassing the following goals:

1. To increase the research, teaching and extension capabilities of Debub University and Alemaya University staff in accordance with their mandates to better allow them to serve the developmental needs of Ethiopia.
2. Strengthen the capacity of all institutions involved in achieving their educational missions of teaching, research and extension.
3. Enhance the food security and income generating potential of families in Ethiopia.
4. Increase Langston University and GIGR's involvement in international activities and impact on agricultural development.
5. Promote the internationalization of staff to increase awareness of foreign countries, cultures, gender relevance and development issues.

The above goals are being accomplished through the establishment of collaborative research at both GIGR and the Ethiopian institutions, training of staff from both Ethiopian universities at GIGR, and through a development project designed to enhance household food security, income generating potential and family health status through increased goat productivity. This increased goat production is being done via the provision of goats and appropriate technology to women's groups for goat production in villages near both universities. The above objectives support the Special Objective of the USAID Mission in Ethiopia of enhancing food security through increased household income and improved family health status. Project objectives also support a Strategic Objective of the United States Greater Horn of Africa Initiative of strengthening African capacity to enhance regional food security, an objective also supported by the USAID Mission.

Training and Research Activities

Activities at GIGR

The training and research activities in these institutional partnerships are being carried out at both GIGR and the Ethiopian universities. To date, three faculty members from Debub University and two faculty members from Alemaya University have traveled to GIGR and spent between four and six months conducting research and receiving training. Research has focused on the use of crop residues as feedstuffs for goats and on the use of broiler litter in goat diets. While at GIGR, the visitors from Ethiopia participated in a training course on data handling and statistical analysis and performed much of their own laboratory analyses. In addition to research and training activities, seminars on Ethiopian agriculture and culture were given to Langston University students and faculty.

Activities in Ethiopia

Research is underway at both Debub and Alemaya University. Debub University scientists are conducting a trial to test the feeding value of the seed pods and leaves of a leguminous tree, *Acacia tortolis*, found in the area. Alemaya University staff are conducting an experiment to evaluate methods of decreasing the effects of tannins in browse species identified as important village feedstuffs. These research trials are part of efforts by both universities to better characterize village feedstuffs in terms of nutritive value and seasonality. A more complete knowledge of the availability and nutritive value of feeds used by farmers and their methods of feeding will allow these university scientists to formulate better nutritional intervention strategies aimed at increasing goat productivity.

Training is also done by GIGR scientists who travel to Ethiopia and visit these institutions. Seminars have been presented to both staff and students on goat nutrition, research methodology and manuscript preparation and condensed tannins in ruminant nutrition. Additionally, GIGR staff traditionally lecture to students and discuss research and development issues with them. For most students, this is their first opportunity to meet and interact with foreign scientists. In addition to Debub University and Alemaya University, GIGR staff have toured other research facilities in Ethiopia and have met with scientists employed by the Ethiopian Agricultural Research Organization. During these tours, GIGR scientists learn of research conducted at these facilities and give suggestions for improvements.

In November 2000, a special training in the surgical insertion of ruminal cannulas was given by Drs. Art Goetsch and Roger Merkel. Materials needed for the cannulation procedure were taken to Ethiopia where Drs. Goetsch and Merkel performed cannulation surgeries and trained staff at both Debub University and Alemaya University. Both universities now have staff members capable of conducting these surgeries themselves. Furthermore, the goats cannulated during that visit are being used in experiments supporting grant activities.

International Conference on Goat Production Held in Ethiopia

In November 2000, Langston University and GIGR along with the Association Liaison Office for University Cooperation in Development, USAID and Awassa College of Agriculture of Debub University sponsored a conference on goat production entitled "The Opportunities and Challenges of Enhancing Goat Production in East Africa". The conference was held on the Debub University campus, Awassa, Ethiopia. Over 50 participants attended the three day conference and represented Ethiopian livestock research organizations and universities, the Livestock Marketing Board of Ethiopia, the Ethiopian Tanners Association, FARM-Africa a non-governmental development organization, the International Livestock Research Institute, the Agricultural Research Organization Bet Dagen in Israel, the Global Livestock Collaborative Research Support Program based at the University of California-Davis and Langston University. The goals of the conference were to: 1) review the current state of small ruminant production in E. Africa; 2) identify the major production constraints and areas for research and extension; and 3) create a closer relationship among animal industry, research organizations and development/extension efforts to increase animal production. The conference proceedings containing more detailed reports on the partnerships discussed here (see Abebe et al., 2000 and Animut et al., 2000) are available on-line at the E (Kika) de la Garza Institute for Goat Research website, http://www2.luresext.edu under the "Other Activities" section.

Development Activities

Background

Enhancing household food security and income generating potential were targeted through extension efforts aimed at providing goats and needed production training to women. Women are the traditional decision makers in the purchase and preparation of food. Providing women with goats enhances their ability to provide adequate nutrition to their families in two ways: 1) via the direct use of goat products, such as meat and milk, and 2) through the use of cash derived from the sale of live animals or their products. Cash income is very important for families to purchase food, pay for education or buy other household or farm necessities. The sale of excess livestock and(or) products increases the amount of goats and goat products available in the marketplace, thereby increasing food security, raising regional health status and, ultimately, having a beneficial effect on the region's economy.

In large parts of Ethiopian society, the economic and social decisions affecting families are mainly the domain of men. Women, through this project, will be receiving and repaying project credit (in the form of livestock), become the decision makers in the care and sale of livestock and livestock products and manage the income received. These activities, in a male-dominated aspect of society, represent progress in the empowerment of women and will pave the way for increased participation by women in future economic and community decisions.

The development activities center around the provision of "goat packets" to women cooperators in a revolving scheme. Extended goat packets consisted of two does per cooperator with bucks given

for group use, along with needed training in production and management techniques. This strategy calls for a return to the project of young breeding females equal to the number of females received, with returned animals generating new "goat packets" for additional producers. Steps involved in this development activity include: identification of women's groups willing to participate; preparation of goats, training materials and training sessions; initial training of women; provision of goats; and, most importantly, on-going training, monitoring and evaluation.

Development Activities at Debub University

Formation of Women's Groups

To determine potential sites for the project, Debub University staff met with Ministry of Agriculture zonal government officials and conducted an initial survey of the area. After site selection, Debub University scientists, Ministry of Agriculture officials, development agents and village elders met and developed the following criteria used as a guide in selecting women cooperators:

- Willingness to participate
- No cow ownership. It was felt that families who owned cattle may not be as attentive to their goats as families with no cattle.
- Willingness to devote some area for forage production
- Low to average farm size (depending on average landholding of the area)
- Women head of households were selected when possible
- Commitment to abide by project principles, i.e., follow project practices of cut-and-carry feeding, payment of credit, etc.
- Be innovative and willing to try new ideas

Based upon the above criteria, an initial group of twenty women was selected in the Shebedino district, approximately 20 to 30 km south of Awassa. At a later stage the project was expanded to involve another group of 20 women in the Arsi-Negele district, located approximately 40 km north of Awassa. Currently, the project has expanded to involve approximately 80 women participants. Following selection, project goals and objectives were presented to the women participants along with the responsibilities of each party. Each woman then signed an agreement to abide by project practices.

Both districts are characterized by mixed crop and livestock production systems. Perennial crops such as enset (*Ensete ventricosum*) and coffee are the dominant crops in Shebedino, although other grains such as corn are also produced. Conversely, the Arsi-Negele district is dominated by a cereal crop-based agricultural system. The main crops grown in that area include wheat, a small cereal grain called teff (*Eragrostis abyssinica*), corn, Irish potatoes and onions. Livestock are important in both areas. In general, livestock management is more intensive in the Shebedino district where there is less free grazing and more practice of alternative forms of feeding, such as tethering. Much of the Arsi-Negele district has a drier climate than Shebedino and animals are allowed to roam over large areas in search of feed.

Training, Establishment of Forages and Distribution of Goats

After selection, cooperating women participated in training activities on goat husbandry led by extension agents and Debub University staff. In addition to training held in the villages, participating women were brought to the Debub University goat farm to see the farm facilities and where they had the opportunity to ask additional questions.

From the outset of the project, a need was felt to encourage backyard forage development by project women. Seedlings of tree legumes such as *Sesbania* spp. and *Calliandra* spp. and cuttings of elephant grass and Guatemala grass were distributed to participant women in the Shebedino area. The performance of these forages in the farmers' backyard was quite variable, however, the women learned the importance of growing extra feed for their animals. The plan to intensify forage production last rainy season was hampered by late rains and unavailability of vehicles for distributing seedlings from the nursery site.

An initial lot of eighty female goats was purchased in September, 1999 and distributed to participating women. Additional goats were either purchased or made available from Debub University for distribution as more women joined the project. Following distribution of goats, extension agents and Debub University scientists began monthly visits to the villages. During these visits they conducted further training, did follow-up work on backyard forage development and answered questions and provided advice on issues of concern, such as care of new-born kids and the feeding of pregnant animals.

Progress in the Shebedino Area

No deaths have been recorded among the distributed local goats so far. Thirty-two of the forty does distributed have kidded, an 80% kidding rate. Litter size, calculated on the basis of the number of does who have kidded, is 1.03. While litter size obtained was small, it was felt this was due to the fact that most goats were in their first parity. Some women have already expressed an intent to begin repaying animals to the project so as to own their animals free of debt. Abortion was a problem in one village though most does that aborted once have since kidded. Goats that prove to be infertile are replaced by the project.

Monthly weighings have shown that kids attained weights of up to 20 kg at less than one year of age. This finding was surprising in light of the severe drought that was observed in 2000. This weight gain may be evidence of the adaptability of goats to the environment but is likely due to the extreme care given them by the women farmers. During the peak of the drought, goats were fed leaves of a plant called enset (false banana) The tuber and stem of enset can be processed for human food while leaves, as well as other plant parts, can be a source of livestock feed. The fact that farmers were feeding enset leaves during the drought illustrates the importance that project farmers attached to their animals.

Progress in the Arsi-Negele Area

The rationale for extending the project to this site was simply related to the utilization of goat milk in the area as indicated in a preliminary survey of farmers. Of the initial 40 goats distributed 8 goats have died. The causes of such high adult mortality rate (20%) are unknown. Twenty-six does have given birth to 35 kids, resulting in a 1.34 litter size. Kid mortality was 14.3%. Mortality of kids may be linked to a copper deficiency prevalent in the area. The most obvious clinical sign of copper deficiency in ruminants are ataxia or swayback. According to farmers in the area, a delayed type of ataxia is observed at about one to two months of age and is manifested as a swaying gait which develops into a motor incoordination of the hind-quarters and even the fore-quarters. This problem has been indicated as a major constraint of small ruminant production in the area. Mineral licks that contain copper have been distributed to model farmers. It is hoped to increase the distribution of this mineral lick.

Lessons Learned

Most women farmers are pleased with the project even though they have yet to generate income from their goats. The consider the goats to be valuable assets to their family and a source of ready cash should need arise. The work on backyard forage development was encouraging. Even though the scale of production was small, the idea of growing forage for use during critical periods has been appreciated by farmers. Farmers were also very creative in finding areas for planting of the supplied forage trees and grasses around their homes and along fence rows. The demand for goat milk for family consumption is great. One woman whose goat had kidded milked one half of the udder for her infant son while leaving the other for the goat's kid. However, this woman felt the kid was not gaining enough weight and stopped the practice. Because of events such as this, it was decided to try and upgrade the milk production potential of goats given to farmers was seen. Crossbred bucks have been given to two project areas to evaluate the effect of crossbreeding on village milk production and the ability of the farmers to provide enough feed and care so that crossbred animals show an advantage over local animals.

A major difference noted between the two project sites was the level of mortality. While no deaths were recorded in Shebedino, adult as well as kid mortality seemed a common occurrence in Arsi-Negele. This is perhaps due to differences in the production systems employed in the areas. More intensive management of goats is practiced in Shebedino as compared with the more extensive feeding management practiced in the Arsi-Negele area. This suggests that 'improved goats', or the offspring of local goats bred to exotic breeds, may do better under the more intensive management found in the Shebedino area rather than the more extensive grazing system employed in Arsi-Negele.

The differences in production systems between Shebedino and Arsi-Negele not only impact the type of goat that can be successfully raised in each area but also must be considered when formulating nutritional, reproductive and management improvement strategies. Further, research is required to formulate production strategies that take into account the environmental conditions under which the target animals will be raised. This necessitates that research be designed to target specific problems in

each area, which may put a strain on the limited resources available for such work at Debub University. This underlines the importance of collaborative projects such as the current partnership between Debub University and GIGR that can provide the resources and training needed for research to formulate appropriate intervention strategies that have a beneficial impact on agricultural development.

Development Activities at Alemaya University

Site Identification, Selection of Women Participants

Alemaya University staff consulted with local extension agents in determining the two sites to be used in the development project. The sites selected represented different cropping systems with one area dominated by chat (*Catha edulis*) cultivation while in the other area corn and sorghum are the main crops grown. In each extension site three villages were selected for participation resulting in six villages involved in the project. Spreading the project over this number of villages allowed for a wider geographical impact of the project and prevented the possibility of overgrazing and feed shortages that could occur from too many goats being put in one area.

Before selecting individual participants, all women in the selected villages were called to a meeting where the project's goals and activities were discussed, i.e., what the women could expect from the project and what was expected from each participant. After these initial meetings, Alemaya University staff and extension agents developed the following criteria for the selection of women to receive goats:

- Interest in participating in the goat production project. Selected women were expected to voluntarily participate in every aspect of the project and to receive goats with the understanding that a number of young breeding female goats equal to the number received would be returned to the project.
- Family size and livestock ownership. Large families owning few livestock had a better chance of being selected to receive goats. This was done to better achieve the objective of enhancing household food security of resource poor households.
- Priority was given to women-headed households, provided the women had time to care for the goats and that goats would not be an additional burden to them.

Using the aforementioned criteria, fifty women households from each site or sixteen to seventeen per village were selected. This resulted in a total of one hundred women participants.

Training and Distribution of Goats

Training materials were prepared in the local language, Amharic, for ease of understanding and use by extension agents and villagers. The importance of goats, and aspects of feeding and forage development, health care and related management issues of goat raising were explained in the training materials. Training was provided to the women's groups in their villages and at the Alemaya University goat farm, where women were given an opportunity to see the campus goat farm housing facilities,

management, feeding and feed base.

Goats of the Somali breed were purchased from local markets and distributed to women in June 2000. The one hundred selected women farmers were given two does each with a buck provided for a group of three to four female farmers. In total, 200 female goats and 30 male goats were distributed.

Farmer Survey

In addition to helping the rural poor in improving their livelihood by providing goats, a second objective of the development project was to collect information on the on-farm productivity of local Somali goats, and the management practices employed by villagers in goat raising. In August 2000, one-half of the women participants were interviewed to collect information on the common crops grown, management practices employed in goat raising, and future plans of product use in the project sites.

Crops, Feeding, Management and Housing

Common crops cultivated in the project areas are sorghum, corn, chat, sweet potato, potato, beans, wheat and barley. All but one respondent allowed their goats to graze/browse on either communal land or on small privately owned fallow areas, fence rows, etc. Some farmers were reluctant to graze their goats on communal grazing areas for fear of contracting diseases from contact with other animals. Time spent grazing ranged from 5 to 10 hours daily. However, owners in some villages tended to have their goats return from grazing early in the day for fear of predators, especially hyena.

Many farmers practiced supplemental feeding after their goats returned from grazing. Typical feeds given were thinnings from corn and sorghum, byproducts of chat, weeds or other harvested grass, sweet potato vines, kitchen byproducts and some leftover foods, and grain byproducts from flour production. A small number of women purchased wheat bran or peanut cake for feeding. Additionally, almost all owners provided table salt to their goats, either mixed with water or other feedstuffs. Goats were watered either once or twice daily.

In two-thirds of respondents households, tending goats was mainly the job of children whereas women took care of the goats in the remaining households. Male heads of house were the least involved in goat raising. At night goats were kept in the house with their owners as few farmers have separate housing for livestock.

Year-round mating is practiced. As several women share the use of a single buck, the women must be able to detect signs of estrus and arrange for use of the buck if it is with another cooperator. One problem mentioned by some women is the failure of bucks to respond when females came into heat. Unproductive bucks will be replaced by the project.

Use of Goat Products

Seventy percent of respondents selected milk as the most important potential product from their

goats followed by meat, manure and skin. The remaining 30% ranked goat meat over milk in importance. All respondents indicated that upon kidding they will milk goats for home use. Milk will be given to children or used to prepare a common traditional drink called hoja (boiled coffee pulp mixed with milk). While 85% of respondents indicated that priority for milk use will be given to children, the remainder gave priority for the making of hoja. There is a traditional belief that if hoja is consumed by the mother, she will produce enough breast milk for her baby. Milk will not be sold as respondents do not expect excess production.

Goat manure was a highly valued product for its use as a fertilizer for the cash crop, chat. Respondents indicated that the odor of goat manure used in chat fields deterred wild animals, specifically a small deer-like ruminant called the grey duiker (*Syivicapra grimmia*), from eating the chat leaves. Goat skins are processed and mainly used as a praying mat, common among religious Muslims. Goat skins are preferred to sheep skins or cattle hides for these mats as sheep skin is very hairy and cattle skin is not supple enough.

Concerns and Constraints

Even though cattle could provide more milk than goats all but three respondents preferred goats to other farm livestock. Reasons cited by villagers included: the diverse feeding habit of goats; their small size that makes them easy to manage; low feed requirement; fast reproduction rate resulting in immediate cash income and milk production; and the belief that meat and milk from goats, as compared with that from other animals, is felt to have a curative or medicinal value. As a result, goats are slaughtered and fed when a child gets sick. Most respondents felt that goats were not difficult to raise but others indicated that goats were prone to flee and run to the fields to eat chat or other crops.

The fact that goats generally share the same house with their owners is a concern. While some owners realize the problems of keeping goats in the house, security and a lack of financial resources were given as constraints to building separate animal barns. Efforts need to be made to further educate villagers on the potential health risks of living with animals and on
the importance of constructing separate animal housing. Possibly, model animal houses should be constructed in several villages to illustrate the health and management benefits, e.g. easier collection of manure, of separate animal housing.

The potential for a feed shortage was not an expressed concern of farmers. This survey was conducted in the wet season when green feed was abundant and it may be possible that feed will become scarce during the dry season. However, women participants did not share this opinion.

A lack of efficient veterinary service for animals was another constraint observed. When animals became sick farmers tended to purchase medicine and treat animals themselves. This lack of timely treatment of sick animals may have been one a factor in the death of seven female goats out of those distributed to the women's groups.

Conclusions

Participation in international activities provides GIGR with many unique opportunities. Not only do GIGR scientists learn about goat production and constraints in foreign countries, information generated through the research conducted by visiting scientists can be used to increase goat production both here and abroad. GIGR staff are able to learn about foreign cultures and customs increasing their cultural awareness and better allowing them to perform their work. Collaborating foreign institutions benefit from the training received and from the resources made available to them for research and extension. Through these partnerships and the associated development activities, GIGR also plays a role in improving the lives of people in developing countries. The knowledge that through the efforts of GIGR staff and the support of its clientele some village parents in Ethiopia are better able to provide for their children is an aspect of GIGR's mission of which everyone who works and is associated with Langston University and GIGR can be proud.

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GOAT DIET/FEEDING EXAMPLES

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Introduction

There is a wide variety of production systems in which goats are raised in the U.S. Likewise, goats consume many different types of vegetation and are fed various diets and supplements mixed on farm or purchased from local sources. The Institute receives many questions about types of diets and supplements that can be used with goats. Hence, listed below are some of the diets and supplements fed at the Institute in the past few years. Many of these have been used in experiments, although some are fed to maintain goats when not used in research. Research diets and supplements may have been formulated for specific reasons, rather than to maximize profit from production. Therefore, there are also comments regarding how some of these diets or supplements might be altered for greater utility under field production conditions. Also, in some instances names of brands of, or nutrient concentrations in, particular commercial feed products may be listed. This does not imply endorsement by the Institute or that other products might not be equally suitable. Please feel free to contact us for specific questions relating to practical application of any of these diets or supplements.

Complete Diets

Meat and Fiber Goats

CD1 Langston Buck Test Diet

This is the diet currently used for the Meat Goat Performance Test. It has a medium level of high-fiber feedstuffs, although performance of the bucks on this diet has been very good. The dietary level of ammonium chloride was increased slightly from that used previously and the additional 0.5% of white salt was added to minimize problems with urinary calculi. The diet is pelletized, with use of a commercial pelleting agent (i.e., Pellet partner).

Air-dry composition values are given later in the Extension Overview. The calculated composition of this diet on a dry matter basis is:

Crude protein (CP) - 17%
Total digestible nutrients (TDN) - 67%
Calcium (Ca) - 0.82%
Phosphorus (P) - 0.41%

Ingredient	% (air dry basis)
Dehydrated alfalfa meal	19.98
Cottonseed hulls	29.07
Cottonseed meal	15.99
Ground corn	15.99
Wheat midds	9.99
Pellet partner	5.00
Trace mineralized salt	0.50
White salt	0.50
Yeast	1.00
Calcium carbonate	0.95
Ammonium chloride	1.00
Vitamin A30 premix	0.02
Rumensin 80 premix	0.01

CD2 High Concentrate, Corn-Based Experimental Diet

This is an 80% concentrate diet used in a recent experiment with growing Spanish and Boer crossbred doelings. The calculated composition of the diet on a dry matter basis is:

CP - 13.5%
TDN - 76.8%
Ca - 0.61%
P - 0.34%

Ingredient	% (air dry basis)
Millet hay	19.760
Ground corn	66.315
Soybean meal	8.902
Molasses	2.838
Dicalcium phosphate	0.241
Limestone	0.953
Vitamin premix	0.494
Trace mineralized salt	0.449
Deccox, 6%	0.049

The Vitamin premix contained 2,200 IU vitamin A, 1,200 IU vitamin D_3, and 2.2 IU vitamin E per gram, and the trace mineralized salt contained 95 to 98.5% NaCl and at least 0.24% Mn, 0.24% Fe, 0.05% Mg, 0.032% Cu, 0.011% Co, 0.007% I, and 0.005% Zn.

CD3 High Forage Experimental Diet

This is an 80% forage diet used in the same experiment that CD2 was used in. As expected, rate of live weight gain was lower for CD3 than for CD2. The diet was offered free-choice. Trace mineral and vitamin premixes are those used in CD2. The calculated composition of the diet on a dry matter basis is:

CP - 13.5%
TDN - 59.4%
Ca - 0.67%
P - 0.34%

Ingredient	% (air dry basis)
Millet hay	80.073
Ground corn	5.323
Soybean meal	10.189
Molasses	2.875
Dicalcium phosphate	0.535
Vitamin premix	0.501
Trace mineralized salt	0.455
Deccox, 6%	0.050

CD4 Moderate Concentrate, Low CP Experimental Diet

This is an experimental diet with a moderate concentrate level and a low concentration of CP. It does not contain ammonium chloride for prevention of urinary calculi in wethers or males. This diet supported slower weight gain by growing Angora doelings compared with CD5 that is higher in CP. Trace mineral and vitamin premixes are those used for CD2. The calculated composition of the diet on a dry matter basis is:

CP - 9%
Metabolizable energy (ME) - 2.3 Mcal/kg

Ingredient	% (air dry basis)
Cottonseed hulls	42.0
Ground corn	39.0
Ground oats	13.0
Soybean meal	4.4

Trace mineralized salt	0.5
Calcium carbonate	0.9
Vitamin premix	0.2

CD5 Moderate Concentrate, High CP Experimental Diet

This is an experimental diet with a moderate concentrate level and a high level of CP. It does not contain ammonium chloride for prevention of urinary calculi in wethers or males. This diet supported greater weight gain by growing Angora doelings compared with CD4 that is lower in CP. Trace mineral and vitamin premixes are those used for CD2. The calculated composition of the diet on a dry matter basis is:

CP - 15%
Metabolizable energy (ME) - 2.4 Mcal/kg

Ingredient	% (air dry basis)
Cottonseed hulls	42.0
Ground corn	23.8
Ground oats	13.0
Soybean meal	19.3
Trace mineralized salt	0.5
Calcium carbonate	1.2
Vitamin premix	0.2

CD6 70% Concentrate Experimental Diet

This is an experimental diet with concentrate level of 70%, including a variety of concentrate feedstuffs, some of which are relatively high in fiber. It contains some feedstuffs high in protein that escapes microbial degradation and is available for digestion in the small intestine. Trace mineral and vitamin premixes are those used for CD2. Ammonium chloride and white salt are present to minimize problems with urinary calculi. The calculated composition of the diet on a dry matter basis is:

CP - 16%
TDN - 67%
Ca - 0.86
P - 0.43

Ingredient	% (air dry basis)
Cottonseed hulls	14.689
Wheat midds	19.525
Dehydrated alfalfa pellets	14.853
Ground corn	18.876
Rolled oats	19.525
Soybean meal	3.456
Blood meal	0.678
Fish meal	0.969
Feather meal	0.678
Molasses	3.565
Limestone	1.291
Vitamin premix	0.495
Trace mineralized salt	0.450
White salt	0.495
Ammonium chloride	0.495
Deccox, 6%	0.050

CD7 Dehydrated Alfalfa Pellets

Dehydrated alfalfa pellets were fed free-choice in an experiment, along with a mineral/vitamin supplement (e.g., MVS1), for a rate of growth by weaned Spanish kids as great as that achieved with CD6. However, we have not evaluated dehydrated alfalfa pellets with Boer cross kids or with meat goats at weights much greater than 75 pounds. Dehydrated alfalfa pellets are often 19% CP and 61% TDN on a dry matter basis.

CD8, CD9, CD10, CD11 High Concentrate Experimental Diets

These are four diets used in an experiment investigating protein requirements of meat goats. Diet CD8, which was lowest in CP, supported live weight gain lower than that with the other treatments. The rate of growth of goats consuming CD9, CD10, or CD11 was similar among treatments. Trace mineral and vitamin premixes are those used for CD2.

Item	CD8	CD9	CD10	CD11
INGREDIENT				
Cottonseed hulls	30.000	30.000	30.000	30.000
Ground corn	62.030	52.935	47.501	41.536
Soybean meal	1.049	9.959	9.993	10.035
Blood meal	0.000	0.000	1.726	3.470

Fish meal	0.000	0.000	2.302	4.630
Feather meal	0.000	0.000	1.726	3.470
Molasses	3.000	3.000	3.000	3.000
Dicalcium phosphate	0.654	0.459	0.067	0.000
Limestone	1.293	1.351	1.180	1.146
Vitamin premix	0.500	0.500	0.500	0.500
Trace mineral salt	0.690	0.690	0.690	0.690
Ammonium chloride	0.500	0.500	0.500	0.500
Deccox, 6%	0.050	0.050	0.050	0.050
Sodium sulfate	0.234	0.556	0.765	0.973
COMPOSITION (% of dry matter)				
CP	10.2	14.2	18.3	23.6
TDN	71.8	71.5	71.2	70.4
Ca	0.68	0.68	0.68	0.68
P	0.34	0.34	0.34	0.34

CD12 High Concentrate Experimental Diet

This is a 75% concentrate diet used in a recent experiment with different breeds of weaned goats (Alpine, Angora, Boer, and Spanish). It has a fairly high level of CP to ensure that growth would not be limited by protein. Ammonium chloride and white salt are included to minimize problems with urinary calculi. Trace mineral and vitamin premixes are those used for CD2. Chromic oxide was included as a marker to allow the determination of diet digestibilities. The calculated composition of the diet on a dry matter basis is:

CP - 17%
TDN - 71%
Ca - 0.71%
P - 0.36%

Ingredient	% (air dry basis)
Prairie hay	25.00
Ground corn	55.23
Soybean meal	6.06
Blood meal	2.07
Fish meal	2.56
Feather meal	2.07
Dried molasses product	3.00
Trace mineralized salt	0.75
White salt	0.50

Vitamin premix	0.50
Deccox, 6%	0.05
Limestone	1.06
Dicalcium phosphate	0.10
Ammonium chloride	0.75
Chromic oxide	0.30

CD13 Moderate Concentrate Experimental Diet

This is a 50% concentrate diet used in the same experiment that CD12 was fed in. It also has a fairly high level of CP to ensure that growth would not be limited by protein. Ammonium chloride and white salt are included to minimize problems with urinary calculi, although levels are lower than with CD12, which is higher in concentrate. Trace mineral and vitamin premixes are those used for CD2. Chromic oxide was included as a marker to allow the determination of diet digestibilities. The calculated composition of the diet on a dry matter basis is:

CP - 17%
TDN - 62%
Ca - 0.70%
P - 0.35%

Ingredient	% (air dry basis)
Prairie hay	50.000
Ground corn	28.90
Soybean meal	6.821
Blood meal	2.500
Fish meal	3.200
Feather meal	2.500
Dried molasses product	3.000
Trace mineralized salt	0.750
White salt	0.250
Vitamin premix	0.500
Deccox, 6%	0.050
Limestone	0.629
Dicalcium phosphate	0.100
Ammonium chloride	0.500
Chromic oxide	0.300

Dairy Goats

DCD1 50% Concentrate Early Lactation Diet

The 50% concentrate diet shown below was used in an experiment in early lactation and has been employed as a standard diet in some instances. Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

CP - 16.7%
ME - 2.42 Mcal/kg
NE_l - 1.53 Mcal/kg
Ca - 1.06%
P - 0.51%

Ingredient	% (dry matter basis)
Cottonseed hulls	25.000
Ground alfalfa hay	25.000
Ground corn	27.194
Soybean meal	16.100
Molasses	3.000
Dicalcium phosphate	1.319
Calcium carbonate	0.893
Vitamin premix	0.500
Trace mineralized salt	0.691
Magnesium oxide	0.303

DCD2, DCD3 High Forage Early Lactation Diets

The following two 80% forage diets were used in a recent early lactation experiment. These diets were relatively high in CP (i.e., approximately 18.5% of dry matter); the level of neutral detergent fiber in the diet was about 44% of dry matter. The DCD3 diet included some feedstuffs high in ruminally undegraded protein (e.g., escape or bypass protein). These diets supported lower milk production by does and doelings in the early lactation period compared with diets containing 60% concentrate and 40% forage (DCD4 and DCD5). The diets containing additional ruminally undegraded protein (DCD3 and DCD5) improved milk production only in the first few weeks of the early lactation period. Trace mineral and vitamin premixes are those used for CD2.

Ingredient	DCD2	DCD3
	----------% (dry matter basis)----------	
Cottonseed hulls	20.00	20.00
Alfalfa hay	60.00	60.00
Ground corn	0.73	2.59
Soybean meal	10.00	3.33
Blood meal	0.00	1.40
Fish meal	0.00	1.84
Feather meal	0.00	1.42
Molasses	3.00	3.00
Partially hydrogenated tallow	3.00	3.00
Dicalcium phosphate	1.46	1.31
Ammonium sulfate	0.25	0.25
Vitamin premix	0.50	0.50
Trace mineralized salt	0.76	0.76
Magnesium oxide	0.30	0.30

DCD4, DCD5 High Concentrate Early Lactation Diets

The following two 40% forage, 60% concentrate diets were used in the early lactation experiment in which DCD2 and DCD3 were fed. These diets were relatively high in CP (i.e., approximately 19% of dry matter); the level of neutral detergent fiber in the diet was about 33% of dry matter. The DCD5 diet included some feedstuffs high in ruminally undegraded protein (e.g., escape or bypass protein). These diets supported greater milk production by does and doelings in the early lactation period compared with diets containing 20% concentrate and 80% forage (DCD2 and DCD3). The diets containing additional ruminally undegraded protein (DCD3 and DCD5) improved milk production only in the first few weeks of the early lactation period. Trace mineral and vitamin premixes are those used for CD2.

Ingredient	DCD4	DCD5
	----------% (dry matter basis)----------	
Cottonseed hulls	20.00	20.00
Alfalfa hay	20.00	20.00
Ground corn	31.31	36.09
Soybean meal	17.60	5.33
Blood meal	0.00	2.43
Fish meal	0.00	3.18

Feather meal	0.00	2.46
Molasses	3.00	3.00
Partially hydrogenated tallow	3.00	3.00
Dicalcium phosphate	1.08	0.89
Limestone	1.20	0.81
Ammonium sulfate	0.25	0.25
Sodium bicarbonate	1.00	1.00
Vitamin premix	0.50	0.50
Trace mineralized salt	0.76	0.76
Magnesium oxide	0.30	0.30

DCD6 20% Concentrate Late Lactation Diet

The 20% concentrate diet shown below was used in an experiment in late lactation. The level of milk production by doelings supported by this diet was similar to that with higher dietary concentrate levels. However, milk production by does consuming this diet was less than by does consuming diets with 35 or 50% concentrate. Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

CP - 17.7%
ME - 2.18 Mcal/kg
NE_l - 1.36 Mcal/kg
Ca - 1.14%
P - 0.40%

Ingredient	% (dry matter basis)
Cottonseed hulls	20.000
Ground alfalfa hay	60.000
Ground corn	10.600
Soybean meal	3.949
Molasses	3.000
Dicalcium phosphate	1.060
Ammonium sulfate	0.200
Vitamin premix	0.500
Trace mineralized salt	0.691

DCD7 35% Concentrate Late Lactation Diet

The 35% concentrate diet shown below was used in an experiment in late lactation. The level of milk production by doelings supported by this diet was similar to that with other dietary concentrate levels. However, milk production by does consuming this diet was tended to be less than by does

consuming diets with 50% concentrate but greater than with 20% concentrate. Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

CP - 17.5%
ME - 2.34 Mcal/kg
NE_l - 1.47 Mcal/kg
Ca - 0.92%
P - 0.40%

Ingredient	% (dry matter basis)
Cottonseed hulls	20.000
Ground alfalfa hay	45.000
Ground corn	23.081
Soybean meal	6.588
Molasses	3.000
Dicalcium phosphate	0.940
Ammonium sulfate	0.200
Vitamin premix	0.500
Trace mineralized salt	0.691

DCD8 50% Concentrate Late Lactation Diet

The 50% concentrate diet shown below was used in an experiment in late lactation. The level of milk production by doelings supported by this diet was similar to that with other dietary concentrate levels. However, milk production by does consuming this diet was greater than by does consuming diets with 20, 35, or 65% concentrate. Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

CP - 16.7%
ME - 2.49 Mcal/kg
NE_l - 1.57 Mcal/kg
Ca - 0.80%
P - 0.40%

Ingredient	% (dry matter basis)
Cottonseed hulls	20.000
Ground alfalfa hay	30.000
Ground corn	35.205
Soybean meal	9.287

Molasses	3.000
Dicalcium phosphate	0.828
Calcium carbonate	0.289
Ammonium sulfate	0.200
Vitamin premix	0.500
Trace mineralized salt	0.691

DCD9 65% Concentrate Late Lactation Diet

The 65% concentrate diet shown below was used in an experiment in late lactation. The level of milk production by doelings supported by this diet was similar to that with other dietary concentrate levels. However, milk production by does consuming this diet was less than by does consuming a 50% concentrate diet (DCD8). Similarly, other researchers have suggested that milk production by dairy goats may not necessarily be greater with high versus moderate dietary concentrate levels, as is the case with dairy cows. Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

CP - 16.4%
ME - 2.62 Mcal/kg
NE_l - 1.66 Mcal/kg
Ca - 0.80%
P - 0.40%

Ingredient	% (dry matter basis)
Cottonseed hulls	20.000
Ground alfalfa hay	15.000
Ground corn	46.537
Soybean meal	12.133
Molasses	3.000
Dicalcium phosphate	0.724
Calcium carbonate	0.945
Ammonium sulfate	0.200
Vitamin premix	0.500
Trace mineralized salt	0.691
Sodium bicarbonate	0.250
Magnesium oxide	0.020

DCD10, DCD11, DCD12 35, 50, and 65% Concentrate Dry Period Diets

These are three diets used in the dry period in a recent experiment. The does and doelings were in good condition in late lactation before drying off, and performance in the subsequent early lactation period was similar among these different diets. Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

Item	DCD10	DCD11	DCD12
CP, %	16.6	17.9	17.5
ME, Mcal/kg	2.18	2.42	2.65
NE_l, Mcal/kg	1.36	1.52	1.68
Ca, %	0.39	0.40	0.44
P, %	0.25	0.25	0.27

Ingredient	DCD10	DCD11	DCD12
	----------% (dry matter basis)----------		
Cottonseed hulls	50.000	35.000	20.000
Ground alfalfa hay	15.000	15.000	15.000
Ground corn	13.381	30.262	47.018
Soybean meal	16.405	14.453	12.528
Molasses	3.000	3.000	3.000
Dicalcium phosphate	0.081	0.000	0.000
Calcium carbonate	0.042	0.194	0.363
Vitamin premix	0.500	0.500	0.500
Trace mineralized salt	0.691	0.691	0.691
Magnesium sulfate	0.900	0.900	0.900

Concentrate-Based Supplements

Meat and Fiber Goats

S1 Langston Moderate Protein Pellet

The Institute uses some pelleted supplements for different types of forages when animals are not on experiments. They are designed to be fed at various levels with diets based on forage, either being grazed or harvested. Typically animals also have access to a trace mineralized salt block. In some cases the pellets have been fed alone for short periods of time. The first is called the Moderate Protein Pellet, and is used with forages that are low in CP. For forages such as wheat straw that are very low in CP, a high CP feedstuff such as soybean may be fed in addition to this pellet. The calculated composition on a dry matter basis is:

CP - 20.3%
TDN - 74.1%
Ca - 1%
P - 0.5%
Cu - 16.3 ppm
Se - 0.32 ppm
Zn - 142 ppm

Ingredient	% (air dry basis)
Cottonseed hulls	15.00
Alfalfa meal	20.00
Wheat midds	13.40
Ground corn	25.00
Soybean meal	18.85
Pellet partner	5.00
Dicalcium phosphate	0.40
Calcium carbonate	1.10
White salt	0.50
Trace mineral and vitamin premix	0.25
Ammonium chloride	0.50

The composition (air dry basis) of the Trace mineral and vitamin premix is:

Fe, minimum %	3.55
Zn, minimum %	3.77
Mn, minimum %	1.9
S, minimum %	1.2

K, minimum %	1.07
Mg, minimum %	0.79
I, minimum %	0.046
Co, minimum %	0.009
Se, minimum %	0.0026
Vitamin A, minimum I Units per pound	1,200,000
Vitamin D_3, minimum I Units per pound	400,000
Vitamin E, minimum I Units per pound	1,500
Vitamin B-12, minimum mg per pound	5
Vitamin K, minimum mg per pound	165
Riboflavin, minimum mg per pound	1,100
d-Pantothenic acid, minimum mg per pound	1,840
Niacin, minimum mg per pound	5,000
Vitamin B6, minimum mg per pound	14
Folic acid, minimum mg per pound	20
Choline, minimum mg per pound	21,620
Biotin, minimum mg per pound	1
Methionine, minimum %	4.95

S2 Langston Low Protein Pellet

This pellet is used with forages that have moderate to high levels of CP. The Trace mineral and vitamin premix is that given for S1. The calculated composition of the pellet on a dry matter basis is:

CP - 13.3%
TDN - 74.8%
Ca - 1.02%
P - 0.51%
Cu - 14.2 ppm
Se - 0.34 ppm
Zn - 142 ppm

Ingredient	% (air dry basis)
Cottonseed hulls	15.00
Alfalfa meal	19.00
Ground corn	30.00
Wheat midds	28.15
Pellet partner	5.00
Dicalcium phosphate	0.25
Calcium carbonate	1.35
White salt	0.50

Trace mineral and vitamin premix	0.25
Ammonium chloride	0.50

S3 Low/Moderate Quality Forage Supplement for Growing/Yearling Goats

The S3 supplement has been used to supplement growing/yearling goats grazing or consuming harvested forages with low CP and TDN levels. The feeding rate is 0.75% of body weight on a dry matter basis, or about 0.83% of body weight on an as fed basis. For a 30-kilogram (66 pound) goat, this would be 0.25 kilograms (as fed) or 0.55 pounds. Because some of the other treatments did not entail any concentrate feeding, a loose mineral/vitamin supplement was fed separately (e.g., MVS1). Trace mineral and vitamin premixes are those used for CD2. The calculated composition on a dry matter basis is:

CP - 30.2%
TDN - 77.7%
Ca - 0.51%
P - 0.68%

Ingredient	% (air dry basis)
Ground corn	20.330
Ground oats	20.101
Wheat middlings	20.101
Molasses	6.629
Soybean meal	19.878
Fish meal	5.182
Blood meal	3.889
Feather meal	3.889

S4, S5 Flushing Supplements

Two concentrate supplements were used in a recent experiment investigating potential effects of concentrate supplementation before breeding on reproductive performance of Spanish does. The S4 supplement did not include a feedstuff high in CP, whereas S5 contained fish meal. The supplements were offered at 250 grams (0.55 pounds) per day beginning 3 or 7 weeks before the breeding season. The composition of the trace mineralized salt is that given for CD2. The calculated composition of the supplements on a dry matter basis is:

Item	S4	S5
CP, %	8.8	19.2
TDN, %	86	82

Ingredient	S4	S5
	---------% (dry matter basis)--------	
Ground corn	88	68
Dried molasses product	8	8
Menhaden fish meal	0	20
Dried brewers yeast	2	2
Trace mineralized salt	2	2

Dairy Goats

DS1 Langston Dry Pellet

This pellet is another one of the Institute used for pregnant goats in the last month or so before gestation. The Ca level is less than for the other pellets, so that does are prepared to mobilize Ca in early lactation if necessary. The CP level in the pellet is moderate, typically fed with moderate to high quality forage, other than alfalfa. The Trace mineral and vitamin premix is that given for S1. The calculated composition of the pellet on a dry matter basis is:

CP - 15%
TDN - 76.2%
Ca - 0.47%
P - 0.46%
Cu - 14.6 ppm
Se - 0.33 ppm
Zn - 141 ppm

Ingredient	% (air dry basis)
Cottonseed hulls	14.74
Alfalfa meal	20.00
Wheat midds	22.90
Ground corn	30.00
Soybean meal	6.50

Pellet partner	5.00
Calcium carbonate	0.11
White salt	0.50
Trace mineral and vitamin premix	0.25

DS2 Lactation Supplement

The DS2 is a concentrate-based supplement being used in an experiment with grazing and confined dairy goats in early, mid-, and late lactation. It is being fed at two different levels - 0.33 or 0.66 kilograms (0.73 or 1.46 pounds, respectively) per kilogram of milk being produced over 1.5 kilogram. This is the same as 0.33 or 0.66 pounds per pound of milk produced over 3.3 pounds. Trace mineral and vitamin premixes are those used for CD2. The calculated analysis on a dry matter basis is:

CP - 15.7%
TDN - 85%
Ca - 0.74%
P - 0.38%

Ingredient	% (dry matter basis)
Rolled corn	74.5
Whole cottonseed	5.0
Soybean meal	16.0
Sodium bicarbonate	2.0
Dicalcium phosphate	0.2
Limestone	1.6
Mineral oil	1.0
Vitamin premix	0.7

Creep Feeds or Suckling Supplements

CF1 Dairy Kid Creep Feed

CF1 is a dairy kid creep feed at the Institute used in recent experiments. It has a variety of feedstuffs and a high level of molasses. Trace mineral and vitamin premixes are those used for CD2. The composition on a dry matter basis is:

CP - 20%
TDN - 72%
ME - 2.68 Mcal/kg
Ca - 1%
P - 0.5%

Ingredient	% (dry matter basis)
Dehydrated alfalfa pellets	15.00
Ground corn	18.00
Wheat middlings	20.00
Rolled oats	20.00
Soybean meal	11.01
Blood meal	1.00
Fish meal	1.40
Feather meal	1.00
Molasses	10.00
Calcium carbonate	1.54
Vitamin premix	0.50
Trace mineralized salt	0.50
Deccox, 6%	0.05

CF2 Dairy Kid Creep Feed

CF2 is a dairy kid creep feed at the Institute used in an experiment. It is based largely on corn. Trace mineral and vitamin premixes are those used for CD2. The composition on a dry matter basis is:

CP - 20%
TDN - 77%
ME - 2.90 Mcal/kg
Ca - 1%
P - 0.5%

Ingredient	% (dry matter basis)
Dehydrated alfalfa pellets	15.00
Ground corn	57.31
Soybean meal	16.39
Blood meal	1.00
Fish meal	1.00
Feather meal	1.00
Molasses	5.00
Dicalcium phosphate	0.75
Calcium carbonate	1.30
Vitamin premix	0.50
Trace mineralized salt	0.69
Deccox, 6%	0.05

CF3 Meat Goat Creep Feed

CF3 is a creep feed that was used in an experiment with suckling meat goat kids. It is fairly similar to CF1 in composition, with a high level of molasses but a slightly lower level of CP. Trace mineral and vitamin premixes are those used for CD2. The composition on a dry matter basis is:

CP - 18%
TDN - 73%
Ca - 0.64%
P - 0.48%

Ingredient	% (air dry basis)
Wheat midds	19.669
Dehydrated alfalfa pellets	14.587
Ground corn	23.582
Rolled oats	19.668
Soybean meal	6.166
Blood meal	1.000
Fish meal	1.400
Feather meal	1.000
Molasses	10.000
Calcium carbonate	0.500
Vitamin premix	0.500
Trace mineralized salt	0.500
Deccox, 6%	0.050

Mineral/Vitamin Supplements

MVS1 General Mineral/Vitamin Supplement

This supplement has been used on a few experiments with forage-based diets. Trace mineral and vitamin premixes are those used for CD2. It has been fed at a rate of 0.05% of body weight, which equates to 15 grams (about one-half of an ounce, or 0.033 pounds) for a 30-kilogram (66 pounds) kid.

Ingredient	% (air dry basis)
Dicalcium phosphate	15.0
Vitamin premix	25.0
Trace mineral premix	25.0
Deccox, 6%	2.5
Dried molasses product	32.5

MVS2 General Mineral/Vitamin Supplement

This supplement has also been used in experiments with forage-based diets. Trace mineral and vitamin premixes are those used for CD2. It is very similar to MVS1 but without molasses. It has the same feeding rate as MVS1, so assuming complete consumption would deliver slightly greater amounts of minerals and vitamins).

Ingredient	% (air dry basis)
Dicalcium phosphate	22.3
Vitamin premix	37.0
Trace mineral premix	37.0
Deccox, 6%	3.7

MVS2 General Mineral/Vitamin Supplement

This supplement has been used in an experiment with growing dairy goats and different dietary levels of concentrate and forage and different feeding methods. Trace mineral and vitamin premixes are those used for CD2. It is similar to MVS1 and MVS2 but without a higher level of dicalcium phosphate. It has a feeding rate of 0.07% of body weight, slightly greater than for previous supplements.

Ingredient	% (air dry basis)
Dicalcium phosphate	21.42
Vitamin premix	17.86
Trace mineral premix	17.86
Deccox, 22.7 mg/lb	17.86
Dried molasses product	25.00

The proper citation for this article is:

Hart, S. P. and A. L. Goetsch. 2001. Goat Diet/Feeding Examples. Pages 64-85 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

FACTSHEET

Wildlife Services

APHIS

United States Department of Agriculture

Animal and Plant Health Inspection Service

January 1998

Livestock Guarding Dogs

Livestock guarding breeds originated in Europe and Asia, where they have been used for centuries to protect sheep from wolves and bears. Americans have used guarding dogs since the mid-1970's. They are large animals (80–120 pounds) and are usually all white or fawn colored with dark muzzles. Some of the more common breeds are Great Pyrenees (France), Komondor (Hungary), Akbash dog and Anatolian shepherd (Turkey), and Maremma (Italy).

Unlike herding dogs, guarding dogs do not usually herd sheep. Acting independently of humans, guarding dogs stay with or near sheep most of the time and aggressively repel predators. Genetics and proper rearing both contribute to the makeup of a successful guarding dog.

Some guarding dogs do not adequately carry out their protective role. Failures can generally be attributed to improper rearing or acquiring the dog after it is too old for training. However, some dogs don't work well despite having been reared properly. Research and surveys indicate that about three-fourths of trained dogs become good guardians. Knowing what a good guarding dog is and how to raise one correctly can help producers be sure they get the best possible service from their dogs.

Key Points in Successfully Rearing a Guarding Dog

- Select a suitable breed and reputable breeder.
- Rear pups singly from 8 weeks of age with sheep, minimizing human contact (probably the most critical ingredient for success).
- Monitor the dog and correct undesirable behaviors.
- Encourage the dog to remain with or near the livestock.
- Ensure the dog's health and safety.
- Manage the livestock in accordance with the dog's age and experience (e.g., use smaller pastures while the dog is young and inexperienced).
- Be patient and allow plenty of time to train your dog. Remember that a guarding dog may take 2 years or more to mature.

Potential Benefits and Problems With Using Dogs

An Oregon sheep producer nearly eliminated coyote predation in her pasture flock of 50 ewes by adding a single guarding dog. In 6 years of using the dog, she lost only one lamb to coyotes. In contrast, coyotes and bobcats killed several sheep on neighboring farms each year.

Effective guarding dogs help livestock owners by

- reducing predation on sheep,
- reducing labor (lessening the need for night corralling),
- alerting the owners to disturbances in the flock,
- protecting the family and ranch property, and
- allowing for more efficient use of pastures and potential expansion of the flock.

However, guarding dogs require an investment with no guarantee of a positive result. The dogs can become ill, be injured, or die prematurely. Some dogs roam away from the flock. Guarding dogs are potentially aggressive; some dogs injure the stock or other animals, including pets, or confront unfamiliar people (e.g., hikers) who approach the sheep. Producers who use dogs should post signs to alert passers-by and escort visitors when near sheep.

Guarding Dogs and Other Control Tools

The use of a guarding dog does not prevent the use of other predation-control methods. However, the other techniques must be compatible. The use of toxicants is not recommended where guarding dogs are working. Traps and snares can kill dogs if they are caught and not released in a reasonable period of time. As a precaution, dogs should be restrained, confined, or closely monitored if these methods are being used in close proximity.

An Idaho sheep producer reduced coyote predation in his pasture flock of 200 ewes by adding a guarding dog to his operation. Prior to obtaining the dog, the producer lost an average of 12 lambs per year to coyotes. The use of the guarding dog, combined with other predation-control methods, resulted in a loss of only four lambs over the next 5 years.

Guarding dogs can also be helpful in range sheep operations. However, many factors influence dog effectiveness. A Wyoming sheep rancher noted a significant reduction in coyote predation in his range flocks for the first 3 years he used guarding dogs. During that time, the coyote population continued to increase. In the fourth year, the producer began to see a decrease in his dogs' effectiveness. Coyotes had become so numerous they were simply overwhelming the dogs. By the fifth year, his predation losses had returned to previous levels.

Recommendations for Producers

Guarding dogs will not solve all predation problems for most producers, but in many situations they are a useful tool. They can aid in reducing occasional predation and have worked well in both fenced pasture and herded range operations. Their effectiveness can be enhanced by good livestock management and by eliminating persistent predators.

Guarding dogs may not be suitable in very large pastures (several sections or larger) where sheep are widely scattered. At least two dogs are recommended for range operations or in large areas with more than several hundred sheep.

Additional Information

Sources of pups and additional information about livestock guarding dogs can be obtained from the nearest office of the Animal and Plant Health Inspection Service's (APHIS) Wildlife Services (WS) program. You may also contact Roger A. Woodruff, APHIS guarding dog specialist, 720 O'Leary Street, NW, Olympia, WA 98502, (360) 753–9884; Jim Luchsinger, 5940 S. 58th Street, P.O. Box 81866, Lincoln, NE 65801; Jeffrey S. Green, APHIS, WS, 12345 W. Alameda Parkway, Suite 204, Lakewood, CO 80228, (303) 969–6565, extension 233; or Alton Dunaway, APHIS, WS, Suite 301, 3322 West Avenue, Nashville, TN 37203, (615) 736–2007.

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WILDLIFE DAMAGE MANAGEMENT

Trapping Coyotes

Coyotes (*Canis latrans*) are members of the dog family. They prey on a wide variety of animals including rodents, rabbits, deer, game birds and livestock. They also consume vegetation such as prickly pear apples, mesquite beans and persimmons. Coyotes come into conflict with ranchers and farmers when they prey on livestock such as sheep, goats, cattle, hogs and poultry, and when they cause damage to watermelons, cantaloupes and other agricultural crops. Coyotes cause millions of dollars in damage yearly to livestock and crops in Texas.

Biology and Reproduction

Adult weight: Average 25 to 45 pounds.

Total length: 39 to 51 inches.

Color: Grizzled gray or buff overlaid with black.

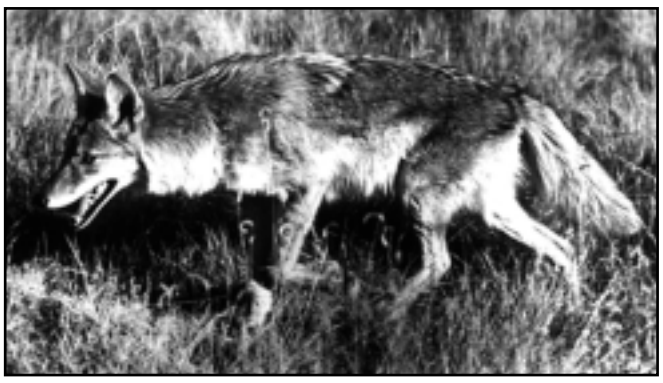
Feet: Tracks are similar in appearance to dogs.

Gestation period: Approximately 63 days.

Litter size: Five to seven.

Number of litters: One litter per year, usually born in March, April or May.

Life Span: Generally 6 to 8 years in the wild.



Damage

Coyotes normally kill livestock by biting them around the throat. To determine if an animal has been killed by a coyote, carefully peel back the skin around the throat and look for tooth puncture wounds surrounded by hemorrhaging. Since some other predators may kill in a similar way, it is also necessary to look for signs such as tracks and droppings to determine which predator did the killing. If there are no teeth marks on the head and throat and little bleeding, the animal probably died from some cause other than depredation. Domestic dogs also kill livestock, but not as effectively as coyotes. Animals killed by dogs usually have many other puncture wounds on various parts of the carcass. In addition, dogs seldom feed on their kill.

During the watermelon and cantaloupe seasons, coyotes often feed on ripe melons in the field. Raccoons also eat melons, but coyote damage can be recognized by large holes in the melons and by tracks around the damaged fruit.

Where coyotes cause damage to livestock or crops, it may be necessary to remove the coyotes to stop the depredation. Trapping with leghold traps is an effective way of removing coyotes. But to successfully trap coyotes, you must be aware of their habits and abilities and have some basic knowledge of setting a leghold trap.

Habits

Coyotes are very adaptable and live in a variety of habitats ranging from ranching and farming areas to city suburbs. Coyotes are most active at night, in early morning, and in late evening. They rely on their acute sense of smell, keen hearing and eyesight for hunting prey and avoiding possible danger.

Texas Wildlife Damage Management Service, P.O. Box 100410, San Antonio, Texas 78201-1710

Coyotes establish regular travel routes along livestock trails, ranch roads, canyons, ridges or any path that offers easy travel and good visibility. A trapper can find these travel routes by looking for coyote sign, tracks and droppings.

Coyote tracks are similar to dog tracks, but it is possible to distinguish between the two. Dog tracks are round with the toes spread apart. Toenail marks usually are visible on all toes. Coyote tracks are more rectangular with the toes closer together. If any toenail marks show, they are usually on the middle two toes (see Figure 1). Also, coyote tracks appear in a straight line, while those of a dog are somewhat staggered.

Coyote droppings, or scat, contain animal hair and bone fragments. This readily distinguishes coyote droppings from those of domestic dogs that have been eating table scraps or dog food. Fresh coyote scat is black, but turns grey or white as it weathers.

Coyotes establish scent posts by urinating at various locations along their travel routes. These scent post locations may be tufts of grass, small bushes, animal carcasses, skeletons or other objects. Often there are scratch marks near a scent post which help identify it. Natural scent posts or ones created by a trapper are good locations for trap sets.

Trap Sets

There are several types of trap sets that can be used to trap coyotes, depending on the situation. The most common are scent post sets, dirt hole sets, blind or trail sets and animal carcass sets.

Scent Post

If a scent post can be found, a trap should be set at this location. If a scent post cannot be found, one can be established by placing coyote or dog urine on a tuft of grass or other suitable object near the pathway. The trap should be placed approximately 6 inches on the downwind side of the scent post.

When making a scent post set, consider what senses the coyote uses to locate a scent post. Smell is most important, but vision is also a factor. The scent should be one that arouses the interest of the coyote and makes it want to investigate. The scent post should be placed so that the wind blows the smell across the coyote's path. If wind direction is variable, then two scent post sets might be used on either side of the trail. A scent post set is most effective when placed near a highly visible object along a trail, such as a skeletal bone, tree stump or lone tuft of grass. Coyotes are very curious animals and the trapper should take advantage of this trait when choosing sites for trap sets.

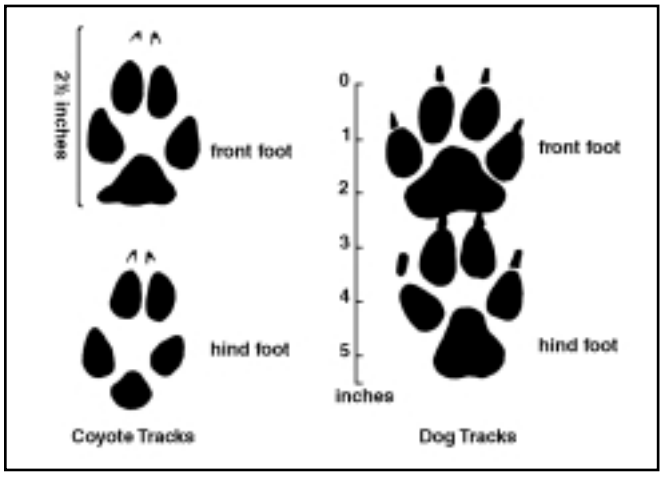


Figure 1.

Dirt Hole

The dirt hole set also must be close to the coyote's path, and placed so that the wind will carry the scent of the bait to the approaching coyote.

To make a dirt hole set, dig a slanting hole 3 to 5 inches wide and approximately 8 inches deep at the base of a grass clump or embankment. The trap should be placed 6 to 8 inches in front of the hole. A fetid bait is placed in the hole and lightly covered with dirt or grass. Any remaining dirt can be scattered away from the hole to make it appear that an animal has dug the hole.

Guided by the coyote sign present, the trapper should carefully examine the area for good trap sites. It is important with both the scent post and dirt hole sets that the traps be placed so that the animal will pass reasonably close to them. Good locations for these sets are the intersection of two or more trails, water holes, fence corners, pasture gates and stream crossings.

Trail Set

The blind or trail set is useful where coyotes are crawling under a fence, regularly traveling a certain trail, or have become wary of scent sets. The trap is set on the trail with small pebbles or sticks placed on each side of the trap to guide the animal into it. To increase the chances of a catch, two traps can be set with the trap pans about 10 inches apart and a guide stick placed on the trail between the traps. No scent or bait is used with the trail set. An excellent place for a trail set is where coyotes step over a rock, stick or any other object on the trail. A disadvantage of the trail set is the livestock and other wildlife using the trail may interfere with the trap.

Carcass Set

Coyotes, along with other animals, often feed on fresh carcasses. Traps set in the area of a carcass are effective. To avoid trapping non-target animals such as vultures, opossums, skunks, etc., the trap sets should be located along trails leading to the carcass but well away from it (several hundred yards to a half mile or more).

Traps

A variety of traps are available. Cage traps are generally ineffective. The most effective traps are the number three or four double spring leghold

with offset jaws (see Figure 2). Coil spring traps no smaller than a number three should be set for coyotes.

Stakes or drags must be attached to the traps to anchor the trapped coyote. Staking the trap is accomplished by attaching an 18-inch iron rod by a swivel to the trap spring or base with about 18 inches of chain. Drags should be attached to the trap with about 6 feet of chain, but length may vary depending on the type of terrain or other circumstances. Stakes and drags can be purchased through trapping supply companies or a farm and ranch supply store.

It is important that traps be kept clean and in good working condition. New traps have a thin coating of grease and must be cleaned before use. Boiling in water or setting the traps out to weather is usually sufficient to remove the grease. Old traps should be periodically cleaned by wire brushing and boiling to remove any odors, heavy rust, or dirt that may slow the action of the trap. During the cleaning process, traps can be simmered in log wood crystal dye or walnut and/or pecan leaves and hulls to help preserve them. Log wood crystals are available from trapping supply companies and directions for dyeing traps are on the packaging.

Setting Traps

The trapper needs some specific equipment. A good trapper's kit contains a kneeling or setting cloth, digging tools, hammer, screen dirt sifter, small whisk broom, pan covers, gloves and scent.

The setting cloth, about 3 feet square and made of canvas, is for the trapper to kneel on while setting the trap and for placing dirt on from the trap hole. Masonry hammers, small grubbing hoes, garden trowel and hatchets can be used for digging the trap hole. A dirt sifter used for covering the trap with dirt can be made from 1/4 inch hardware cloth in a wood or metal frame. Denim material, canvas, screen wire or plastic sandwich bags make good pan covers. The pan cover should be 5 1/2 x 7 inches in size for a number four trap, with a slit cut in one side for the trap trigger. The pan cover is necessary to keep dirt from getting under the trap pan, which would prevent the trap from springing. Pan covers vary in size depending on the trap size.

When trapping for coyotes, the leghold trap is always buried. Whether the trapper is making a scent post, dirt hole or trail set, the basics for setting the trap are the same. When the trap site is chosen, the trapper should kneel on the setting cloth to dig the trap hole and be careful to place the dirt on the cloth rather than scattering it around the trap site (see Figure 3). The trap hole should be about 5 inches deep and shaped to accommodate the trap. Double spring traps require a "V" shaped hole, while coil spring traps need a square hole.

When setting a double spring trap, depress the springs until the trap jaws can be opened fully. Then, while holding the jaws open with your foot, set the trigger mechanism by placing the trap dog (trigger) over the jaw and in the notch of the pan. The trigger can be adjusted so that the pan sits level and has minimum distance to travel before the trap throws. The trap springs must be turned back toward the trap dog in order for the front jaw to stay open.

After the hole has been dug and the trap mechanically set, the trap drag or stake is placed in the hole first. If a stake is used, it is driven into the ground with a hammer. If a drag is used, it is placed in the hole with the chain on top of the drag and covered with dirt until the hole is about 2 inches deep (see Figure 4). This dirt should be packed to provide a firm foundation for the trap. Place the trap in the hole, being sure that it is level and seated firmly so that it does not rock from side to side. If a coyote feels movement under the ground from an improperly seated trap as it steps up to investigate the scent or bait, it will most likely become suspicious and shy away from the set. The next step is to place the pan cover over the trap pan. Raise the front jaw of the trap and, sliding the pan cover under this jaw, place the notched end of the cover around the trap dog (see Figure 5). Cover the pan completely so that dirt cannot get under the pan. A small stick is helpful in positioning the pan cover. Now, using the dirt sifter, cover the trap with finely sifted dirt to a depth of approximately 1/4 to 1/2 inch (see Figure 6). Use the whisk broom or a stick to touch up and lightly pack the soil around the trap. The idea is to make the trap set appear as natural to the surrounding area as possible. Any remaining dirt on the setting cloth can be discarded some distance from the trap set.

The last step is to place the scent or bait behind the trap so that the coyote must step on the trap to smell the attractant (the attractant may be placed before covering the trap with dirt to make it easier to align with the trap pan). Small guide sticks can be placed over the trap springs to ensure that the coyote will step on the trap pan.

When working with trap shy coyotes, the trapper may want to wait a day or two after setting the traps before adding the attractant. This extra time will allow most of the trapper's scent to disperse. With wary coyotes, guide sticks should be eliminated as they tend to make the animal suspicious.

Other wildlife is also attracted to the scent or bait used to trap coyotes. To avoid trapping non-target animals such as opossums, raccoons, skunks, badgers, etc., under-pan springs can be used to increase the amount of pressure required to throw the trap. The under-pan spring fits on the base of the trap and provides tension to the underside of the trap pan. This allows the trap to throw under the weight of a large predator, but keeps smaller animals from being caught.

For more information and assistance, contact the nearest office of the Texas Wildlife Damage Management Service.

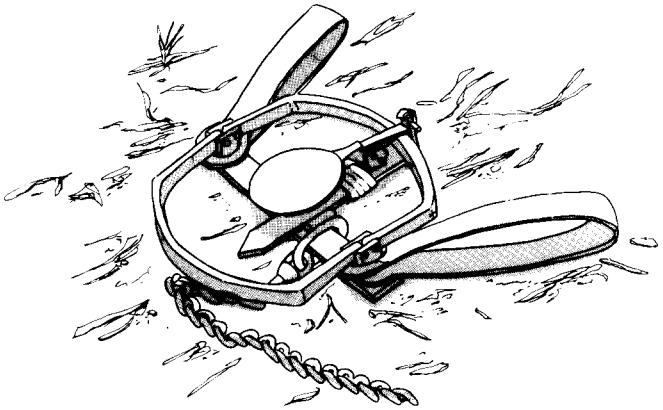


Figure 2

Figure 3

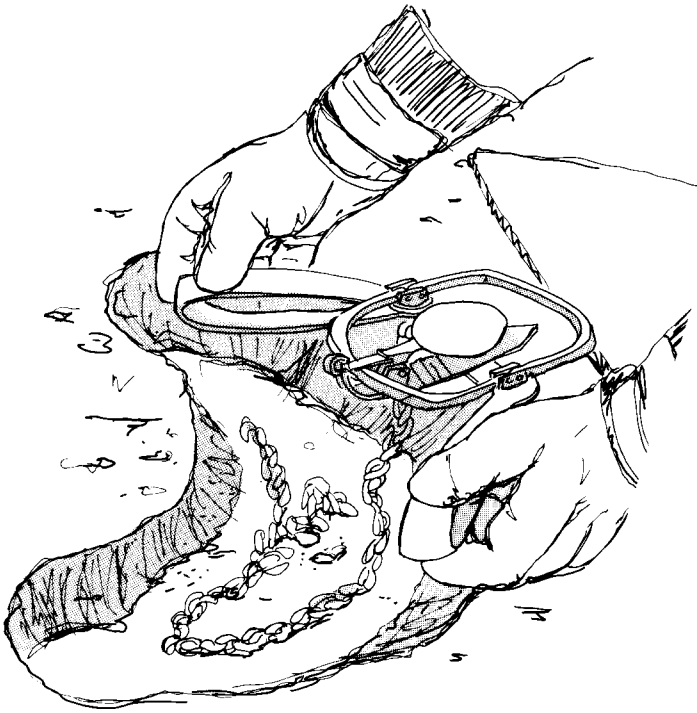


Figure 4

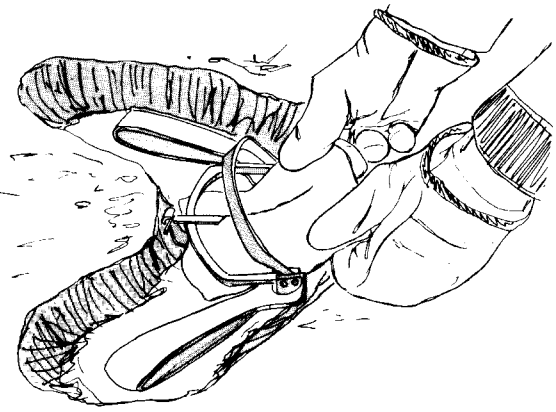


Figure 5

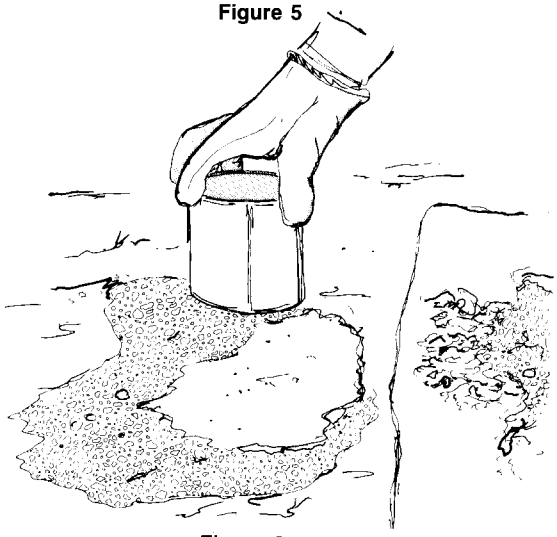


Figure 6

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WILDLIFE DAMAGE MANAGEMENT

Controlling Coyotes with Snares

Snares are relatively simple devices that can be used effectively in certain situations to trap coyotes (*Canis latrans*). A snare consists of a wire loop with a locking device that tightens around the animal's body as it passes through the loop (see Figure 1). Snares are most commonly set where the coyotes are crawling under a fence, but they can also be set in trails in the brush, or at a den entrance. The device is looped in such a manner that the animal must put its head through the loop as it passes through the restricted area. Once the snare is around the animals neck or body, the more the animal pulls, the tighter the snare gets.

Snares used in predator control are made of flexible cable and are either 1/16 inch, 3/32 inch or 5/64 inch in diameter. The length of snares varies, but they are usually between 32 and 48 inches long. The snare should be long enough to allow the trapper to attach the end with the swivel to a firm object or drag, with enough of the cable left to make a loop from 8 to 10 inches in diameter. To use snares effectively, it is necessary to know as much as possible about the coyote's habits.

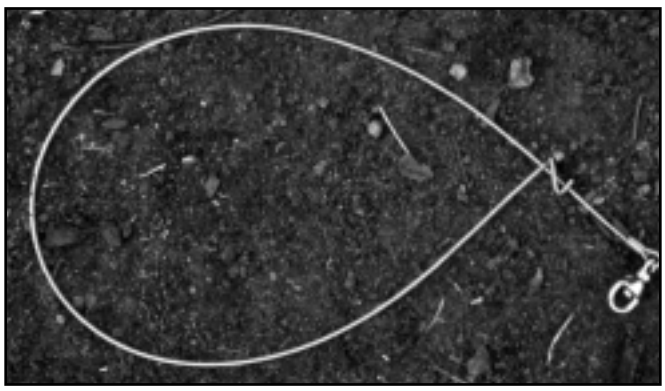


Figure 1.

Habits

Like most animals, coyotes are creatures of habit. They are most active at night and in the early morning and late evening hours. They rely on their acute sense of smell and keen eyesight for hunting prey and avoiding possible danger. Coyotes establish regular travel routes in the area in which they live. These routes are usually along ranch roads, livestock trails, canyons, ridges, or any other place that offers good visibility and easy travel. A trapper can find these travel routes by looking for coyote signs such as tracks or droppings.

Coyote tracks are similar to dog tracks, but it is possible to distinguish between the two. Dog tracks are round with the toes spread apart and are usually larger than coyote tracks. Toenail marks are usually visible on all toes. Coyote tracks are more rectangular with the toes closer together. If any toenail marks show at all, they are usually on the middle two toes (see Figure 2). Also, coyote tracks appear more in a straight line, while those of a dog are somewhat staggered.

Coyote droppings, also called scat, contain animal hair and bone fragments. This readily distinguishes a coyote's droppings from those of domestic dogs that have been eating table scraps or dog food. Fresh coyote scats are black, but turn gray or white as they weather.

Equipment

One advantage of using snares is that only a minimum amount of equipment is needed. A trapper needs a supply of snares that have been cleaned and are ready to be placed in the field. To prepare snares for the field, place them in the open air for aging; this technique helps to remove the oil on the cables. Snares also can be boiled for 1/2 hour in a mixture of 1/2 pound of baking soda per 3 gallons

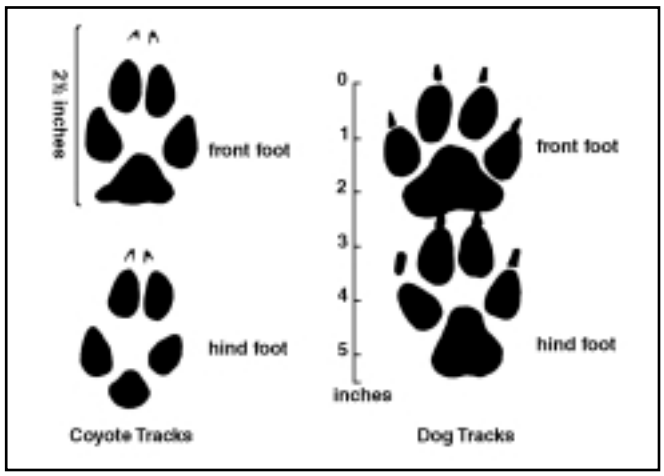


Figure 2.

of water. Trap dye or wax may also be added if desired.

A pair of clean gloves is recommended. The use of gloves helps reduce the amount of human odor on the snares. Well fitting cotton or knit gloves are usually preferred since they can be laundered. In addition, the trapper will need some heavy wire, such as bailing wire, to anchor the snare to the fence or drag, and small thin wire or sewing thread to hang the snare. The only other equipment needed is a pair of pliers capable of cutting and bending the wire.

Location of the Set

Snares work best when set in holes through or under netwire fences where coyotes are entering and leaving a pasture. Signs such as tracks, hair on the fence, or digging will indicate coyote crawls.

Snares may be used where there are barbed-wire fences. While some coyotes may go through the fence between the wire strands, many will dig a crawl under the bottom strand of the fence. Coyote crawls under fences often can be located by following their trails through the brush or grass leading up to the fence. Care should always be taken when using snares to avoid trapping non-target animals such as rabbits, deer, javelinas, armadillos, etc.

Making the Set

The swivel end of the snare should be firmly attached to the bottom strand of the fence or to a drag, such as a heavy log. Some trappers prefer to use a drag instead of attaching the snare to the fence because once caught, the coyote will pull the drag away from the fence and keep the trap site from being disturbed. Although the loop size varies, it should usually be between 8 and 10 inches in diameter when set. If the loop size is too small, the snare may be knocked down when the coyote crawls under the fence. The snare should be positioned directly under the fence. The top of the loop should be attached to the fence by means of a small, thin wire or a single strand of sewing thread (see Figure 3). This will help keep the snare in the proper upright position, but allow it to be released with the slightest pull.

Checking the Set

It is best to check snares on a daily basis. Although a snare is designed to kill an animal if it closes around the animal's neck, it is possible to catch a coyote around its body. If this happens the animal may eventually pull and chew on the cable enough to break it. Checking snares daily often will prevent the trapper from losing the coyote.

When checking the snare, approach the set only close enough to see if a coyote has been caught or if the snare is still in place. This will minimize disturbance at the set location.

After a coyote has been caught, a new snare should be used at the trap site. Once caught a coyote usually will bend and twist the cable and the snare so that it cannot be used again. However, the swivel and locking device can be removed and used on another snare.

For more information and assistance, contact the nearest office of the Texas Wildlife Damage Management Service.


Figure 3.

The Texas Wildlife Damage Management Service is a cooperative program involving the Texas Agricultural Extension Service, United States Department of Agriculture–Animal and Plant Health Inspection Service–Wildlife Services.
2M, Reprint WM4

FACTSHEET

Wildlife Services

United States Department of Agriculture

Animal and Plant Health Inspection Service

June 1999

The Livestock Protection Collar

Coyotes are the leading cause of predation losses in the sheep and goat industry. The livestock protection collar (LPC) is a wildlife damage management tool used by the Wildlife Services (WS) program of the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) to protect sheep and goats in fenced pastures from depredating coyotes. The collar is the most selective method available to manage coyote predation on goats and sheep and can only be used by specially certified LPC applicators.

The LPC consists of a bladder filled with a 1 percent solution of Compound 1080 (sodium fluoroacetate) and attached to Velcro™ neck straps. This collar is attached to the neck of sheep and goats. When attacking livestock, coyotes frequently bite a sheep's or goat's throat where the toxicant-filled rubber bladder is positioned. One advantage of using the LPC is that only the coyote that is actually attacking the sheep or goat is killed. Other coyotes that may not be killing livestock are unaffected.

The LPC is registered by the Environmental Protection Agency (EPA), and WS personnel who use them must be certified through the State pesticide regulatory agency. LPC applicators must follow all label directions and use restrictions set forth by the EPA.

The collar is one of many tools available to WS for predator management. WS employees consider all methods in deciding how to solve a specific damage situation with the goal of developing the most cost-efficient and biologically sound management plan.

LPC Mode of Operation

When a coyote attacks a collared animal and bites the collar, the coyote receives a dose of toxicant in its mouth. The median toxicant dose received by attacking coyotes is approximately 0.65 mL of Compound 1080 solution, or 6.5 mg of sodium fluoroacetate (the active ingredient).

Within 2 to 9 hours of receiving a dose through the mouth, the coyote will die a painless death from cardiac failure or central nervous system failure. The average coyote dies about 4.8 hours after puncturing a collar.

Environmentally Safe

Sodium fluoroacetate is the sodium salt of fluoroacetic acid and a naturally occurring compound in the environment. It is a chemically stable, nonvolatile compound and is relatively insoluble in most organic solvents.

Should sodium fluoroacetate spill during a predator attack, the compound is degraded by soil microorganisms. Accumulation of the toxicant in plants is limited, as plants produce enzymes capable of degrading sodium fluoroacetate.

The toxic contents of LPC's are dyed yellow and easily detected when spilled. Contaminated soil can be scooped up with a shovel according to the directions on the pesticide label. However, should a spill go undetected, the toxicant will be degraded in the soil.

Nontarget Hazards

WS employees use their expertise in animal behavior patterns and biology to determine the risk to nontarget animals. WS employees recommend using LPC's only where the risks to nontarget animals are negligible.

Secondary poisonings do not occur because the bodies of poisoned coyotes contain only nontoxic, trace levels of the toxicant. In research conducted by WS, scavenger species were given tissues from coyotes killed with sodium fluoroacetate to eat and showed no negative effect.

No known nontarget poisonings have resulted from the use of LPC's containing sodium fluoroacetate. Animal species vary widely in their response to sodium fluoroacetate, with primates and birds the least sensitive and carnivores the most susceptible. Fish show no sensitivity to the toxicant.

Livestock carcasses contaminated with toxicant on the wool or hair near punctured collars may pose a risk to scavengers. However, in research studies with dogs, skunks, magpies, and eagles that were allowed to feed on contaminated carcasses, these species were not adversely affected because they would not eat the contaminated wool or hair.

Wildlife Services Program

A Federal service program that shares costs with cooperators, WS is authorized by Congress to manage wildlife damage as stated in the Animal Damage Control Act of March 2, 1931.

The employees of WS recognize that wildlife is an important public resource greatly valued by the American people, and they conduct their wildlife damage management programs accordingly.

Additional Information

For more information about this and other WS programs, or to find out how to request assistance from your WS State office, contact the WS Operational Support Staff at (301) 734–7921 or write to:

USDA, APHIS, WS
4700 River Road
Unit 87
Riverdale, MD 20737

You can also find information on WS programs on their Website (http://www.aphis.usda.gov/ws).

EXTENSION OVERVIEW

Dr. Terry A. Gipson

Interim Goat Extension Leader

The year 2000 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 and national 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 fourth annual meat buck performance test and various goat workshops on artificial insemination and on internal parasite control.

Goat Field Day

Last April 29, Langston held its fifteenth annual Goat Field Day to inform and educate potential, novice and veteran goat producers. A total of 145 participants attend the Goat Field Day and the theme was "Goats in the Twenty-First Century". For the morning session, Mr. Vincent Maefsky of Poplar Hill Dairy Goat Farm in Scandia, MN discussed his personal odyssey in the dairy goat industry, Mr. Marvin Shurley, president of the American Meat Goat Association and a meat goat producer from Sonora, TX, discussed the meat goat industry; and Dr. Donald Huss, Texas Cashmere Association and a cashmere producer from Menard, TX, discussed the cashmere industry. For the afternoon session, Mr. Robert York of the National Livestock Producers Association discussed the National Sheep Industry Improvement Center's loan program; Dr. Nancy Roberts of the USDA APHIS (OKC office) discussed the proposed regulations on interstate movement of sheep and goats to control scrapie; and Mr. Gary Bledsoe of the Oklahoma Department of Agriculture discussed the OK agricultural diversification loan program, Dr. Steve Hart discussed control of invasive plant species using goats, and the morning speakers formed a panel roundtable. Dr. Lionel Dawson was unable to conduct the basic goat management workshop and Dr. Tulio Prado conducted the workshop in his place. Mr. Tim McKinney supervised the youth program.

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. The Langston DHI program is unique in that it is the only DHI laboratory in the United States that analyzes milk samples with goat milk standards for fat, protein and somatic cell count. All other DHI laboratories use cow milk standards to analyze goat milk. 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.

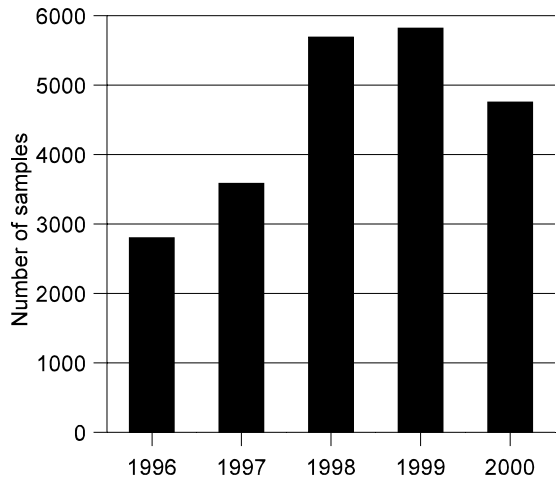


Figure 1. Number of goat milk samples analyzed

The Langston DHI program has been very popular with dairy goat producers and has grown significantly since its establishment in 1996. Figure 1 shows the growth of the DHI lab in terms of number of samples processed. The slight downturn in 2000 is because one very large herd elected not to performance test last year. Currently we have 60 herds from 27 states enrolled in the Langston Goat Dairy DHI Program.

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 Goat Newsletter in 2000. Interest in the newsletter has grown and we currently have over 3,000 subscribers to our free quarterly Goat Newsletter.

Grazing Demonstration

A field demonstration was conducted using goats to control sericea lespedeza, an invasive plant that is infiltrating the native range in the Flinthills, choking out the grasslands that are a major land and economic resource. Sericea lespedeza infestation will reduce carrying capacity to of native range to zero animals/acre. Stocker goats made significant progress in controlling sericea lespedeza. Stocker goats utilized over 70% of the sericea biomass. Sericea lespedeza made up 80% of the goats diet in mid-season and 25% later in the season when little lespedeza was available. Grazing with goats reduced seed production from 980 seeds/ramete to less than 1 seed/ramete. As a result, the seed bank was reduced from 5,500 seeds to 3350 seeds/m^2. Germination of seeds in the seedbank was increased from 14.5% to 64% due to grazing by goats which will accelerate attrition of the seedbank and facilitate control. Stocker goats gained 10 kg during the summer grazing season. This resulted in a net profit of $5.00/hd or $20.00 per acre while controlling sericea lespedeza. In addition, goats were effective at controlling red cedar, sumac, honey locust, plum and blackberry. A field day was held to show producers (86 in attendance) the results of the demonstration. Results of the demonstration were also presented a Lespedeza conference in Oklahoma (attended by 120 producers) and two lespedeza conferences in Kansas (total attendance of 180 producers). The results have been presented in a number of producer results and as an abstract at a national meeting.

In another field demonstration in which the Army Corps of Engineers was a collaborator, goats were used to provide vegetation control. Due to budgetary cuts, the Corps has less money for vegetation management and some areas have been overrun by brush and other woody species to the extent that it is no longer able to be rented for pasture. It is also too dense for good wildlife habitat. Grazing for one year with goats resulted opened up the cover to be ideal habitat for wildlife. Deer and quail were observed to take up residence the year after grazing with goats. As a result of this grazing demonstration, the Corps and producer plan a larger study the next year.

Artificial Insemination Workshop

On September 9, 2000, an *Artificial Insemination* workshop was held at Langston University. Participants learned how to synchronize and detect estrus and how to artificially inseminate does. They also learned about the collection, processing, care and storage of semen. Nineteen participants enrolled for the workshop. In the morning session, Dr. Terry Gipson gave a presentation on basic reproductive anatomy and physiology. Dr. Lionel Dawson of Oklahoma State University then lectured on estrus detection and synchronization. Mr. Les Hutchens of Reproductive Enterprises, Inc. in Stillwater, OK displayed the intact female reproductive tract and the anatomy was re-discussed. Mr. Hutchens also discussed the A.I. equipment, especially the French gun and sheaths. After the morning break, Mr. Hutchens discussed the contents of an A.I. kit. After a lunch of goat sausage, baked beans, potato salad and goat milk ice cream, the participants were guided through semen handling and liquid nitrogen tank maintenance by Mr. Hutchens. Afterwards, participants were able to inseminate some Alpine does that had been synchronized using Synchromate-B and PG-600. After several hands-on inseminations with the live animals, participants were given the opportunity to ask questions of the presenters.

In an effort to move the university to the producers, Langston University conducted it's first ever hands-on artificial insemination workshop off-campus in Tahlequah, OK on September30, 2000. Ten participants attended the artificial insemination workshop at the Cherokee County Fairgrounds host by Ms. Candice Howell, Langston University Youth Specialist. The same format and personnel were involved in the Tahlequah workshop as in the Langston workshop except that Mr. Mark Mouttet replaced Mr. Les Hutchens.

Controlling Internal Parasites Workshop

On Saturday, June 3, 2000 a workshop on *Controlling Internal Parasites* was held at Langston University. Seven participants attended the hands-on workshop. In the morning session, Dr. Lionel Dawson of Oklahoma State University lectured on the parasites that infect goats, their life cycles and various anthelmintics those goat producers can use. After a lunch of goat sausage, baked beans, potato salad and goat milk ice cream, the participants were guided through the collection of fecal samples and their preparation for counting by Dr. Terry Gipson. The participants then collected fecal samples from Angora does and they conducted fecal egg counts. Eight microscopes were provided for the participants to use in the fecal egg counts. Included in the registration fee was a McMaster counting chamber which is used to determine fecal egg counts.

Boer Goat Judging School

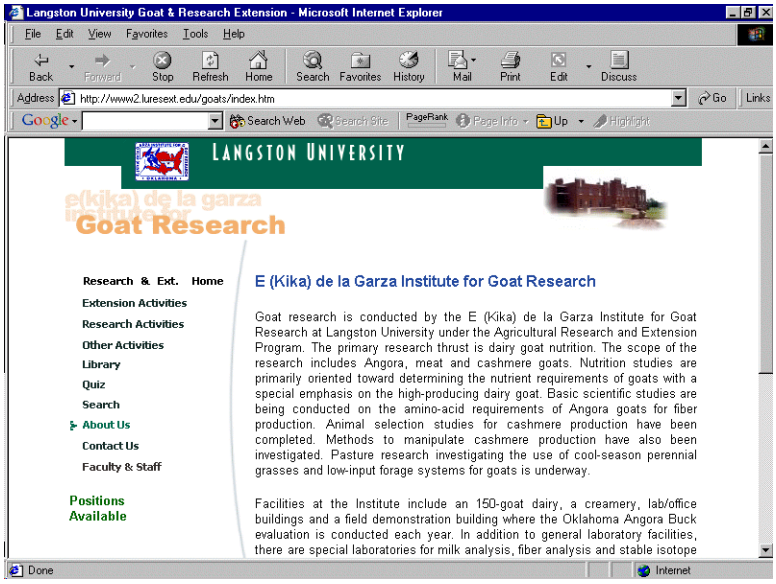
On June 19, Langston University held a two-day Boer Goat Judging School. Messrs. Stephanus Malan and P.B. "Syce" Botha, South African Boer Goat judges, were the instructors for the school. Six participants attended the school that was sponsored by Langston University, American Boer Goat Association and Oklahoma Boer Goat Association

Junior Oklahoma Boer Goat Association Show

Following the midpoint report of the buck performance test, at 12:00 (noon) the Junior Oklahoma Boer Goat Association held their annual fund-raising show at Langston University. There were 42 entries with 18 exhibitors with 4 classes of does, 3 classes of wether market goats, and 2 buck classes. The were also 3 classes of showmanship. The judges for the show were Dr. Terry Gipson, Mr. Jim Daniel and Mr. Wiley Robison. The JOBGA show was a huge success and the JOBGA was very appreciative of the major role that Langston University played in providing the opportunity for the youth of Oklahoma to gain experience in showing and exhibiting livestock.

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 two 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. Contents of the Photo Album include photos of the 2000 Field Day, Dr. Roger Merkel's recent trip to Ethiopia, the recent conference on

the Opportunities and Challenges of Enhancing Goat Production in East Africa, and the 7th International Conference on Goats held in Tours, France earlier this year. 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.

Tulsa State Fair

At the 2000 Tulsa State Fair, Langston University participated in the Birthing Center program with three pregnant Spanish does. Dr. Carey Floyd of the Oklahoma Department of Agriculture coordinated the birthing center and said that the goats were the highlight of the center. The three does gave birth to two sets of twin and a single. This was a huge success and plans are underway to provide pregnant does for 2001.

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 the 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 fourth annual meat buck performance test started May 5, 2000 started at the South Barn complex of Langston University with 34 bucks enrolled from nine different breeders. Thirty-three of the bucks were fullblood Boers and one Kiko buck. Twenty-five bucks were from Texas, eight from Oklahoma and one from Tennessee. The test was open to purebred and crossbred bucks born between December 1, 1999 and March 31, 2000.

Bucks were given a thorough physical examination by Dr. Lionel Dawson, dewormed with Safeguard (fenbendazole), foot bathed with Nolvasan 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. All bucks were retagged by Extension staff after admission to the performance test. Four weeks after check-in, all bucks were given a booster vaccination for enterotoxemia and caseous lymphandinitis. Bucks are routinely monitored for internal parasites using fecal egg counts.

Entrance weight for the 34 bucks averaged 53.5 lb with a range of 37.2 to 71.6 lb. The average age was 92 days with a range from 77 to 155 days.

Adjustment Period

All bucks underwent an adjustment period of eighteen days immediately after check-in. During the adjustment period, bucks were acclimated to the test ration and to the Calan feeders. Nine bucks were assigned to each 20' × 20' inside pen equipped with nine Calan feeders. Each pen also had a 20' × 20' outside run. The inside and outside pen space is separated by an overhead door which can be raised or lowered as the weather dictates. Every other pen was also equipped with a fan to circulate air in the barn complex whenever needed. The grass in the outside pens was mowed often, and grazing was negligible. Each buck wore a collar with an electronic "key" encased in hard plastic. The key unlocks the door to only one Calan feeder, thus enabling the buck to eat out of his individual feeder. Each morning, yesterday's feed that remains in the Calan feeder is weighed and removed from the Calan feeder. Fresh feed is weighted and placed into the Calan feeder. The difference in weights between the fresh feed place in the Calan feeder one morning and the remaining feed the next morning is the amount consumed. Because only one goat is capable of opening the Calan door and eating, it is possible to calculate the feed intake of the individual bucks. The area immediately around the Calan 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 a float-valve raised waterers. Weights at the beginning of the test averaged 57.1 lb with a range of 41.9 to 95.8 lb.

Diet

The following diet was formulated by a nutritionist at Langston University. 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 unchanged from that 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 calculated CP content of the diet is 16% with 2.5% fat, 20.4% fiber, and 60.6% TDN. Ca, P, and Na levels are 0.74, 0.37, and 1.07, respectively. Zn is 33 ppm, Cu, 17 ppm, and Se 0.21 ppm.

Unfortunately, on 6/11/00, Buck #827 was found dead in his pen. The body was taken to Oklahoma State University's Diagnostic Laboratory. The post mortem report indicated that the animal had died of bloat. No other animal has shown any sign of major illness and to date the health problems of the bucks on-test have been minimal.

Changes for 2000

In 1999, the American Boer Goat Association approached Langston University and the Oklahoma Meat Goat Association with the desire to designate the Oklahoma meat buck performance test as an ABGA Approved Performance Test. To qualify, the Oklahoma meat buck performance test needed to lengthen the time on test from 10 weeks to 12 weeks. Langston University and the Oklahoma Meat Goat Association agreed to lengthen the performance test to 12 weeks.

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 (0.3) pounds per day to be awarded any points.

Gain

Average weight at the end of the test was 102.2 lb with a range of 79.3 to 136.6 lb. Average gain for the test was 45.2 lb with a range of 26.4 to 56.1 lb.

Average Daily Gain (ADG)

For the first half of the test, the bucks gained on averaged 0.59 lb/day with a range from 0.31 to 0.76 lb/day.

Feed Efficiency

For the test, the bucks consumed an average of 320.0 lb of feed with a range of 207.9 lb to

408.7 lb. For the test, the bucks averaged a feed efficiency of 7.2 (feed efficiency is defined as the number of lb of feed needed for one lb of gain), with a range of 5.5 to 9.4.

Muscling

The average loin eye area as determined by ultrasonography was 1.54 square inches with a range of 1.01 to 2.23 square inches and the average right rear leg circumference was 8.9 inches with a range of 7.5 to 10.0 inches.

Index

For 2000, 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:

$$\frac{\text{area of longissimus muscle (loin)}}{BW^{0.75}}$$

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:

$$\frac{\text{circumference of hind left leg}}{BW^{0.75}}$$

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 indexes above 100% and those below average have index scores below 100%.

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, Messrs. Jerry Hayes and Bill Snelling of Langston University for their management and oversight of the day-to-day activities, Dr. Fred Ray of Oklahoma State University for conducting the ultrasound measurements

for the lion eye area, Mr. Les Hutchens and his associates at Reproductive Enterprises, Inc. for conducting the breeding soundness exams, and Stillwater Milling for custom mixing the feed.

Rank	ID	Index Score	Start Wt (lb)	End Wt (lb)	Gain (lb)	ADG (lb/day)	Feed Intake (lb)	Feed Efficiency (*)	Loin Eye Area (in^2)	Rear Leg Circum. (In)
1	845	101.2	44.1	98	53.9	0.76	294.6	5.5	1.16	8.2
2	849	101.1	52.9	109	56.1	0.72	364.8	6.5	1.98	9.3
3	858	101.0	43	90.3	47.3	0.67	281.9	6.0	1.58	7.5
4	848	100.9	50.7	106.8	56.1	0.70	354.9	6.3	1.60	10.0
5	859	100.8	43	93.6	50.6	0.63	318.1	6.3	1.76	7.5
6	854	100.6	51.8	102.4	50.6	0.61	334.8	6.6	1.95	8.9
7	831	100.6	41.9	83.7	41.8	0.54	247.4	5.9	1.58	7.5
8	855	100.6	45.2	94.7	49.5	0.61	316.1	6.4	1.70	8.2
9	850	100.5	45.2	92.5	47.3	0.62	302.6	6.4	1.45	8.4
10	857	100.5	52.9	102.4	49.5	0.67	333.9	6.7	1.51	7.5
11	828	100.4	73.8	120	46.2	0.65	347.5	7.5	2.22	9.5
12	851	100.4	47.4	102.4	55	0.68	363.3	6.6	1.30	8.6
13	842	100.3	55.1	100.2	45.1	0.60	301	6.7	1.56	10.0
14	847	100.3	54	100.2	46.2	0.62	336.3	7.3	1.77	9.5
15	836	100.3	49.6	99.1	49.5	0.62	341.1	6.9	1.55	9.5
16	838	100.2	63.9	113.4	49.5	0.65	362.4	7.3	1.73	9.5
17	840	100.1	74.9	125.6	50.7	0.68	408.7	8.1	1.93	9.5
18	832	100.0	52.9	92.5	39.6	0.46	235.7	5.9	1.54	8.2
19	852	100.0	59.5	109	49.5	0.61	359.6	7.3	1.55	8.9
20	844	99.8	68.3	112.3	44	0.61	349.4	7.9	1.69	9.8
21	830	99.7	66.1	111.2	45.1	0.60	349.3	7.7	1.54	9.8
22	846	99.6	52.9	92.5	39.6	0.45	273.6	6.9	1.55	9.1
23	853	99.6	48.5	92.5	44	0.49	268.6	6.1	1.01	8.6
24	856	99.6	44.1	79.3	35.2	0.44	207.9	5.9	1.07	7.7
25	839	99.4	58.4	98	39.6	0.55	301.3	7.6	1.23	9.8
26	843	99.4	63.9	104.6	40.7	0.57	336.9	8.3	1.42	9.3
27	837	99.3	51.8	90.3	38.5	0.54	298.3	7.7	1.16	9.3
28	835	99.3	66.1	109	42.9	0.60	373.6	8.7	1.45	9.5
29	829	99.2	62.8	102.4	39.6	0.54	317.1	8	1.16	8.4
30	826	99.1	95.8	136.6	40.8	0.52	369.2	9.1	2.23	8.4
31	834	99.0	66.1	104.6	38.5	0.52	319.5	8.3	1.32	9.1
32	841	99.0	66.1	107.9	41.8	0.55	342.2	8.2	1.06	9.3
33	833	97.8	70.5	96.9	26.4	0.31	249.3	9.4	1.39	8.2
AVG		100	57.1	102.2	45.2	0.59	320.0	7.2	1.54	8.9

* lb of feed for one lb of gain.

The proper citation for this article is:

Gipson, T. 2001. Extension Overview. Pages 98-107 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

RESEARCH INTRODUCTION

A general overview of recent research activities can be derived by viewing of the following sections on USDA/CSREES RESEARCH PROJECTS, INTERNATIONAL PROJECTS, ABSTRACTS, ARTICLE SUMMARIES, and EXPERIMENTS.

Most international projects outlined are composed of intertwined, interrelated, and complementary research, extension, and education activities. In addition to the ongoing projects with two Ethiopian institutions, a large multinational project in the Middle East has commenced. In this 5-year project, the Institute will provide technical expertise and overall project management and coordination. A number of proposals for research or research and extension projects have been developed and submitted to agencies such as the USDA for funding consideration. Titles of some of recent proposals are:

- √ Meat Goat Sire Central Performance Testing - Current Efficacy and Future Enhancement
- √ Effects of Growth, Genotype, and Diet on Metabolism in Meat Goats
- √ Effects of Stress on the Health and Production Efficiency of Dairy Goats
- √ Improving Goat Profitability by Changing Fat Deposition
- √ Effect of Supplemental Trace Minerals and Vitamins on Sperm Production and Morphology in Dairy Goats
- √ Splanchnic Tissue Metabolism in Meat Goats
- √ Enhanced Goat Production Systems for the Southern United States

Hopefully, some of these proposals will be successful so that new projects can be implemented in the next year. Obtaining outside funds for research and extension projects is necessary to maintain a strong program and hopefully to make it even better.

The article summaries presented are for papers that have been published in 2000 and also for a few that have been accepted for publication (In Press) and will be in print in 2001. Abstracts pertain to research presentations that have been or will be given at scientific meetings in 2001 (Southern section and national American Society of Animal Science).

As is noted on the title page for the section on experiments, the studies listed have been recently conducted, are in progress, or are being planned for the near future. Although, there may also be other trials conducted that have not yet been thought of or outlined. Besides these experiments, there are some from last year with samples currently undergoing laboratory analyses and others for which articles are undergoing review for publication in various scientific journals.

Standard Abbreviations Used

BW = body weight
cm = centimeters
CP = crude protein
d = day
dL = decaliter
DM = dry matter
DMI = dry matter intake
g = gram
kg = kilogram
L = liter
M = mole
mL = milliliter
mm = millimeters
mo = month
ng = nanogram
NDF = neutral detergent fiber
OM = organic matter
P = probability
SE = standard error
TDN = total digestible nutrients
wt = weight
vol = volume
vs = versus
μ = micro

The proper citation for this article is:

Goetsch, A. 2001. Research Introduction. Pages 108-109 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

USDA/CSREES RESEARCH PROJECTS

Title: **Goat Nutrient Requirements, Management Practices, and Production Systems**

Support: Evans-Allen

Period: 2001-2006

Objective: Study goat nutrient requirements, management practices, and production systems 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: **Seasonal Manipulations to Improve Cashmere and Meat Returns in Goats**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1997-2001

Objectives: Quantify the natural seasonal cycle of cashmere growth

Quantify the response in fiber growth and breeding cycles of two methods of melatonin treatment applied in April

Determine whether shedding, following the cessation of a spring melatonin treatment, can be prevented by the suppression of plasma prolactin concentration.

Title: **Exogenous Hormone and Nutritional Manipulation to Increase Fiber Production**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1997-2001

Objectives: Investigate the interactions among growth hormone, insulin-like growth factor I, insulin, and thyroid hormones in mohair growth and skin metabolism

Define the role of growth hormone in skin metabolism and mohair growth and determine whether growth hormone has the potential to improve mohair production and quality

Title: **Enhancing Browse Utilization by Goats**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1997-2001

Objectives: Investigate the chemical composition and potential nutritive value of browse, with emphasis on the tannin content, type, and limitation to digestion

Explore relationships among supplemental polyethylene glycol, tannin content in forage, and forage utilization by ruminants in order to increase intake of tannin-containing forages

Title: **Postruminal Nitrogen Supply for Fast Growing Meat Goats**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1998-2002

Objectives: Determine the level of dietary crude protein required for fast growth of goat kids differing in growth potential

Determine the influence of both level and source of supplemental protein on ruminal fermentation, postruminal nitrogen supply, and performance of young meat goat kids

Determine the influence of dietary level of ruminally undegraded protein on ruminal fermentation and postruminal nitrogen supply, as well as performance of kids differing in growth potential

Determine the complementary nature of different sources of ruminally undegraded protein on postruminal amino acid supply, as well as performance of kids differing in growth potential

Title: **Nutrient Requirements of Goats: An Update and Reevaluation**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1998-2002

Objective: Compile and review literature experiments published since NRC (1981) concerning nutritional requirements of goats in order to update and reevaluate exisiting requirement recommendations and(or) develop more appropriate and accurate alternate systems

Title: **Metabolic Changes Affecting Utilization of Poor Quality Diets by Goats**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1999-2002

Objective: Determine influences of supplementation of poor-quality forage diets with rumen-protected betaine on energy and nitrogen metabolism in goats

Title: **Sustainable Dairy Goat Milk Production from Forages**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1999-2002

Objectives: Study milk production, composition, animal health, and inputs for a grass-based dairy system as compared with a conventional confinement dairy.

Determine the response in milk production of grass-based dairy goats to different levels of concentrate supplementation.

Model the effect of pasture intake and concentrate supplementation on milk production and change in body weight.

Title: **Quality Characteristics and Yield Predictive Models of Goat Cheeses**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1999-2002

Objectives: Determine the effects of milk composition and somatic cell counts on the quality and yield of goat cheese and develop yield predictive models for goat cheeses (French soft, Colby, and Mozzarella).

Characterize Colby or Mozzarella cheeses in terms of composition, microstructure, rheological properties, protein profiles, and sensory characteristics as affected by seasonal variations of milk composition and property changes during cheese storage.

Title: **A Calorimetry System for Study of Small Ruminant Pastoral Energetics**

Support: National Research Initiative Competitive Grants Program, Equipment Grant

Period: 1999-2001

Objectives: Install a four-animal calorimetry system, indirect, open-circuit calorimetry system

Use a calorimetry system in conjunction with other techniques to determine energy expenditure by goats with different grazing/browsing conditions

Title: **Energy for the Productive Caprine**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 2000-2003

Objectives: Quantify energy requirements of goats for:

Maintenance
Live weight gain or growth
Gestation with single, twin, or triplet kids
Lactation
Mohair fiber growth

Title: **Diet Selection and Performance by Sheep and Goats Grazing Mixed Pastures**

Support: 1890 Institution Teaching and Research Capacity Building Grants Program

Period: 1997-2001

Objectives: Measure growth of kids and lambs grazing pastures containing a complex mixture of grasses and forbs, and pastures alley cropped with mimosa

Determine the quality and productivity of mimosa as browse in pastures co-grazed with goats and sheep

Study the interaction between stocking rate and time in affecting quantity and quality of the major botanical components, animal weight gain, and diet selectivity

Determine the most suitable stocking rate that provides the highest total gain per unit land area with the least amount of change in botanical composition

Title: **The Detection of Mastitis in Dairy Goats**

Support: Oklahoma Applied Research Support (OARS) Program/Oklahoma Center for the Advancement of Science and Technology (OCAST)

Period: 2001-2003

Objectives: Extensively test various mastitis detection assays that were developed for the bvine dairy industry to determine the applicability of those methods to detect mastitis in dairy goats

Determine the suitability of mastitis detection methods for use as a regulatory standard to monitor milk quality and goat udder health under field conditions

Title: **Use of Goats for Sustainable Vegetation Management in Grazing Lands**

Status: Full proposal under review

Support: Sustainable Agriculture Research and Education Grant Program

Period: 2001-2004

Objectives: Investigate effects of various goat management methods for vegetation rehabilitation or control in different grazing land settings in the south-central U.S.

Demonstrate and display appropriate means of vegetation management with goats, as well as to provide education in other related management areas

Develop an information package on optimal use of goats for grazing land vegetation management to ensure long-term, sustainable, and widespread project impact

The proper citation for this article is:

Goetsch, A. 2001. USDA/CSREES Research Projects. Pages 110-114 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

INTERNATIONAL PROJECTS

Title: **An Institutional Partnership to Enhance Food Security and Income Generating Potential of Families in Southern Ethiopia Through Improved Goat Production and Extension**

Support: Association Liaison Office for University Cooperation in Development-USAID, Partnering with Higher Education for International Development

Collaborator: Awassa College of Agriculture of Debub University in southern Ethiopia

Objectives: Establish ties between Langston University and Debub University

Increase the research and extension capabilities of Debub University staff

Establish women's groups for goat production

Enhance the internationalization, culture diversity, and gender relevance at Debub University and Langston University

Title: **Enhancing Institutional Research and Extension Capabilities for Increased Food Security Through Improved Goat Production**

Support: United Negro College Fund-USAID International Development Partnership Activity

Collaborator: Alemaya University in eastern Ethiopia

Objectives: Improve the research, teaching, and extension capabilities of Alemaya University staff, allowing it to better serve the developmental needs of the surrounding region

Establish a development project to enhance household food production, income and health status through targeting increased goat productivity and women in development by providing goats and appropriate technology to women's groups for goat production

Increase Langston University's international involvement and development impact

Internationalization of Langston University staff to increase awareness of foreign countries, cultures, gender relevance, and development issues

Title: **Anthelmintic Plants for Internal Parasite Control in Goats**

Support: USDA Scientific Cooperation Program

Collaborator: Awassa College of Agriculture of Debub University in southern Ethiopia

Objectives: Evaluate efficacy of anthelmintic plants and plant extracts to control internal parasites in goats

Determine effects of these medicinal plants on feed intake and carbohydrate and nitrogen metabolism

Title: **Multinational Approaches to Enhance Goat Production in the Middle East**

Support: USAID Middle East Regional Cooperation Program

Collaborator:

Egypt	Desert Research Center Animal Production Research Institute Ain Shams University
Israel	Volcani Center
Palestinian National Authority	Agriculture Extension Department
Jordan	Jordan University of Science and Technology

Objectives:

Overall:	Revitalize and develop the Middle East goat industry via cooperative research and technology transfer to increase income and improve the standard of living of the indigenous people
Specific:	Characterize goat production systems of the Middle East region and distribute improve goat genotypes
	Increase knowledge of goat milk properties and develop new technologies for production of goat milk products in the Middle East
	Transfer appropriate available and developed technologies for goats to Middle Eastern farms/households, in particular proper milk hygiene and processing

Title: **Enhanced Education and Computer Capabilities: The Foundation for Sustained Collaboration**

Support: Association Liaison Office for University Cooperation in Development-USAID, Partnering with Higher Education for International Development

Collaborator: Awassa College of Agriculture of Debub University in southern Ethiopia

Objectives: Upgrade the extension skills of Debub University staff through training at Oklahoma State University and through practical presentations in Ethiopia

Upgrade computer capabilities of Debub University will be upgraded through training in networking and establishment of a student computer laboratory/campus network on the Awassa campus

Title: **Fostering Future Collaboration between US Institutions and the Armenian Agricultural Academy through Training and Information Exchange**

Support: USDA-Cooperative State Research, Education, and Extension Service Innovation Fund

Collaborator: Armenian Agricultural Academy in Yerevan, Armenia

Objectives: Raise the quality of Armenian goat-dairy products by instituting a Dairy Herd Improvement type of organization for Armenian dairy goat producers

To further train Armenian nationals in artificial insemination (AI) techniques for dairy goats

Increase Langston University's knowledge of Armenian animal production systems and foster institutional collaboration

Langston University staff will travel to Armenia to assist CSREES and the Armenian Agricultural Academy develop strategic goals and objectives

The proper citation for this article is:

Merkel, R. 2001. International Projects. Pages 115-117 in Proc. 16th Ann. Goat Field Day, Langston University, Langston, OK.

ABSTRACTS

☞ *2001 Southern and National Meetings of the American Society of Animal Science (Journal of Animal Science, Volume 79, Supplements 1 and 2)*

Effect of Prolactin Administered to a Perfused Area of Skin in Angora Goats

R. Puchala, S. G. Pierzynowski, T. Wuliji, A. L. Goetsch, and T. Sahlu

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Prolactin is believed to mediate seasonal hair follicle growth cycles; therefore the effect of prolactin infusion on mohair growth of Angora goats was investigated using a skin perfusion technique. Six Angora wethers (average BW 30 ± 3 kg) were implanted bilaterally with silicon catheters into the superficial branches of the deep circumflex iliac artery and the deep circumflex iliac vein. For the first 14 d of the experiment animals were infused (2.4 mL/h) into the deep circumflex iliac arteries with prolactin (one side) and saline (other side). The infusion rate of prolactin was 221 μg/d and was calculated to triple prolactin blood concentration in the perfused region. The area of skin supplied by the deep circumflex iliac artery was approximately 240 cm^2. Two weeks after cessation of infusions, 100 cm^2 areas within the perfused regions were shorn to determine mohair growth. Greasy and clean mohair production was decreased ($P < 0.05$) by prolactin compared with saline (3.79 vs 4.62 g and 3.02 vs 3.67g/100 cm^2/28 d, respectively). Oxygen saturation in blood hemoglobin from deep circumflex iliac veins was greater ($P < 0.02$) on the side infused with prolactin than on the control side (75.1 vs 68.2 %). Higher concentrations of Met, Lys, Val, Ileu, and Leu were observed in the venous blood taken from the deep circumflex iliac vein on the side infused with prolactin compared with saline ($P < 0.05$). Direct skin infusion with prolactin decreased fiber synthesis and may have decreased oxygen consumption by the skin. Decreased fiber production/nutrient utilization by the skin may be due to competition for nutrients with other processes that are regulated by prolactin such as lactation or reproduction. Selection of animals with low blood prolactin or low seasonal blood prolactin variation may reduce the rest phase of fiber follicles and improve fiber production.

Condensed Tannins and Ruminant Nutrition

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The objective of this paper is to present a brief overview of effects of condensed tannins (CT) on ruminant nutrition and animal production. Tannins are phenolic plant secondary compounds and are widely distributed in the plant kingdom. Tannins exist primarily in CT and hydrolyzable tannin (HT) forms. HT are potentially toxic to ruminants. Pyrogallol, a hepatotoxin and nephrotoxin, is a product of HT degradation by ruminal microbes. However, CT are considered to be non (or less)-toxic because they are not absorbed from the intestine. CT are the most common type of tannin found in temperate legumes, trees, and shrubs. CT often precipitate with dietary proteins at pH 5.5-7.0, with the extent of this reaction being dependent on the concentration, molecular weight, and structures of the CT and of the protein. Low concentrations of CT (2-4% CT, DM basis) in several temperate plant species (e.g., *Lotus corniculatus*, sulla, and sainfoin) are beneficial for ruminants,

and have resulted in improved milk yield, wool growth, live weight gain, ovulation, and lambing percentage, as well as preventing pasture bloat and reducing intestinal parasite burden. This is related to the reduced protein solubility and degradation in the rumen and to enhanced flow of non-ammonia nitrogen to the abomasum and to increased absorption of essential amino acids from the small intestine. However, high forage CT concentrations (5-10% CT) reduce voluntary feed intake and digestibilities, especially in tropical regions where feed choices and quality are limited. At present, there are few opportunities for reducing the negative effects of high CT concentrations in these regions and future progress for improving ruminant productivity is dependent on improving our understanding of the chemical structure of CT from various plants and understanding how CT affect ruminal microbes and forage nutritive value.

Carcass Weight, Dressing Percentage, and Lean Tissue Components of Fall Born Spanish Kids Fed Forage or High Concentrate Diets

T. Wuliji[1], A. L. Goetsch[1], R. Puchala[1], S. Soto-Navarro[1], R. Merkel[1], G. Detweiler[1], T. Sahlu[1], and A. Litherland[2]

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The manipulation of seasonal reproduction in goats for fall kidding allows for marketing of young meat goats during Christmas and Easter holiday seasons. Although meat goats are often reared on low to moderate planes of nutrition, high quality diets may be desirable for production of out-of-season meat goats. Fifty-eight (29 males and 29 females) fall born (October) Spanish kids with an initial average BW of 13.5 kg were used in an experiment with two 9-wk feeding phases (I and II) and individual housing. Goats consumed ad libitum prairie hay (L), dehydrated alfalfa pellets (M), or a 70% concentrate diet (H), either throughout the 18-wk experiment (MM and HH) or with a diet change at the beginning of Phase II (LM, LH, and MH). Four goats per treatment were slaughtered at the end of Phase II. Body weight, hot and chilled carcass weights, and dressing percentage were determined. Percentages of lean, fat, and bone tissues in selected primal cuts (leg, rack, and loin of a half carcass) were calculated from dissected weights. Body weight of slaughtered animals was 22.3 (SE 1.5), 19.7 (SE 1.8), 20.9 (SE 2.2), 24.6 (SE 1.7), and 23.3 (SE 1.7), and mean dressing percentage was 49.2 (SE 1.4), 47.8 (SE 0.5), 43.5 (SE 0.6), 47.8 (SE 1.1), and 45.8% (SE 1.1) for HH, LH, LM, MH, and MM, respectively, being greater for treatments consuming H vs M in Phase II. Chilled carcass weight was less ($P < 0.05$) for LM and LH than for MM, MH, and HH (10.9, 9.1, 8.7, 11.4, and 10.2 kg for HH, LH, LM, MH, and MM, respectively). Lean, fat, and bone percentages of the leg, rack, and loin, respectively, were 63.6, 16.4, and 20.6% for HH; 67.0, 12.1, and 20.8% for LH; 67.0, 10.4, and 22.6% for LM; 62.5, 17.6, and 19.9% for MH; and 66.6, 11.6, and 21.7% for MM, respectively. The fat component of dissected primal cuts was greater ($P < 0.05$) for goats on H than M in Phase II. In conclusion, dehydrated alfalfa pellets supported a rate of growth of Spanish kids as rapid as that with a concentrate-based diet, both with a constant nutritional plane and after consumption of low quality forage. High concentrate diets appear to promote fattening beyond what would be expected from the rate of growth.

Sustainable Dairy Goat Milk Production from Forages

B. R. Min, S. P. Hart, and T. Sahlu

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This study was to investigate the effects of different levels of concentrate supplementation on milk production and composition by pastured dairy goats. Forty-four Alpine goats (56 ± 11 kg BW) were randomly allocated to four groups and supplemented with 0.66 (Groups A and B), 0.33 (group C), and 0 kg concentrate (group D) per kg of milk over 1.5 kg/d. Mixed vegetative forages (rye/crimson clover, rye/ryegrass, wheat/ryegrass, and crabgrass) were rotationally grazed by the goats except for group A (confined and fed alfalfa hay). Milk production was recorded daily and milk samples were collected twice monthly for 7 months (March to September 2000) and analyzed for fat (F), protein (P), lactose, solids-not-fat (SNF), and total solids (TS). Contents of F, SNF, and TS were similar among diets. However, P concentration in group C was higher than for groups A, B ($P = 0.10$), and D ($P < 0.01$). Lactose concentration in group D was lower than in other groups ($P < 0.05$). Average milk concentrations of F, SNF, TS, P, and lactose decreased ($P < 0.01$) over the lactation (from March to September) by 38, 37, 21, 19, and 12%, respectively. Average milk yield of the 7-month period was 3.4, 2.9, 2.5, and 2.1 kg/d for treatments A, B, C, and D, respectively, with significant differences ($P < 0.01$) among all treatments. However, milk yield in the first 2-month period was similar (3.6, 3.3, 3.1, and 3.1 kg/d for treatments A, B, C, and D, respectively) and then decreased significantly in the summer (3.3, 2.8, 2.3, and 1.8 kg/d, respectively; $P < 0.01$). Greatest summer milk production for group was probably due to higher energy intake. Goats in group A gained BW (19 g/d); but groups B, C, and D decreased in BW (–9.3, -12, and –30 g/d, respectively). Milk yield and composition varied among dietary treatments, with some measures affected by stage of lactation and season. It can be concluded that all concentrate levels supported similar high levels of milk production by pastured dairy goats in early lactation, but were inadequate for high production during the summer.

Effects of Milk Feeding Regimes on Performance of Artificially Reared Alpine Kids

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Forty Alpine kids (20 females and 20 males) were used to determine effects of different levels of milk intake restriction and number of meals on starter diet intake and growth. Kids began the experiment at 3 to 9 d after birth (3.8 ± 0.15 and 4.2 ± 0.16 kg initial BW for females and males, respectively). A mixed starter diet was consumed ad libitum during the 10-wk suckling and 4-wk post-weaning periods; milk consumption was ad libitum for the first 2 wk. Treatments were: ad libitum consumption of milk in two meals in wk 3-8, then 50% of consumption on the preceding few days with one meal in wk 9 to 10 (AL); 75% of intake on the last few days of wk 2 in two meals in wk 3-8, then 50% consumption (67% of intake in wk 3-8) in wk 9-10 with one meal (R-2X); 75% consumption in one meal in wk 3-8, then 50% consumption in wk 9-10 in one meal (R-1X); and

75% consumption in two meals in wk 3-6, then 37.5% consumption in one meal in wk 7-10 (R-2X-1X). Milk DMI was greatest ($P < 0.05$) among treatments for AL (174, 115, 128, and 113 g/d for AL, R-2X, R-1X, and R-2X-1X, respectively). Starter diet DMI (g/d) was 19, 25, 19, and 35 in wk 3-4 (SE 6); 27, 37, 25, and 48 in wk 5-6 (SE 8); 51, 78, 72, and 143 in wk 7-8 (SE 16); 138, 194, 165, and 249 in wk 9-10 (SE 15); 343, 396, 388, and 417 in wk 11-12 (SE 47); and 508, 530, 489, and 539 in wk 13-14 (SE 38) for AL, R-2X, R-1X, and R-2X-1X, respectively. ADG was 163, 173, 175, and 175 in wk 1-2 (SE 8); 136, 84, 105, and 133 in wk 3-4 (SE 12); 114, 56, 87, and 102 in wk 5-6 (SE 20); 193, 132, 134, and 107 in wk 7-8 (SE 16); 87, 154, 96, and 136 in wk 9-10 (SE 22); 88, 110, 129, and 109 in wk 11-12 (SE 22); and 122, 108, 118, and 126 in wk 13-14 (SE 27) for AL, R-2X, R-1X, and R-2X-1X, respectively. In conclusion, restricted milk intake regimes can be used to increase dry feed consumption for ADG similar to that with ad libitum milk intake. Likewise, opportunities exist for unimpaired growth with restricted milk feeding in one meal daily during the latter portion of the suckling period.

Effects of Preweaning Concentrate Supplementation on Performance of Meat Goats

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Sixty-four Spanish does with 112 Boer × Spanish or Spanish kids (16 singles and 96 twins) were used to determine effects of preweaning feeding of a concentrate-based supplement on preweaning and early postweaning growth. In mid-April, from approximately 6 to 14 wk after birth, animals grazed wheat forage (Phase 1), followed by 5 wk on native grass pasture (Phase 2) and an 8-wk postweaning period with a moderate level of supplemental concentrate (Phase 3). Treatments were no supplementation in Phases 1 and 2 (C), ad libitum consumption of a concentrate-based supplement in Phases 1 and 2 (A), no supplementation in Phase 1 and ad libitum consumption of supplement in Phase 2 (A-2), and limit feeding of supplement (approximately 1% of live weight, DM) in Phases 1 and 2 (L). Supplement intake averaged 30, 74, 90, 157, and 158 g/d for L and 36, 87, 192, 240, and 229 g/d for A in wk 2-4, 5-6, and 7-8 of Phase 1 and wk 1-2 and 3-5 of Phase 2, respectively; supplement intake for A-2 averaged 171 and 249 g/d in wk 1-2 and 3-5 of Phase 2, respectively. Forage DM mass was 2,474, 2,062, 1,315, 1,434, 2,245, 1,405, and 1,161 kg/ha in wk 1, 3, 5, and 7 of Phase 1 and wk 1, 3, and 5 of Phase 2, respectively. Kid live weight gain was similar among treatments in Phase 1 (108, 131, 119, and 113 g/d), lower ($P < 0.05$) for A than for C and A-2 and lower for L than for C ($P < 0.05$) and A-2 ($P = 0.09$) in Phase 2 (73, 21, 15, and 60 g/d), and lower ($P < 0.05$) for C than for A and A-2 in Phase 3 (44, 67, 90, and 83 g/d for C, L, A, and A-2, respectively). In conclusion, under conditions of this experiment preweaning feeding of a concentrate-based supplement did not enhance kid growth preweaning but generally improved early postweaning growth.

Feed Intake, Digestibility, and Growth of Spanish kids Consuming Different Quality Diets

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Fifty-two Spanish kids (average initial BW = 13.5 ± 0.06 kg) were used in an experiment with two 9-wk phases. Three diets were used: prairie hay consumed ad libitum and supplemented with 0.125% BW (DM) of soybean meal (average = 21.4 g/d; H), dehydrated alfalfa pellets consumed ad libitum (A); and a 70% concentrate diet consumed ad libitum (C). Treatments were A in Phases 1 and 2 (AA), C in Phases 1 and 2 (CC), H in Phase 1 and A in Phase 2 (HA), H in Phase 1 and C in Phase 2 (HC), and A in Phase 1 and C in Phase 2 (AC). Dry matter intake in Phase 1 was lowest ($P < 0.05$) for HA and HC and greater ($P < 0.05$) for AA and AC than for CC (636, 502, 385, 352 and 634 g/d), and DMI in Phase 2 was 839, 629, 834, 636 and 805 g/d (SE = 12.6) for AA, CC, HA, HC, and AC, respectively. Average daily gain for AA, CC, HA, HC, and AC, respectively, was 81, 79, 0, 0 and 86 g (SE = 17.6) in Phase 1 and 73, 54, 112, 82, and 92 g (SE = 29.9) in Phase 2. Apparent total tract DM digestibility, determined at the end of the performance period with five animals per diet, ranked ($P < 0.05$) H < A < C (39, 54, and 66%, respectively). Likewise, ruminal pH was greatest for C and lowest for H ($P < 0.05$; 6.0, 6.5, and 6.8 for H, A, and C, respectively). The concentration of total VFA in ruminal fluid at 4 h after feeding was 35, 104, and 68 mmol/L for H, A, and C, respectively (SE = 3). In conclusion, dehydrated alfalfa pellets supported performance of Spanish kids as great or greater than that with a concentrate-based diet, when fed continuously and following consumption of a low-quality forage-based diet.

Extension of the Cashmere Growth Period in Spanish Goats with Melatonin

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Melatonin suppresses blood prolactin levels, and the prolactin surge in fur animals is usually associated with fiber shedding. Therefore, use of melatonin to induce out-of-season breeding could affect the seasonal pattern of cashmere fiber growth in goats by extending the active, anagen phase. Eighty 80 female Spanish goats (15 2 yr of age and 65 doelings) were used to determine influences of spring melatonin treatment on cashmere fiber growth. Treatments were control (C); melatonin implant (18 mg; Regulin, Shering Pty. Ltd.) without (M) and with three bromocryptine mesylate (215 mg) implants (IB) (Innovative Research of American, Sarasota, FL); and oral administration of melatonin (3 mg/d for 5 wk) (Sigma Chemical Co., St. Louis, MO) without (O) or with bromocryptine mesylate (OB). Melatonin treatments started 5 wk before breeding. Cashmere growth was examined by clipping fiber regrowth in a 10 × 10 cm area on the mid-side each month. Mean daily clean fiber growth rate (mg/d) estimated by mid-side patch clipping was greater ($P < 0.01$) for melatonin-treated groups compared with C in April (44.7, 82.9, 77.5, 80.6 and 71.5 mg/d)

and May (39.6, 69.8, 81.4, 63.9 and 63.5 mg/d); in the overall 12-mo period fiber growth was greatest ($P < 0.05$) among treatments for I and IB (12.5, 15.9, 15.3, 13.1, and 12.9 g for C, I, IB, O, and OB, respectively). Mean cashmere fiber diameter was greater ($P < 0.05$) for I, IB, O and OB compared with C (17.4, 18.7, 18.9, 18.4, and 18.1 microns) in a pooled sample for February, March, and April, while in May, June, and July diameter for C was lowest ($P < 0.05$) among treatments (16.8, 18.6, 18.7, 18.4, and 18.8 microns for C, I, IB, O, and OB, respectively). In conclusion, spring melatonin treatment for out-of-season breeding appeared to extend the period of cashmere fiber growth, and the lack of effect of bromocryptine mesylate suggests no additive effect to melatonin treatment. Oral administration of melatonin had effects on cashmere fiber growth measured by mid-side patch clipping similar to those of an implant early in the experiment, but over the entire 12-mo period fiber growth was not influenced.

Modeling Extended Lactation Curves in Dairy Goats Using Grafted Polynomials

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Some dairy goat producers milk their does for an extended period before rebreeding and drying off, but little information is available about the shape of extended lactation curves for goats. To examine the effect of extending lactations upon the shape of the lactation curve, test-day records (n = 7,425) of 469 does with extended lactations were obtained from USDA/AIPL. Range for days in milk was 419 to 696 d, with an average of 530 d. The number of test days ranged from 12 to 20 with an average of 16 per lactation. Lactations from six breed types (Alpine, LaMancha, Nubian, Saanen, Toggenburg, and Experimental) and four parities (first, second, third, and fourth or greater) were included. Nonlinear regression analysis using several grafted polynomial models was conducted for each animal. The models used were quadratic-linear (QL), quadratic-quadratic (QQ), quadratic-quadratic-linear (QQL), quadratic-quadratic-quadratic (QQQ), quadratic-quadratic-quadratic-linear (QQQL), quadratic-linear-quadratic-quadratic (QLQQ), and quadratic-linear-quadratic-quadratic-linear (QLQQL). The most appropriate model was selected by testing for significant ($P<.05$) reduction in error sums of squares from the QL model for each individual animal. A ($P < 0.01$) higher percentage of selected models were QL than were QQQ (64 vs 22%, respectively). The selection of other models was 6% for QQQL, and 3, 3, and 2% for, QLQQ, QQ, and QQL, respectively. The QLQQL model was not selected. There were no significant ($P > 0.10$) breed or parity effects on the distribution of selected models. The median join point was 300 for QL, and 348 for QQ. Points were 193 and 343 for QQQ; 87 and 147 for QQL; 445, 331, and 131 for QQQL; and 287, 185, and 57 for QLQQ. A QL grafted polynomial model appears sufficient to model the majority of extended lactation curves in dairy goats.

Feed Intake and Growth by Spanish and Boer × Spanish Doelings Consuming Diets with Different Levels of Broiler Litter

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Sixty Spanish (S) and 40 Boer × S (BS) doelings, 14.9 ± 3.8 and 21.9 ± 3.8 kg, respectively, were allocated to five treatments in an 84-d experiment (four 21-d periods) to test effects of dietary level of broiler litter (L) on feed intake and ADG. Six S and four BS doelings were assigned to two replicates per treatment. Treatments were OL: 20% chopped millet hay (H; 6.1% CP, DM basis) + 80% concentrate (11.9% CP); 20L: 20% H + 80% concentrate (12.9% CP) with 20% dietary L; 40L: 20% H + 80% concentrate (17.0% CP) with 40% dietary L; 60L: 20% H + 80% concentrate (21.0% CP) with 60% dietary L; and 80F: 80% H + 20% concentrate (24.4% CP). Diets were consumed ad libitum, group feed intake was determined daily, and BW was measured at 21-d intervals. DMI differed ($P < 0.05$) among all treatments in period 1 (772, 620, 683, 371, and 468 g/d; SE = 12.6) and 2 (816, 657, 748, 347, and 579 g/d; SE = 11.1) for 0L, 20L, 40L, 60L, and 80F, respectively. Goats consuming 0L had greatest and 60L lowest ($P < 0.05$) DMI in period 3 (938, 825, 859, 557, and 832 g/d; SE = 15.9) while in period 4, DMI was greatest for 0L and 40L and lowest ($P < 0.05$) for 60L (1,007, 933, 1,007, 682, and 905 g/d; SE = 19.9) for 0L, 20L, 40L, 60L, and 80F, respectively. ADG was similar between S and BS with 60L but greater ($P < 0.05$) for BS with other diets, and the difference between genotypes in ADG was greatest among treatments with 0L (interaction, $P < 0.05$). ADG of S was 108, 81, 71, 9, and 37 g/d (SE = 8.7), and that of BS was 177, 118, 105, 12, and 58 g/d (SE = 10.6) for 0L, 20L, 40L, 60L, and 80F, respectively. In conclusion, S and BS doelings can be fed diets with up to 40% L for growth comparable to or greater than that with a low quality forage-based diet, and diets with moderate to high levels of L or based on low quality forage may lessen differences in ADG between S and BS compared with concentrate-based diets.

Effects of Urea Treatment of Straw and Dietary Broiler Litter on Feed Intake and Digestion in Spanish Wethers

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Eight Spanish wethers (29.3 ± 1.15 kg) were allocated to simultaneous 4 × 4 Latin squares to test effects on intake and digestion of urea treatment of wheat straw and supplementation with different levels of broiler litter (BL). Wheat straw, untreated (U, 0.41% N) or treated with urea (T, 2.25% N), was consumed ad libitum; supplement treatments (ST) were C: corn-based (1.42% N, 0.64% BW);

S: C + 0.25% BW soybean meal (3.10% N, 0.89% BW); L: C + 0.5% BW BL (2.97% N, 1.14% BW); and H: C + 1.0% BW BL (3.06% N, 1.64% BW). Chromic oxide was included in supplements to estimate apparent digestibilities. Straw type and ST did not interact in OM and N intakes and digestibilities. Straw OM intake was similar between U and T; total OM intake was greatest among ST ($P < 0.05$) for H and lowest ($P < 0.05$) for C (476, 566, 649, and 739 g/d for C, S, L, and H, respectively). Digestibility of OM was not influenced by straw type, but was lower ($P < 0.10$) for L and H than for C and S (67.9, 68.3, 61.9, and 60.7% for C, S, L and H, respectively; SE = 2.5). Digestible OM intake (DOMI) was greater ($P < 0.05$) for T than for U (436 vs 327 g/d); among ST DOMI was lowest ($P < 0.05$) for C and greater ($P < 0.05$) for H vs S (314, 377, 396, and 440 g/d for C, S, L, and H, respectively; SE = 19.6). Intake of straw N was greater ($P < 0.05$) in goats consuming T than U (9.7 vs 1.0 g/d) and greatest among ST for H (8.0, 13.6, 15.8, and 19.6 g/d for C, S, L, and H, respectively). Apparent N digestibility was not affected by straw type and was greatest among supplement treatments ($P < 0.05$) for S (51.5, 67.8, 51.4, and 46.4%, for C, S, L, and H, respectively). In conclusion, improvements in DOMI by supplementing a basal wheat straw diet with S or BL were not influenced by urea treatment. The increase in DOMI with a low level of BL (i.e., 0.5% BW) was comparable to that with S, and greater change occurred with 1.0% BW BL.

Effects of Insulin Administered to a Perfused Area of Skin in Angora Goats

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The effect of insulin infusion on mohair growth of Angora goats was investigated using a skin perfusion technique. Six Angora wethers (average BW 32 ± 4 kg) were implanted bilaterally with silicon catheters into the superficial branches of the deep circumflex iliac artery and vein. For the first 14 d of the experiment, 2.4 mL/h of saline solution was infused into the deep circumflex iliac arteries. The infusate for one side contained insulin, delivered at 48 mU/h and estimated to triple the blood insulin concentration in the perfused region. The area of skin supplied by the deep circumflex iliac artery was approximately 250 cm^2. An area of 100 cm^2 within the perfused region was used to determine mohair growth. Two weeks after cessation of infusions, perfused areas were shorn. Greasy and clean mohair production from the perfused region was not affected by insulin infusion compared with the side infused with saline (4.57 vs 4.69 and 3.67 vs 3.74 g/100 cm^2/28 d for greasy and clean mohair, respectively; $P > 0.10$). Similarly, insulin did not change mohair fiber diameter or length ($P > 0.10$). Plasma glucose concentration was lower ($P < 0.05$) in blood from the deep circumflex iliac vein on the side infused with insulin (57.2 vs 63.4 mg/dL). Blood flow and plasma concentrations of amino acids were not different between treatments ($P > 0.10$). The lack of an insulin effect on mohair fiber growth may be due to insufficient supply of amino acids or, similar to IGF-1, insulin may have limited effects on fiber-producing follicles.

Evaluation of Genetic Relativeness and Diversity in Five Goat Breeds Using Randomly Amplified Polymorphic DNA (RAPD) Analysis

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The primary objective of this study was to apply a randomly amplified polymorphic DNA technique to evaluate genetic relativeness and diversity among five goat breeds, namely Boer, Saanen, Angora, Shaannan white, and Guanzhong dairy goat. They were meat, dairy, fiber, and indigenous dual-purpose breeds, respectively. The analysis was based on band-sharing frequency, genetic distance, and Shannon diversity index. Blood samples were collected from 17 Boer, 14 Saanen, 13 Angora, 11 Shaannan white, and 5 Guanzhong dairy goats via jagular venipuncture for each individual DNA isolation. DNA pools were formed for 7 individuals from each breed, except the 5 Guanzhong dairy goats. A total of 20 arbitrary 10mer primers with GC content of 40, 50, 60, or 70%, designed according to references and manufacturer's recommendations and synthesized by Dalian Biotechnology company of China thereafter, were employed in RAPD analysis. Seventeen of 20 primers detected an amplified pattern with 2 to 11 bands, 4 of which had amplified polymorphic fragments in each breed; the between-breed average band sharing frequency was from 0.91 to 0.98. Nei's standard genetic distance was in the range of 0.02 to 0.09, and a dendrogram based on Nei's distance from amplification patterns of four random primers in five goat breeds was constructed. As expected, the estimate of distance between Saanen and Guanzhong dairy goat was lowest among goat breeds. The Shannon diversity index of each goat breed was 0.54, 0.19, 0.12, 0.35 and 0.34, respectively, which indicated a large genetic diversity in Boer, Shaannan white, and Guanzhong dairy goat populations in the sampling region. It was confirmed that RAPD marker analysis can be used to determine genetic diversity and relativeness among and within goat breeds.

SUMMARIES OF RECENT JOURNAL ARTICLES (2000 and In Press)

Influences of the number of fetuses and levels of CP and ME in gestation and lactation supplements on performance of Spanish does and kids during suckling and post-weaning

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Pregnancy and lactation appear to influence mohair growth via competition for nutrients between skin follicles and other tissues. Conversely, based on research with Australian feral goats, effects on pregnancy and lactation on cashmere fiber growth are due to physiological changes associated with pregnancy and lactation rather than via nutrient competition, which impact times of cashmere cessation and initiation in the growth cycle. Effects of the nutritional plane of does in the last one-third of gestation and of kids during suckling also have not been extensively studied. Objectives of this research were to determine effects of supplement levels of metabolizable energy and crude protein for US Spanish does, from a herd selected for cashmere fiber production, in gestation and lactation on performance of does and kids during suckling and post-weaning. Forty-eight mature US Spanish does (40 kg) were used in the experiment. At 60 days of gestation, does with single or twin fetuses consumed mature bermudagrass hay ad libitum and 1% body weight (dry matter basis) of supplements with 18.6 or 28.5% crude protein and 2.2 or 2.8 Mcal/kg metabolizable energy. The high energy-high protein supplement was offered at 1.5% body weight (dry matter basis) for 15 days after birth, and does received the same supplement treatments as in gestation thereafter until weaning at 50 days after parturition. For a 50-day post-weaning period, kids consumed ad libitum the high energy-low protein supplement. With a moderate plane of nutrition during gestation elicited by ad libitum consumption of low-quality grass hay and a relatively high level of supplemental concentrate, the number of fetuses did not affect cashmere weight of U.S. Spanish does from a herd selected for cashmere fiber production, with shearing in February at 100 days of gestation. Different supplement metabolizable energy and crude protein levels during gestation and lactation periods did not influence birth weight of single or twin kids. Kid body weight and cashmere weight after 50-day suckling and post-weaning periods were affected by an interaction between the number of fetuses and level of metabolizable energy in supplements given to does in gestation and lactation, suggesting possible impact of nutrient demand as influenced by number of fetuses on doe responses to different supplements in milk production and consequent kid body weight. However, because of the limited number of observations in this experiment, these findings warrant further research.

Effects of dietary protein source on fleece and live weight gain in Angora doelings

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The US Angora goat, on a BW basis, is one of the highest fleece-producing ruminants. Mohair growth requires little energy but much protein is needed. In particular, requirements for the sulfur-containing amino acids cysteine and methionine are high. However, the array of amino acids needed for fleece-free BW gain is different from that needed for fiber growth. Thus, diets

containing supplemental protein sources promoting high BW gain may not necessarily do so for fiber growth, which would be of special importance for growing, fiber-producing ruminants, such as yearling Angora doelings typically bred for kidding at 2 years of age. Therefore, objectives of this study were to determine if different common supplemental dietary protein sources have similar effects on live weight and mohair growth in yearling Angora doelings. Fifty-one yearling Angora doelings (20 ± 0.6 kg initial BW) were used; diets consisted of approximately 40% roughage and 18 to 19% CP (DM basis), of which two-thirds was supplied by corn gluten meal, cottonseed meal, hydrolyzed feather meal or Menhaden fish meal; DM intake was restricted at approximately 0.7 kg/day. Results of this experiment indicate that dietary characteristics promoting high growth or BW gain may not be those most conducive to high mohair growth. In this particular instance, a diet with supplemental fish meal resulted in greater ADG than diets with feather, corn gluten, or cottonseed meals, whereas corn gluten meal yielded greatest mohair growth. Further research is necessary to fully understand how dietary properties and nutrient status affects BW gain and mohair growth by yearling Angoras.

Effects of season on fleece traits of Angora does in the U.S.

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Although Angora goats do not visibly shed fiber, seasonal changes in fiber growth driven by photoperiod have been observed in Australia and New Zealand. Seasonal changes in mohair growth by U.S. Angoras have not yet been characterized, which would be useful information for design of feeding strategies and as affecting mohair quality traits. In this regard, fiber growth in Angora does of the E (Kika) de la Garza Institute for Goat Research was evaluated over a 1-year period, with the conclusion that a seasonal cycle of fiber growth in U.S. Angora goats does exist. Primary follicle activity was lower in winter than summer, and clean fiber growth rate and fiber diameter were lowest in winter, greatest in summer, and intermediate in autumn and spring. Fleece fiber medullation was greatest among seasons in summer, and medullated fiber diameter was greater in spring and summer than in winter. These results should be useful to design optimal feeding programs for mohair production and shearing times for minimal medullated fiber contamination. For example, based on these findings the optimal time of shearing U.S. Angoras for minimal contamination with medullated fibers may be just before spring and autumn equinoxes when it is likely that medullated fibers have been recently shed.

Effects of mimosine on fiber shedding, follicle activity, and fiber regrowth in Spanish goats

J. Luo, A. J. Litherland, T. Sahlu, R. Puchala, M. Lachica, and A. L. Goetsch

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Mimosine is a pyridoxal antagonist, which inhibits DNA replication and protein synthesis; thus, it may act mainly by arresting cell division in the follicle bulb. A study on annual patterns of follicle

activity in Australian cashmere goats indicated that primary follicles were largely inactive during the winter (short daylength); secondary follicles became inactive about 1 mo later and remained so for only a short period of time. This difference between follicle types may provide an opportunity to chemically defleece or remove cashmere fiber with minimal guard hair contamination. In addition, typically, cashmere goats are shorn when the mean temperature is around 10° C in the early spring. Because shorn goats are susceptible to cold stress for up to 3 mo, retention of guard hair would be very useful in cold weather. Therefore, objectives of this experiment were to evaluate the effects of mimosine infusion on fiber shedding, follicle activity, and fiber regrowth in Spanish goats. Ten 2-yr-old Spanish wethers (58.2 ± 7.21 kg BW) were used to determine effects of 2-d intravenous infusion of mimosine (beginning on January 8) on fiber shedding, follicle activity, and fiber regrowth. At 7 to 10 d after the start of infusion, all five goats infused with mimosine exhibited shedding, whereas shedding by controls was not observed. In conclusion, 2-d intravenous infusion of mimosine at 120 mg/(kg BW · d) in the winter induced cashmere shedding but had less effect on guard hairs, suggesting future potential use of chemicals such as mimosine to remove cashmere fiber.

Effects of dietary level of Leucaena leucocephala on performance of Angora and Spanish doelings

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Leucaena (*Leucaena leucocephala*) is a drought-resistant, leguminous tree found throughout the tropics and subtropics. Leucaena leaves are readily consumed and nutritious; however, Leucaena contains toxic compounds such as mimosine. The nutritive value and toxicological effects of Leucaena with fiber-producing goats have not been extensively studied, particularly at high dietary levels. Therefore, objectives of this experiment were to evaluate effects on live weight and fiber growth by Angora and Spanish goats of different dietary levels of Leucaena compared with a diet containing a feedstuff high in ruminally undegraded protein. Thirty Angora (16 ± 2 kg initial body weight) and 20 Spanish doelings (19 ± 2 kg initial body weight), approximately 8 months of age, were used in a 10-week experiment. The control diet (CS) included 9% dry matter of formaldehyde-treated casein; other diets consisted of 15, 30, 45 or 60% DM of Leucaena leaf meal (0.75% mimosine). Results of this experiment indicate that diets containing moderate to high levels of Leucaena, at least up to 45%, can be fed to goats without adverse effects on BW gain or fiber growth or characteristics. Moreover, the lack of interaction between dietary treatment and breed (i.e., Angora vs Spanish) for most variables suggests that differences among animals in fiber production do not have appreciable impact. However, Leucaena used in this experiment was relatively low in mimosine, and factors such as the amino acid composition of ruminally undegraded protein of Leucaena deserve consideration and further study

Effects of dietary protein concentration on postweaning growth of Boer crossbred and Spanish goat wethers

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Development of the Boer goat in South Africa focused on selection for attributes such as size, muscling, and growth rate. Greater body weight and growth rate for Boers and Boer crossbreds than for other goat breeds and types have been documented at a number of locations. However, though Boer goats can grow more rapidly than other types of goats, growth rates are less than for sheep, implying that nutrient requirements may not be markedly different from other goats. Furthermore, ad libitum feed intake by goats relative to BW is frequently greater than for cattle and sheep. Thus, the objective of this experiment was to estimate the protein requirement by determining effects of protein concentration in high concentrate diets on growth of weaned, confined Boer crossbred and Spanish wethers. Boer (3/4) × Spanish (1/4) and Spanish goat wethers, 4 to 4.5 mo of age and 17.6 and 19.4 kg initial BW, respectively, were fed 70% concentrate diets provided ad libitum for 30 wk in confinement. The concentration of crude protein in consumed dry mater was 9.3, 13.8, 17.1, and 22.1% (P1, P2, P3, and P4, respectively); supplemental protein was from soybean meal for P1 and P2 and from soybean meal plus a blend of blood, fish, and feather meals for P3 and P4. Results of this experiment indicate a similar dietary protein requirement relative to dry matter intake for growing Boer × Spanish and Spanish wethers consuming high concentrate diets in confinement. Diets with a protein concentration of 14% or greater may support greater live weight gain than a diet with 9% protein. A ruminally degraded protein concentration of 11.5% of total digestible nutrients seems adequate for unimpaired microbial digestion and protein synthesis. However, further research on protein requirements of growing meat goats is warranted, such as with dietary protein concentrations between 9 and 14% and other diet natures and production settings.

Effects of dietary tallow level on performance of Alpine does in early lactation

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Dietary inclusion of fat in diets of lactating dairy cattle increases energy density and can enhance milk production without necessitating an increase in the level of cereal grains in the diet. There also have been experiments with dairy goats investigating influences of dietary addition of various fat sources. Fat supplementation has increased milk production and(or) fat concentration in many studies, although there are some reports in which effects did not occur possibly due to factors such as the particular fat source used. Stage of lactation has impact, with greatest potential for positive effects early than late in lactation. Although there has been research with added dietary fat for dairy goats, in many instances the number of dietary fat levels used was low, and there is a variety of commercial fat products presently available. Therefore, 60 Alpine does (47 ± 1.3 kg initial body

weight) were used to determine effects of dietary inclusion of different levels of partially hydrogenated tallow on performance in early lactation (weeks 3-11). Treatments entailed a 30% concentrate, negative control diet and diets higher in concentrate (42-46%) with 0, 1.5, 3.0, 4.5 or 6.0% dry matter of partially hydrogenated tallow. Early lactation milk yield increased as dietary tallow level increased up to 3 or 4.5% of the diet, then decreased as the level increased to 6.0%. Milk fat concentration increased linearly as dietary tallow level increased, with no change in milk protein. However, efficiency of energy use for milk production appeared greater with 1.5 and 3.0% tallow compared with higher levels, possibly because of limited ruminal fiber digestion and(or) fatty acid absorption with high dietary tallow levels. Further research is necessary with diets higher in concentrate level to address practical and economical considerations for use of fat sources in diets of confined, high-producing dairy goats, and dietary ingredient costs must be considered in design of most profitable lactating dairy goat diets.

Growth and harvest traits of Boer × Spanish, Boer × Angora, and Spanish goats consuming a concentrate-based diet

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The number of Boer crossbred meat goats has been increasing rapidly, although how their growth and harvest traits compare with those of Spanish goats and influences of maternal genotype have not been thoroughly evaluated. This information would be useful to achieve optimal meat goat production systems and yield of goat products desired by consumers. Therefore, postweaning growth (9 to 24 weeks of age) and harvest traits (212 ± 5.0 days of age) of Boer × Spanish, Spanish, and Boer × Angora wethers consuming a concentrate-based diet were compared. Over the 16-week performance period, average daily gain (ADG), dry matter intake (DMI), and the ratio of ADG:DMI were greater for Boer crossbreds than for Spanish goats (ADG: 154, 117, and 161 g; DMI: 646, 522, and 683 g/day; ADG:DMI: 263, 235, and 261 g/kg for Boer × Spanish, Spanish, and Boer × Angora, respectively). Dressing percent (46.3, 47.3, and 47.0% of body weight) and quality grade score (11.17, 9.67, and 11.17 for Boer × Spanish, Spanish, and Boer × Angora, respectively; 12 = Choice +; 11 = Choice; 10 = Choice -; 9 = Good +) were similar among genotypes. Weights of some noncarcass components were greater for Boer crossbreds than for Spanish goats, but relative to empty BW, noncarcass component weights were similar among genotypes. Concentrations of moisture, ash, fat, and protein in carcass and noncarcass components did not differ among genotypes. Contributions to the carcass of different primal cuts were similar among genotypes, and there were few differences in concentrations of separated lean, bone, and fat in primal cuts. In conclusion, with consumption of a concentrate-based diet, postweaning growth from 9 to 24 weeks of age was greater for Boer crossbreds than for Spanish wether goats, with little or no difference between Boer × Spanish and Boer × Angora goats. Because of more rapid growth of Boer crossbreds than of Spanish goats, weights of the carcass and primal cuts were greater or tended to be greater for Boer crossbreds. However, relative to carcass or empty body weight, under production conditions similar to this experiment, slaughter and carcass variables should be similar for Boer × Spanish, Boer × Angora, and Spanish goats.

Effects of gender and age on performance and slaughter and carcass characteristics of Boer × Spanish goats

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Meat goat production is rapidly expanding in the U.S., in large part because of the increasingly diverse ethnicity of the population. There are many ethnic minorities that consume goat meat, particularly at holidays and special social events. As a result, goats are not marketed in the U.S. at a standard age or weight, but may be sold at particular times when prices are high. Previously, all types of goats in the U.S. were used for meat, including cull dairy goats and Angoras, as well as the Spanish goat. Spanish goats have been primarily employed for brush control in low input production systems and have not been selected for meat production, which has contributed to variable market weight and carcass characteristics. Presently, the number of crossbred Boer goats marketed is increasing rapidly. Growth rate and mature size are greater for Boer goats and their crosses compared with Spanish goats and Angoras. There has been very little experimentation concerning factors influencing growth performance and harvest traits of meat goats. Such research is necessary for goat producers to design production systems matching market demands, and also for consumers to make appropriate purchasing decisions. Thus, an experiment was conducted to determine influences of gender and age on growth performance and harvest traits of Boer crossbred meat goats. Wether, female, and male Boer × Spanish goats (16.8, 15.6 and 16.9 kg initial body weight, respectively) consumed a high concentrate diet from 116 to 340 days of age, with harvest at 56-day intervals. Average dry matter intake for the entire experiment was lowest among genders for females (674, 534 and 682 g/day), and average daily gain was greater for males and wethers than for females (119, 89 and 138 g/day for wethers, females and males, respectively). Dressing percentage was similar among genders and lowest among ages at 116 days (41.7, 48.5, 49.9, 51.3 and 50.9% for 116, 172, 228, 284 and 340 days, respectively). Internal fat mass was lower for males vs wethers and females (6.9, 7.0 and 5.1% empty body weight for wethers, females and males, respectively) and increased with increasing age (2.3, 5.4, 6.3, 7.7 and 9.9% empty body weight; 0.32, 1.08, 1.60, 2.77 and 4.08 kg at 116, 172, 228 and 340 days of age, respectively). Carcass scores and grades were similar among genders. Among genders, males had the greatest carcass percentages of separable bone (27.1, 27.0 and 29.4%) and lean (50.1, 49.7 and 54.1%) and were lowest in fat (18.0, 19.5 and 12.7% for wethers, females and males, respectively). Carcasses were 38.9, 29.9, 27.0, 22.6 and 20.7% bone; 6.7, 18.3, 15.1, 21.0 and 22.4% fat; and 49.4, 48.5, 50.9, 53.9 and 53.8% lean at 116, 172, 228, 284 and 340 days, respectively. In summary, with a moderate rate of live weight gain, differences among genders of Boer × Spanish goats in performance and harvest traits were not affected by age from approximately 4 to 11 months. Carcass composition changed appreciably from 4 to 6 months but varied much less thereafter. Internal fat mass as a percentage of body weight increased steadily as age increased, with weight at each age being nearly as great as that of carcass fat.

Effects of dietary sulfur level on amino acid concentrations in ruminal bacteria from ruminal fluid of goats

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Mohair production by Angora goats can be affected by plane of nutrition, including dietary sulfur (S) concentration. Cysteine is the primary S-containing amino acid in animal fiber protein. The high concentration of cysteine in keratain relative to that in plant material suggests that wool- and mohair-producing ruminants could require greater quantities of S-containing amino acids than other ruminant classes. Most protein and S-containing amino acids available for digestion and absorption by ruminants are derived from dietary protein escaping ruminal fermentation and microbial protein synthesized in the rumen. The former is determined by the quantity of protein fed and susceptibility to degradation by ruminal microorganisms. Microbial protein formed in the rumen depends on the quantity of OM fermented and availability of required nutrients such as ammonia. Low ruminal S concentration can also depress microbial growth and fiber digestion, and nutrient availability can impact composition of microbial cells as well. Therefore, an experiment was conducted to determine the effect of dietary S on amino acid concentrations in ruminal fluid bacterial cells of goats. Twelve Angora and 20 Alpine goat wethers consumed diets (14.3% crude protein and 1.67-1.80 Mcal/kg of metabolizable energy, dry matter basis) with 0.11, 0.20, 0.28 or 0.38% S (supplemental S: $CaSO_4$; N:S ratio: 21, 12, 8 and 6, respectively) for 10 weeks. The concentration of cysteine in bacterial dry matter changed quadratically (curvilinear) as dietary S increased (3.28, 3.77, 3.80 and 3.65% for 0.11, 0.20, 0.28 and 0.38% S, respectively). However, dietary S did not alter methionine concentration in bacterial dry matter or total amino acids, and for the few amino acids whose concentrations were affected, magnitudes of change were relatively small. In conclusion, with diets moderate to low in metabolizable energy concentration, levels of S greater than 0.20% and N:S ratios less than 12:1 had very little effect on amino acid concentrations in ruminal fluid bacteria of growing goats, which supports the contention that the primary potential influence of inorganic dietary S on absorbed S-containing amino acids is through the quantity of microbial protein synthesized in the rumen.

Effects of dietary levels of forage and ruminally undegraded protein on early lactation milk yield by Alpine does and doelings

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Increased dietary levels of ruminally undegraded protein (RUP) in early lactation has in many instances improved milk yield by dairy cows. However, in the few studies with goats conducted in this area, added RUP has not enhanced performance. Thus, there is need for experimentation to determine what, if any, experimental conditions are conducive to milk yield responses by dairy goats to added RUP. Hence, a group of Alpine does and doelings were fed diets with 40 or 80%

forage in weeks 3 to 19 of lactation. Diets were 18-19% crude protein, with or without added RUP, which was supplied by a mixture of blood, fish, and feather meals that provided two-thirds of the protein from soybean meal in control diets. Milk yield and protein concentration for these doelings and does, which were in low to moderate body condition, were greater with 40 vs 80% forage throughout the 16-week early lactation period. RUP affected milk production only in the first few weeks, and numerically the response to RUP early in the experiment was greater with 40 vs 80% forage. Over the entire 16-week period, body weight gain was greater with 40 vs 80% forage, and doelings increased in body weight slightly more than did does. Responses to dietary forage and RUP levels were similar between doelings and does. In summary, with low to moderate body condition, moderate dietary concentrate levels may support greater milk production by Alpine goats throughout early lactation, whereas there appears potential for short-term performance benefit from added RUP only very early in the lactation period.

The effect of restricted consumption of water and(or) dry matter in milk replacer on growth by male and female Alpine kids

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Current management systems for kids fed milk or milk replacer do not facilitate rapid transition at weaning to dry feeds. In some instances, liquid feeds are offered at relatively high levels, which may limit dry feed consumption, particularly with abrupt weaning. To investigate other feeding options, Alpine male and females at 3 to 9 days of age were fed a commercial sheep/goat milk replacer for 8 weeks, with free-choice intake or with slight restrictions in consumption or water or water and dry matter. Levels of restriction in weeks 4-8 were approximately 70% of free-choice intake. Restriction treatments did not improve performance after abrupt weaning, and restricting intake of water alone did not enhance growth. Growth rate of males was greater than that of females, but an adverse effect of restricting both water and dry matter intake only on growth of males suggested less susceptibility of females to nutrient intake restriction.

Growth and cashmere production by Spanish goats consuming ad libitum diets differing in protein and energy levels

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Most previous research concerning effects of nutritional plane on growth and characteristics of cashmere fiber has been with feral goats. This work has shown than nutritional plane has relatively small effects on cashmere fiber growth and quality other than when the nutritional plane is very low. Effects of protein and energy levels in diets consumed free-choice on cashmere fiber growth have

not been thoroughly studied. Thus, an experiment was conducted with 36 Spanish goat wethers (averaging 196 days of age and 17.5 kg body weight at the start of the experiment) from a herd previously selected for cashmere growth. Wethers consumed (free-choice) diets with 10 or 15% crude protein and 40, 60, or 80% concentrate, providing ME concentrations of 2.00, 2.35, or 2.70 Mcal/kg dry matter. Cashmere fiber diameter was greater for 15 versus 10% dietary crude protein regardless of metabolizable energy level. Diet composition did not impact cashmere fiber length. Dietary concentrations of crude protein and metabolizable energy did not alter guard hair weight but interacted in weight of cashmere fiber. These results imply that fiber characteristics of goats selected for cashmere production might be relatively more susceptible to nutritional plane effects than is the case for feral goats.

Growth of Spanish, Boer × Angora and Boer × Spanish goat kids fed milk replacer

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Contributions of heterosis for economically important traits have been well documented in other species. The Boer goat has long been recognized for its superior meat producing ability and is widely used to improve growth and carcass traits of local breeds through crossbreeding. Milking ability of the dam can greatly influence the opportunity of kids to express growth potential; therefore, hand-rearing eliminates such maternal effects. However, information is lacking on how performance of Boer crosses compares with Spanish goat kid performance during the preweaning period under identical feeding and management conditions, such as with feeding of milk replacer. Acidified milk replacer has been widely used in rearing young calves and kids, with advantages of reducing milk feeding and labor costs and simplifying management. Kids fed cow milk replacer can grow as rapidly as kids given goat or cow milk. Therefore, the objective of this study was to compare preweaning performance of two Boer crossbreds and Spanish goats under standardized nutritional conditions - feeding acidified milk replacer in an intensive management system. Boer × Angora kids consumed more milk replacer from birth to 3 weeks of age than did Boer × Spanish and Spanish kids, although intake was similar among genotypes in weeks 4 to 8. Starter diet intake was greatest among genotypes for Boer × Spanish, and the feed conversion ratio was 13% greater for Boer cross kids than for Spanish kids. This study reflects that Boer crosses exhibit superior growth and feed efficiency during the preweaning period compared with Spanish kids under intensive management conditions.

Growth and carcass traits of Boer × Alpine wethers slaughtered at the ages of 31 and 50 weeks

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The Alpine goat has high milk production but low rates of carcass fat and protein deposition compared with traditional meat goat breeds. Thus, crossbreeding Alpines with a meat goat breed is a means of increasing profit potential from sale of kids for meat production. Boer goats are more muscular and larger in mature size than other breeds of goats; thus, crossing the Alpine goat with the Boer could produce a genotype with high growth rate and carcass characteristics suitable for goat meat market specifications. Changes in body weight gain, feed efficiency, and carcass characteristics with advancing age are well understood for cattle and sheep. Briefly, efficiency of feed utilization and body weight gain decrease with advancing time as adipose tissue accretion increases and lean tissue deposition declines, although degrees of change vary with factors such as particular stages of maturity, diet composition, and previous nutritional plane. Concomitantly, whole body fat content increases with age, again with magnitudes of change for different depots or sites depending on aforementioned conditions. For goats, presently high carcass fat levels are not desired by U.S. consumers. Thus, there is need to evaluate differences in efficiency of production and carcass characteristics between meat goats of different ages, in order to determine optimal ages and times for slaughter. In this regard, 14 Boer × Alpine wethers were used to determine effects of feeding from 15 to 31 weeks (Phase 1) and from 38 to 50 weeks (Phase 2) on feed intake, body weight gain, feed efficiency, plasma constituents, internal organ mass, and carcass traits. All wethers consumed diets free-choice with 20 and 16% crude protein and 33 and 40% neutral detergent fiber diet in Phase 1 and 2, respectively. Body weight after Phase 1 and 2 was 42 and 57 kg, respectively; body weight gain was greater in Phase 1 than in Phase 2 (228 vs 118 g/day); and the ratio of BW gain to dry matter intake differed between phases (0.19 in Phase 1 vs 0.10 in Phase 2). Cold carcass weight (20.4 vs 29.6 kg), dressing percentage (50.1 vs 56.5%), and percentage of carcass fat (16.4 vs 20.2%) were greater after Phase 2 than Phase 1, and leg cut percentage (30.5 vs 28.3%), carcass bone percentage (23.7 vs 20.6%), and backfat thickness (0.44 vs 0.30 cm) were greater after Phase 1. However, carcass lean percentage (58.3 and 57.1%) and the percentage of noncarcass fat (6.39 and 7.07% for Phase 1 and 2, respectively) were similar between phases. In conclusion, Boer × Alpine male castrates had appreciably greater BW gain and FCR in Phase 1 (14 to 31 wk of age) than in Phase 2 (38 to 50 wk of age). Most important carcass characteristics favourably affected by the lengthy feeding period were carcass weight and dressing percentage. In general, age did not have appreciable effects on other carcass characteristics, although the carcass fat percentage was 3.8 percentage units greater after Phase 2 than after Phase 1. Overall, it would appear that considerably more desirable marketing opportunities after Phase 2 than after Phase 1 would be required to justify the high feed costs of Phase 2 for Boer × Alpine wethers.

EXPERIMENTS

Recently Conducted, In Progress, or Soon to be Initiated

Dairy Goats

Sustainable dairy goat milk production from forages - year 2

- Study milk production, composition, and animal health of pastured does as compared with a conventional, confinement dairy
- Measure the milk production response of pastured dairy goats to supplemental concentrate
- Model the effect of pasture intake and concentrate supplementation on milk production and changes in body weight

Simple feeding practices for replacement Alpine doelings

- Compare growth of replacement Alpine doelings with separate, free-choice feeding of concentrate and forage with free-choice intake of mixed diets and set concentrate feeding with free-choice forage

Efficacy of Glinus lotoides (Hirta) - *anthelmintic plant for nematode control in young Alpine wethers*

- Examine anthelmintic activities of different oral doses of *Glinus lotoides* (Hirta) for young Alpine wethers

Quality characteristics and yield predictive models of goat cheeses

- Determine the effects of milk composition and somatic cell counts on the quality and yield of goat cheese and develop yield predictive models for goat cheeses (French soft, Colby, and Mozzarella)

The detection of mastitis in dairy goats

- Extensively test various mastitis detection assays that were developed for the b0vine dairy industry to determine the applicability of those methods to detect mastitis in dairy goats
- Determine the suitability of mastitis detection methods for use as a regulatory standard to monitor milk quality and goat udder health under field conditions

Meat and(or) Fiber Goats

Lysine and methionine requirements for growing meat goats

- Determine influences of dietary levels of lysine and methionine on site and extent of

digestion and ruminal fermentation conditions and microbial protein synthesis in meat goats
- Determine effects of dietary levels of lysine and methionine on feed intake, growth rate, and feed efficiency of growing Boer × Spanish and Spanish wethers

Broiler litter for growing/finishing meat goats

- Determine effects of dietary levels of broiler litter and concentrate on feed intake, live weight gain, efficiency of feed conversion, digestibilities, nitrogen and energy balances, ruminal fluid concentrations of ammonia and volatile fatty acids, plasma urea level, and microbial protein synthesis in meat goats
- Characterize interactions between 1) dietary levels of broiler litter and concentrate and 2) meat goat genotype (i.e., Spanish and Boer × Spanish) in live weight gain, ruminal fluid concentrations of ammonia and VFA, and plasma urea level

Effects of previous nutritional plane and age on early growth of meat goats grazing wheat pasture

- Determine if previous nutritional conditions [1) low quality forage supplemented with soybean meal, 2) dehydrated alfalfa pellets, and 3) high concentrate diet] influence performance of meat goats in the first weeks of wheat forage grazing, and how such effects might vary with animal age

Effects of length of nutrient restriction and level of realimentation on growth of yearling Spanish and Boer × Spanish doelings

- Determine effects of the length of time of low nutrient intake on performance by yearling Spanish and Boer × Spanish doelings during and after restriction
- Assess influences of the level of concentrate supplementation during realimentation on compensatory growth by yearling Spanish and Boer × Spanish doelings

Dry matter and nitrogen digestion kinetics in goats fed either a poor or medium quality forage supplemented with increasing levels of Sericea lespedeza

- Investigate associative effects in digestion and digesta passage rate of basal forages with increasing consumption of Sericea lespedeza
- Determine effects of level of supplementation with Sericea lespedeza tannins on total tract digestibilities of dry matter and nitrogen
- Elucidate if effects of lespedeza tannins can be impacted by companion feeding of forages not containing tannins
- Identify optimum levels of Sericea lespedeza in diets based on different quality forages for maximal digestion and nutrient retention

Metabolic changes affecting utilization of poor-quality diets by goats

- Determine underlying physiological processes responsible for effects on goat performance of dietary inclusion of rumen-protected betaine

All Goats

Nutrient requirements of goats

- Update and reevaluate nutrient requirements of goats

Interplay of goat biological type or growth potential and energy restriction in early post-weaning growth

- Assess the interactions between growth potential and energy restriction on present and subsequent feed intake, digestion, and growth of different breeds of goats (Alpine, Angora, Boer, and Spanish)
- Determine the effect of energy realimentation after restriction on feed intake, growth rate, feed efficiency, and nutrient digestion

Energy requirements of goats

- Compare coupled use of heart rate and an indirect, open-circuit calorimetry system with calorimetry for study of goat energy requirements
- Determine maintenance energy requirements for Spanish, Boer, Alpine, and Angora goats

Internal parasite detection in goats and field survival of internal parasitess

- Compare parasite infestation of goats rotational grazing or set stocked
- Determine time of survival *Haemonchus* larvae on pasture
- Modify the mucous membrane color strip for use with goats to predict degrees of anemia and internal parasite load

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