PROCEEDINGS OF THE 19th ANNUAL

GOAT FIELD DAY

April 24, 2004

Agricultural Research and Extension Program
Langston University
Langston, Oklahoma 73050

WELCOME

We deeply appreciate your attendance at this 19th Annual Goat Field Day of the E (Kika) de la Garza American Institute for Goat Research of Langston University. The Field Day is one of the most important things we do each year. The primary purpose of the Field Day is for education and extension in areas of greatest interest to clientele of the Institute. Thus, please share your thoughts with us on today's activities and suggestions for the Field Day next year. In addition to extension and education, the Field Day provides an excellent opportunity for the staff of the Institute to meet other people that work with goats. Such interaction helps make our program the most appropriate it can be for the people it serves.

The proceedings of the Field Day is a very useful tool for the Institute beyond impact realized from the program today. First, there are reports on Field Day presentations. After this information, there are highlights of research 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.

This year's general theme of the program is *"Controlling Unwanted Vegetation."* This is the subject of one of the recent projects of the Institute, which will be highlighted today. In addition, we have other experts who will address this area. I have looked over the articles on these topics in the proceedings, as well as the others, and it looks like we will all learn a great deal of useful new information today. And remember, we attendees also can learn a lot from each other, so let's all make a point of visiting whenever possible. Here is the exciting program planned for today that has developed from your input.

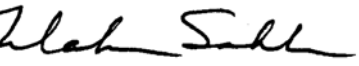
The morning program consists of:

- **Controlling Unwanted Vegetation**
  - **SARE Project** *Steve Hart*
  - **Seven Years in Sixty Minutes: The Most Important Things I Learned About Goats for Fire Management** *Kathy Voth*

The afternoon workshops are:

- **SARE Project** *Steve Hart*
- **What and How Much Do Goats Eat** *Kathy Voth*
- **Basic Goat Husbandry - I** *Jerry Hayes*
- **Basic Goat Husbandry - II** *Lionel Dawson*
- **Tanning of Goat Hides** *Roger Merkel*
- **Oklahoma Milk Regulations** *Frank Harris*
- **Dairy Products Overview** *Steve Zeng*
- **Nutrient Requirement Web Calculators** *Art Goetsch*
- **Simulation Goat Production Modeling** *Mario Villaquiran*
- **DHI Training** *Tim McKinney*
- **USDA Government Programs** *Mark Moseley and Dwight Guy*
- **General Youth Activities** *Sheila Stevenson*
- **Fitting and Showing** *Kay Garrett*

Please let us know your wishes for the 2005 field day, and we will do our best to again provide a quality program with requested and timely topics. On behalf of the staff of E (Kika) de la Garza American Institute for Goat Research, we thank you for your continuing interest and support.



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

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Sustainable Agriculture Research and Education Project: Goats for Vegetation Management

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Introduction

Goats have been used for over a hundred years in Texas to control brush and weed problems. Only recently have people outside of Texas discovered the utility of goats for controlling brush and weeds. Brush and weeds are progressively becoming more of a problem because of changes in the ecosystem and increased costs for traditional methods of control. Brush and weeds are steadily decreasing forage production of range and pastures. Brushy undergrowth greatly increases the fire hazard of forested areas. Brush and(or) weeds decrease the biodiversity of ecosystems, affecting not only native plant species but also animal species from tiny invertebrates all the way to the wildlife or cattle that forage in the ecosystem. Goats can be effectively used to profitably control most brush and weed problems, reducing fire hazard, increasing biodiversity and range carrying capacity, and improving aesthetics. While goats are capable of solving vegetation management problems, success depends on proper application of the technology to a specific problem.

Vegetation in Oklahoma

Much of Oklahoma was originally a grassland savanna, that is a grassland with a few clusters of woody species. These woody species remained as minor components of the ecosystem due to the combined effects of browsing by deer and elk and periodic fires. Settlement and cultivation of Oklahoma almost eliminated periodic fires. Another major factor is the loss of over half of the topsoil from much of Oklahoma soil due to erosion from cultivation or overgrazing. As a consequence, water infiltration rate and storage in the topsoil are reduced and, therefore, a greater proportion of stored water is in the subsoil. This gives a competitive advantage to woody species that have deeper root systems to obtain water and are good at absorbing and holding plant nutrients, whereas grasses, which obtain most of their water from the topsoil, are placed at a severe competitive disadvantage. Since these changes are permanent, brush and weeds will always be a major problem on eroded areas.

Fire, which provided natural control of brushy species for hundreds of years, is being reintroduced as prescribed burning for vegetation management on grasslands. However, due to the risks and consequent liability of fire getting out of control and the cost of burning, fire is not being applied as much as it needs to be. Herbicides used to be an important component of vegetation management, but their use continues to diminish due to increased chemical and application costs, and spraying itself may be ethically unacceptable to the public. In addition, herbicides may kill non-target species and reduce rather than restore natural biodiversity. Costs of mechanical controls such as mowing or bulldozing have increased with costs of fossil fuel and the results, while dramatic, are only temporary, lasting a few months to a few years at most. For the most part, the standard methods of vegetation management that were utilized yesterday cannot be applied in a cost effective manner today.

Goats As A Vegetation Management Tool

Because goats would be expected to have to consume some part of the plant if they are going to control it, the natural question is what plants do goats consume? Dietary preferences of goats are determined by maternal training and relative abundance of plants when they were young. Goats do modify their diets in limited amounts due to what their peers select. We have also observed different preferences in the same batch of animals at different locations, which may indicate that environment

(plant growing conditions) plays a role in animal preferences. Therefore, it cannot be conclusively stated that goats will or will not eat some plants, but some good generalizations can be made. Some species such as blackberry, green briar, winged sumac, winged elm, poison ivy, ironweed, and sericea lespedeza are highly preferred by goats. Some species are moderately preferred, such as post oak, multiflora rose, sunflower, ragweed, hickory, hawthorne, tall thistle, buckbrush, and eastern red cedar. Some plants such as Osage orange, Illinois bundleflower, hackberry, and giant ragweed are preferred to lesser degrees and goats will be less effective at controlling these species unless the particular group of goats has a stronger than normal preference for those plant species. Goats do eat some grass if it is available, but it likely makes up only 20-30% of the diet if sufficient palatable browse is available.

Stocker goats may be used to control vegetation as an alternative to a nanny-kid herd. Stocker goats offer advantages in not having labor and nutrient requirements for reproduction, no over-wintering, and relatively simple management. Wether and doe kids may be purchased in the early summer and sold in the fall. Langston University did a research project using stocker goats to control sericea lespedeza in Kansas. Starting weights ranged from 35 to 65 lb and did not affect live weight gain. Goats can gain 25 lb during the summer and the price roll back may be negligible, especially if animals could be held and sold just prior to Thanksgiving. Profit would be expected to be $5-10 per head. A nanny-kid operation, while requiring much more management and other inputs, has greater profit potential. Nannies have the expense and labor of wintering, breeding, and kidding, but a profit potential of $20-35 per head. Since most of the same animals are used each year and animals can be on a health program, there are potentially fewer health problems.

Goats can be grazed in a complementary manner with cattle or horses to control unwanted vegetation. Goats prefer browse and broadleaf weeds that are generally not consumed by the other two species. This can be a very profitable arrangement since the other species is paying the pasture cost and the only additional costs are for modifying the fence to hold goats. Weed control costs are eliminated. Parasite problems are reduced with co-species grazing and overall pasture productivity and salable product per acre are increased. Goats are also a form of diversification, helping to cushion changing prices in the cattle market.

Fencing is one of the biggest limitations in the use of goats for vegetation management due to its cost and lack of flexibility. Permanent fence such as 1047 goat wire, while very secure, is expensive to put up, costing about $2,500 per mile for materials plus labor. Additional cost may be incurred in clearing vegetation from the fence line. This cost can only be justified if an area will be grazed for several years. Some organizations will assist in providing materials or labor for fencing to solve their vegetation management problem. Permanent fence has an advantage in that it requires a minimum of maintenance, which may be especially advantageous in areas with limited access. Electric fence offers advantages of portability and low cost ($800-1,200/mile) but requires more maintenance and greater skill to install and maintain. If electric fence is not maintained, it will fail to confine animals. Three practices critical to the successful use of electric fence are to put the fence up right with quality materials, train animals to electric fence before turning them out, and maintain the fence by checking the voltage every day (4,500 v minimum) and correcting the problem before the goats find out about it. If an area has a decent barbed wire fence around it, there are several ways that the fence can be modified to hold goats. Several strands of barbed wire may be added down low with stays used between posts. Goat net wire, such as 1047 or 9-39-12, can be hog-ringed on the front of barbed wire. Or, the lowest strand of barbed wire can be moved up between the second and third strand and a short net wire (7-26-12) can be placed down low. Another option is the addition of one or two strands of electric fence on offsets between the ground and first strand of barbed wire and between the first and second strand of barbed wire.

Several people have expressed an interest in herding goats because it would save the labor and expense of putting a fence up. However, finding herders that will live with the goats is the biggest limitation. While Basque shepherds may be obtained on a federal program, they have not stayed long with goats. I do not know of anyone in Oklahoma or anywhere else herding goats successfully. There

may be a possibility for herding during the day and putting in a portable electric fence for the night, but again, labor is a limitation.

What stocking rate is a common question that is difficult at best to answer. In contrast to cattle, the proper stocking rate is not as critical for making a profit. It is necessary to defoliate most of the above ground herbage if vegetation is to be controlled. In general, defoliation must be repeated for several years to achieve vegetation control. However, most woody species are much less tolerant of defoliation than grass, enabling the browse to be stressed by defoliation while applying minimal stress to grass. Stocking rate is affected by soil productivity, rainfall, and quantity of accumulated biomass. There are tradeoffs in stocking rate and productivity. A higher stocking rate will result in greater defoliation and control, but production, whether weight gain or kidding or weaning rate, will be reduced. Forage requirements are different for stocker goats vs brood goats. A nanny goat and her kids will consume 2,500 lb of forage in a year, whereas stocker goats will consume 300-500 lb of forage during the summer grazing season. Generally, 1.5 nanny goats per acre of solid brush or weeds or 3-4 stocker goats is a good starting point. Stocking rate will have to be gradually reduced over years as brush and weeds disappear. A more practical approach is to start with a small group of goats that you can manage, let them multiply and then sell goats as the brush and weeds disappear.

Health is an important consideration is using goats for vegetation management because it is often difficult to collect animals for treatment. It is best to vaccinate and deworm new animals directly off the truck and release them to pasture to reduce stress. New animals often get pinkeye, sore mouth, and sometimes footrot; however, unless a disease is life threatening, it is usually not practical to catch an animal for treatment. Brood goats may be kidded on pasture, making it difficult to assist, but goats have been kidding without assistance for many years. Herding dogs can be helpful to collect animals for working or treatment.

Custom Grazing by Goats

There are many opportunities to use goats for custom grazing. I get calls every 2 months from cattlemen who want the services of goats without the stigma of owning goats. The pay will vary from free grazing to getting paid a fee per animal day for grazing. Some government entities, while unable to pay cash, can provide payment in kind such as assistance in purchase and installation of fence and provision of water and(or) providing daily animal care. Some organizations that can use goats for vegetation management include the Army Corps of Engineers, especially around lakes, and the Forest Service, which needs vegetation control for fire prevention. Municipalities have lakes and drainage ways to be maintained to reduce fire hazard or improve aesthetics. Some communities are interested in vegetation management for reducing the risk of fire and are often able and willing to pay for custom grazing. Some river authorities have vegetation problems such as salt cedar that need to be controlled. There are property owners that have brush and weeds that will give you free grazing. However, in all these situations, fencing, water, and labor for daily management of the animals are major concerns that need to be provided for.

Recent Langston University Projects

Langston University has been working with goats for vegetation management for 15 years. Some of the projects were to control shinnery oak in western Oklahoma, a forest plantation in southeastern Oklahoma, sericea lespedeza in Kansas, and more recently two years of study in collaboration with six Native American Nations using goats to control various vegetation problems.

Shinnery Oak

On the project to control shinnery oak in western Oklahoma, significant progress was made in controlling the oak in only 3 years. This was surprising in that most of the shinnery oak was 10 feet or higher and had a 4-inch trunk diameter. The site had 95% ground cover by shinnery oak and only 5% ground cover by grass. Yes, the first year, the goats grazed all the grass, but it did come back. By the end of the third year, brush had been reduced to 50% ground cover and grass and forbs had increased to 50% ground cover. Another finding was that soil nitrogen increased from 1 to 20 lb per acre over the study, phosphorus increased from 5 to 22 lb per acre, and potassium increased from 133 to 348 lb per acre. This is important in that it takes approximately 20 lb of available nitrogen and phosphorus for native grasses to become established. The shinnery oak absorbed these soil nutrients and the grass was starved for nutrients. Goats correct this problem in that they eat the brush and release the soil minerals in their urine and feces, enabling the establishment of native grass species.

Lespedeza

Work in Kansas showed that goats preferentially consumed sericea lespedeza, but it took 3 years of severe defoliation to kill established perennial plants. During the first 2 years of the study, goats consumed more than 75% of the sericea lespedeza foliage. Sericea lespedeza cover decreased by 12% and plants were much shorter than plants in the ungrazed area (14 vs 33 inches). Smooth brome grass cover increased by 19%. Seed production of sericea was decreased from 979 to 4 seeds per stem. Goats also controlled all the red cedar, sumac blackberries, sand plum, multiflora rose, and buckbrush. Goats also consumed the few thistles that were in the field. Goat numbers were decreased as sericea was controlled to save the grass for grazing by cattle. Grass gradually filled in where it had been choked out by sericea lespedeza.

SARE Project

Overview. We have been conducting a large vegetation management study at six locations in Oklahoma for 2 years in collaboration with six Native American Nations (Figure 1). This project was supported by the USDA Sustainable Research and Education (SARE) program, and provided a very rich learning experience in that the sites were all so different. The primary project goal was to increase appropriate employment of goats in sustainable vegetation management in grazing lands of the south-central US.

Pasture establishment began in mid-November, 2001 and ended in mid-May, 2002. Net wire fence was used for pasture perimeters. Interior fences to separate pastures were either net wire or electric, with use of solar chargers at some sites. Herbicide was applied to electric fence lines at the beginning of the grazing season, and there was occasional weed-whipping. Water was provided in a variety of ways, e.g., pond, spigot, gravity flow from a tank periodically filled by pumping from a nearby creek, and barrels and pickup truck. There was at least one guard dog at each location, which effectively prevented any losses to predators.

A key component of this project was the thorough assessment of vegetation conditions before and after each grazing season. In the spring, permanent transects were laid in each of the study pastures along which ground cover and canopy cover of woody vegetation were measured before and after each grazing season. Soil samples were also taken from each of the pastures before grazing to analyze for fertility. At the same time, the dry-weight-rank technique was used to measure forage in numerous permanent quadrats, the locations of which were marked with a Global Positioning System (GPS) meter. Currently, collected data and samples are being analyzed. Another important measure was body weight change of goats at each site along with sheep at one location and cattle at another, with weight determined at the beginning and end of the grazing season and every 1-2 months within. In addition, fecal samples were collected to monitor need to deworm and also to assess specifically what plants were consumed by fecal microhistology.

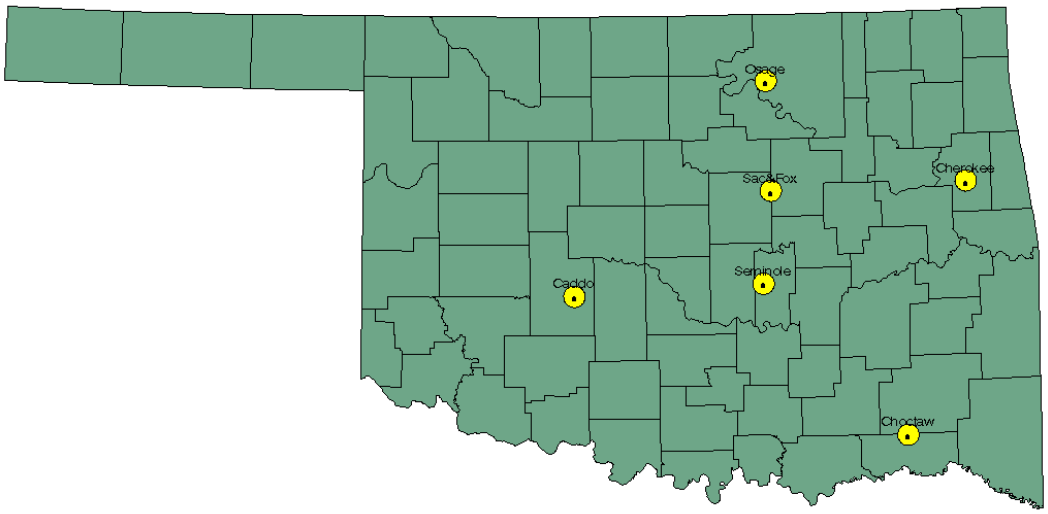


Figure 1:Six research and demonstration site of the SARE project.

Caddo Nation. The Caddo Nation site was located near Gracemont and Anadarko, Oklahoma. There were 10 acres of tribal land, with two 4-acre pastures for grazing and one 2-acre control, ungrazed area. There was much lovegrass and smooth sumac, and the site had not been grazed for many years. Because of the large amount of grass, one treatment entailed co-grazing with 12 sheep and 12 goats in 2002 and 10 of each species in 2003. The second grazing treatment was stocking of 24 goats (6 per acre) in 2002 and 20 (5 per acre) in 2003. One of the desirable effects of grazing noted was the breaking up of large, thick bunches of lovegrass residue from previous years that was smothering current growth, which also enhanced the rate of decomposition and nutrient cycling. The goats consumed various browse plants present including patches of sand plum and buckbrush. The consumption of sumac, which was the dominant brushy species, did not begin until late summer. Honey locust and black locust trees were heavily debarked.

The goats consumed honey locust and sand plum first at the Caddo location. They also killed a stand of black locust, which was 20-ft tall by debarking them; the second year, they were falling down, which greatly opened the area up. However, we did not achieve our objectives at this location. The location had about 60% cover by smooth sumac, 15% by sand plum, 10% by black and honey locust, and the remainder by love grass. The goats consumed little of the sumac at this location and did not control it. Several factors may have contributed to this. Apparently the sumac at this location was not as palatable as it was at other locations, but this was the driest location. Toward the end of the season the goats had only sumac to consume and did not have a variety of plants to consume. At several of the locations, we used different stocking rates in different pastures the first year and the same rate the second year. Goats on the higher stocking rates defoliated more brush, but weight gains were reduced. Since animal gains are what pay for vegetation management, lighter stocking rates are preferable and it will take only a year or two longer to achieve control.

Cherokee Nation. The Cherokee Nation site was located near Tahlequah, Oklahoma. The 20-

acre plot of tribal land hosted native grass species like big bluestem, little bluestem, broomsedge, and Indiangrass, as well as introduced species such as bermudagrass and fescue. However, there was a large population of brushy plant species, among which were multiflora rose, oak and persimmon sprouts, sumac, blackberry, buckbrush, and wild rose. Also prevalent were weeds such as common ragweed. Previously the area was mowed once yearly. Objectives of the activity were to compare effects of goat grazing with other potential means of control (i.e., mowing and herbicide). Thus, the plot was divided into eight pastures. Two 5-acre pastures were grazed by goats at 6 per acre in 2002 and 4 per acre in 2003; two 2-acre pastures were mowed as normally done; two 2-acre pastures were treated with conventional herbicides; and two 1-acre pastures did not receive intervention to serve as a control treatment. By the end of the grazing season, goats had defoliated all undesirable plants including blackberry, buckbrush, sumac, sprouts of persimmon, and various weedy species.

The blackberries were so thick that you could not walk through them. At the beginning of the second year, you could walk through the blackberries with only modest difficulty. Spraying 2 years in a row killed almost all the woody plants and greatly stimulated grass, but also killed the legumes. Mowing, while keeping the woody species low, made them bushier and did not help the grass. Before grazing, in dense stands of brush you could not see for over 30 ft. But, by the end of the first grazing season there was a distinct browse line and you could see for over 200 ft, which also was noted at the Osage Nation site.

Choctaw Nation. The Choctaw Nation site was located near Antlers, Oklahoma at the farm of a tribal member. The approximately 22-acre pasture consisted of a wooded area, predominantly post oak with a brushy understory vegetation component. Grasses included bermudagrass and bahiagrass with significant weed presence. The pasture had been previously grazed by cattle and used for hay production. The area was divided into three 7.3-acre pastures. The objective of this activity was to compare effects of grazing goats alone, co-grazing of goats and yearling crossbred beef heifers, and grazing cattle alone. Stocking rates were set low to allow hay production, with harvest in July. Goats were placed May 28 and grazing ceased on November 8. The goats kept the brushy understory of the woody area well under control and spent considerable time in the open grassy area. Woody plants heavily browsed include American beautyberry and low-hanging branches of winged elm.

Greater Seminole Nation. The Greater Seminole Nation site was situated near Seminole, Oklahoma. As with many of the other sites, the area had not been used in agriculture recently and, thus, has become overgrown with many different brushy plant species and trees of various sizes. An 11-acre plot of tribal land located on the southeast corner of the Mekusukey Mission grounds was used. Notable plants present included poison ivy, sericea lespedeza, persimmon, oaks of various species and sizes, ragweed, buckbrush, blackberry, sumac, and eastern red cedar. The site was divided into two approximately 4.5-acre pastures plus an ungrazed 2-acre control area. There were two stocking rate treatments used with the 4.5-acre pastures in 2002, 4 and 8 goats per acre. However, in 2003 both pastures were stocked with 4 goats per acre.

Osage Nation. The Osage Nation site was located on tribal land at Grayhorse Village, close to Fairfax, Oklahoma, and was the northern most site. The site had a variety of brushy plants and trees, such as honey locust, sumac, and eastern red cedar. The objective of the activity was to determine effects of different stocking rates with a very dense complex mixture of woody plant species. The 15-acre area was divided into three 5-acre pastures, one being an ungrazed control. Different stocking rates employed in 2002 were 4 and 8 goats/acre. However, in 2003 both pastures were stocked with 4 goats per acre. In addition to consumption of tree leaves and establishment of a distinct browse line, the goats debarked a number of small trees (i.e., 8-12 ft high) in dense stands, particularly winged sumac. The second year there was some root sprouting, which goats took care of and by the end of the second grazing season, these plants were falling over. A similar thing happened to the scattered sumac at the Greater Seminole Nation site.

Sac and Fox Nation. The Sac and Fox Nation site was located near Stroud, Oklahoma. The site

was a 20-acre plot of tribal land with a variety of invasive plant species, including eastern red cedar, green briar, black locust, blackjack oak, and post oak, and there were some native grasses present. The objective of this research/demonstration activity was to compare effects on vegetation conditions of an overgrown site and animal growth of continuous moderate stocking of goats with short periods of high stocking rates. This activity has particular relevance to the potential for custom grazers moving goats from farm to farm for short periods of time. The site was divided into four pastures, one 8 acres in size and the other three each 4 acres. One 4-acre control pasture was not grazed, and the other two were grazed by 3 or 6 goats per acre in 2002 and 2 or 3 goats per acre in 2003. The 8-acre pasture was subdivided into four 2-acre paddocks; goats were placed in this area at a rate of 6 per acre in 2002 and 3 goats per acre in 2003. Rotations were every 10 or 11 days, slightly more frequently than initially planned.

Goats ate all the poison ivy early in the first season, which was beneficial to several of the people working with this study. At this location, which was mostly mature forest, the goats cleaned out the understory and surprisingly made some headway on reducing the forest. This was due to natural death of trees that the goats may have hastened by partial debarking. The goats kept all the sprouts down and so no sprouts became established to replace the dead trees. The canopy did become noticeably more open in only 2 years of grazing. The goats were fairly aggressive against red cedar; they not only defoliated it, but debarked it and as a result killed more red cedar on this location than at any other location. For some reason, the goats had a stronger preference for red cedar at this location.

Fecal Egg Counts. As most or all goat producers are well aware, internal parasitism is a very important consideration. Therefore, we used this project as an opportunity to determine how use of goats for vegetation management in a variety of settings might impact internal parasitism and necessary control methods. Goats were dewormed with Moxidectin (0.5 mg/kg body weight) prior to the study and were transported to the study sites in mid-May to early June. Goats were weighed and fecal samples were taken every 1-2 months. Fecal egg counts (eggs per gram; EPG) were estimated by a modified McMaster technique. Location had a major effect on EPG, with month and the interaction between year of grazing and location having significant effects but being of lesser importance. Many animals had 0 EPG throughout most of the grazing season at most locations. Fecal egg counts increased with increasing time spent grazing (2, 3, 8, and 25 EPG). There was a significant location by year interaction because of one location having high EPG in both years and a second and third location having high EPG in different years. The one location with high EPG both years had greater annual rainfall than other locations. At the locations that had high EPG in only one year, animals were observed to graze grass closely during the grazing season even though browse was available. It appears that location is an important consideration affecting internal parasitism and recommendations for its control, but the effects can be different in each year.

Live Weight Gain. Factors affecting carrying capacity and animal performance were also addressed in this project. In the first year of grazing, yearling goats were taken to each site in May-June and weighed every 1-2 months. Animals were removed when forage availability became limiting, usually late summer or fall. Goats were heavily stocked to provide maximum vegetation control. Doe and wether Alpine, Angora, Spanish, and Boer x Spanish crossbred goats were used in the first year. Average daily gain was significantly affected by site, period of grazing, breed, and gender. Wethers gained more than doelings (3.3 vs -4.1 g/day). Alpine and Angora goats gained less weight than meat breeds and crossbreeds. Goats gained the most live weight the first grazing period and less subsequently as forage availability was reduced (12.7, -9.3, and -13.6 g/day). Gain per hectare was not influenced by site or stocking rate, whereas the number of grazing days/ha significantly differed among sites (range 237-1,109 days) due to different forage production. Gain/ha had little relationship to stocking rate, a consequence of grazing to remove all available herbage. Total gain for the season was affected by site, gender, and breed. When goats are grazed at a high stocking density to control vegetation, forage productivity is the greatest factor in determining carrying capacity although sex and breed can have effect.

Summary

There is a significant amount of knowledge that goats can be effectively used to control vegetation. However, the challenge is to work out the application. Fencing is the foremost problem that has to be resolved to use goats for vegetation management. The next most important decision is the use nannies or stocker goats. Some decision has to be made on stocking rate. A business and animal management plan and budget need to be developed to make sure that the business can not only be conducted in the first year, but also in the future. There are sufficient brush and weeds in the US to produce more goat products than can be consumed here and therein lies a great potential for profit as well as improving the environment.

Building fences at the various sites.

Transect #3 at the Caddo site in 2002.

Transect #3 at the Caddo site in 2003.

Transect #80 at the Cherokee site in 2002.

Transect #80 at the Cherokee site in 2003.

Transect #43 at the Choctaw site in 2002.

Transect #43 at the Choctaw site in 2003.

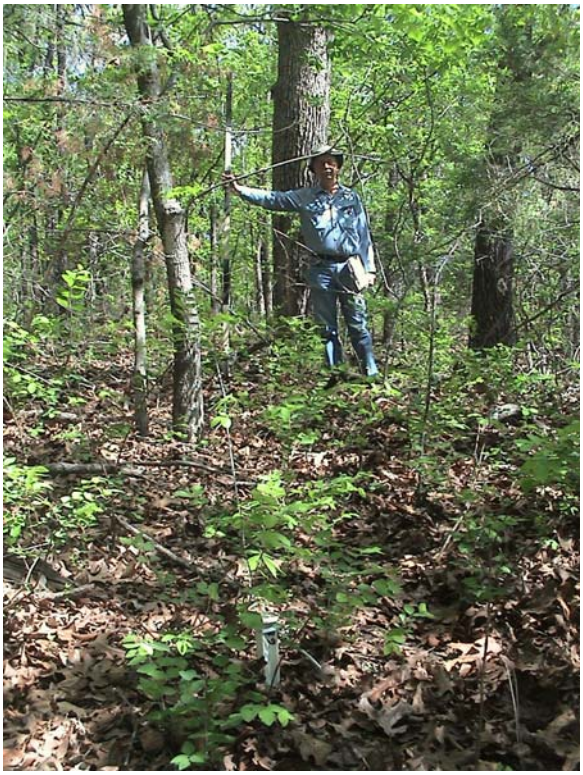
Transect #103 at the Osage site in 2002.

Transect #103 at the Osage site in 2003.

Transect #22 at the Seminole site in 2002.

Transect #22 at the Seminole site in 2003.

Transect #68 at the Sac & Fox site in 2002.



Transect #68 at the Sac & Fox site in 2003.

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Seven Years in Sixty Minutes: The Most Important Things I Learned About Goats for Fire Management

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Introduction

In 1998 I began a research project with 11 goats, another novice goat herder, and a desire to provide fire managers and communities the answers they need in order to feel comfortable choosing goats as a tool for reducing fire danger. Thanks to donations of goats from other research projects, a healthy breeding program, the efforts of Utah National Guard's Camp Williams Training Facility, and funding from the Joint Fire Science Program beginning in 2000, the program grew to 130 goats and a small staff. The result is a handbook on CD called "Goats! For Firesafe Homes in Wildland Areas" which is now available at http://www.livestockforlandscapes.com. The CD expands on the lessons that I will share here.

Why Consider Goats as a Tool?

An aggressive, fifty-year policy of fire suppression has resulted in an accumulation of wildland fuels and an increase in fire intensity and resistance to control. This is a particular problem in the shrub-dominated communities typically found in the lower foothills and mountain areas which are increasingly popular for housing developments and second homes. The deadly 1994 South Canyon fire that killed fourteen firefighters, was fought in oakbrush on steep slopes just a mile from two small Glenwood Springs, Colorado subdivisions. Similar housing developments throughout the country mix seamlessly with oakbrush and mountain brush, and it is increasingly difficult to protect these homes from fire.

The proximity to housing developments affects the way managers control fire fuels. While controlled burning is effective, homeowners are concerned about threats to their property. In addition, increased regulations on smoke and particulate matter output limit its use. Removing brush mechanically is both costly and difficult due to rugged terrain and multiple treatments required. Herbicide is unpopular with residents who fear damage to their own landscaping.

In a few cases, fire managers have turned to goats as a way to reduce fire danger to private property, to eliminate smoke concerns, and to enhance success in rugged terrain. Goats are able to eat a broader variety of vegetation than sheep or cows, are comfortable on steep slopes, and use their athletic balancing and climbing abilities to reach branches over 6 feet in height. They are also popular in areas where they have been used, as evidenced by the wine and cheese parties that Laguna Beach, California residents hold when goats come to their neighborhood to work.

But this tool has not achieved widespread acceptance for a number of reasons. First, fire managers are unfamiliar with the "hows" of managing goats for fuel reduction. Second, if they were to use this tool, there was little information on how much fuel should be removed, no evidence of its efficacy, and no models of fire behavior in treated areas. Finally, finding an ample supply of goats and a herder with the necessary experience is difficult.

To help fire and goat managers alike, here are the high points of what I learned from 1998 to today. I'll start by answering the questions I'm asked most often, and then give you my "Start-Up Success Secrets" to help you begin your own projects.

Does it Work?

The simple answer is yes. This study and others demonstrate that goats will eat and thrive on brushy species. The changes they can make in the fuel load are significant and fire behavior modeling and an actual fire demonstrated that treatment areas do slow and stop a fire.

Vegetation Reduction

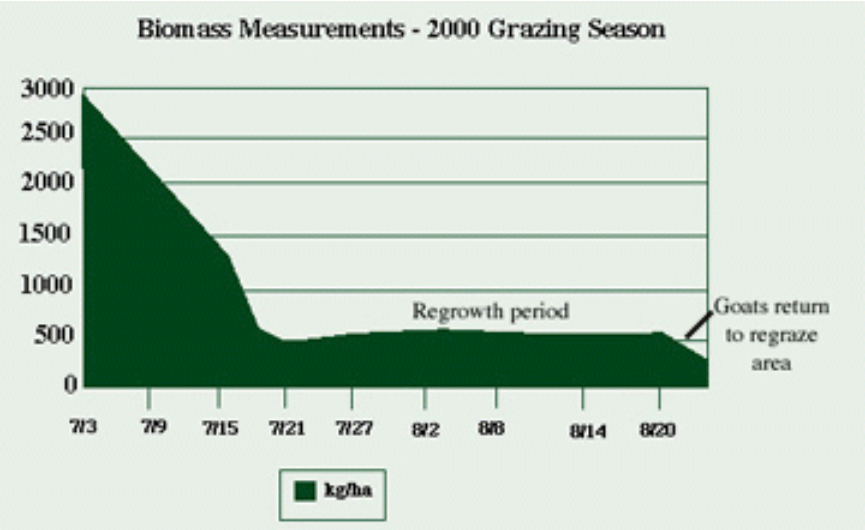
For this project we were interested in shrub-dominated vegetations types such as California mixed chaparral, pocosin shrub, southern hardwood shrub, and oakbrush/mountain brush. To fire managers these types are known as Fire Behavior Fuel Models 4, 5, 6 and 7 (Anderson, 1982). These shrub communities share some commonalties that are important to fire managers. First, they are often found as part of the under story in forests where fire has been suppressed. Second, an increasing number of housing developments are located in these communities. Third, firefighters experience difficulty in controlling fires in these species because they tend to have a high concentration of volatile oils and waxes. Finally, they share a similar response to fire and mechanical treatments. In most cases these species re-sprout prolifically after fire or mechanical top removal (Bradley et al.). This means that each area must receive multiple treatments to maintain benefits. Not only is this economically prohibitive, but repeated fire can also lead to lowering of soil-nitrogen availability (Hobbs and Schimel, 1984). In addition, repeated fire treatments may also lead to a change in stand composition. For example, given their tremendous sprouting potential, oakbrush and maple have a competitive advantage over other shrub species in disturbed stands and over time can out compete them and other herbaceous vegetation.

Previous research demonstrated that goats can effectively reduce shrubby vegetation. Pearson and Martin (1991) found that goat grazing opened the canopy and improved herbage on their test plots in the Ouachita National Forest in Arkansas. Research done by Tsiouvaras et al. (1989) and Green and Newell (1982) in California forests showed that goats would eat a wider variety of plants than other livestock and successfully reduced chaparral vegetation types. Indeed, the City of Laguna Beach has seen such success with goats that they have an annual contract to use 500-800 goats to graze a 1,445-acre “Moat” around the city (Phillips, 1984). Davis et al. (1975) and Riggs and Urness (1988) found that goats will eat oakbrush without experiencing toxic side affects common to cattle. Further, these studies demonstrated that at least two consecutive defoliations in a year by grazing goats successfully controlled re-sprouting. Both found that timing of the grazing amplified the effects by taking advantage of low carbohydrate root reserves in late June (full leaf stage) and August (late summer re-growth). In a follow up study that remains unpublished, Urness also found that the stand structure in their study area remained altered after five years (D. Austin, 1998, personal communications). More open space remained between clumps of vegetation. These more "park-like stands" provide wildlife habitat and might be less prone to carry a fire.

With this as our background we began two years of pilot grazing using small herds to demonstrate effectiveness and to develop initial solutions to the logistical problems of managing and caring for the animals. Based on observations during the pilot grazing seasons (1998 and 1999) a hypothetical curve of biomass reduction was developed. This curve showed a relatively short amount of time to achieve an initial decrease in the amount of biomass in a paddock, followed by a four week period of re-growth, and then a second much shorter period of grazing to remove all re-growth.

Measurements taken in the research plots during the 2000 grazing season showed results very much in line with the hypothesis. The rate of the initial decrease is variable depending on the number of goats, the size of the pen, and the amount of biomass available. In this case with approximately 2,000 pounds of goats (or 17 animals) it took from ten to fourteen days to complete each 100’x 200’ paddock. Paddocks had between 4 and 5 weeks of re-growth when goats returned. Re-growth was consumed in two to four days. Using this information, managers might understand what kinds of changes can be achieved, how much time should be allowed to provide for changes in fuel loads and

heights, and extrapolate the number of miles of fuel breaks that might be possible for initial treatments and for maintenance.



Fire Modeling and Post Fire Results

We coupled this data with a fire behavior modeling tool called "FARSITE." The results indicated that surface flame length, fireline intensity, crown fire, and spotting were all reduced significantly in the treated areas. Then, when a training exercise at Camp Williams caused a fire on July 16, 2001, we got to see if reality matched the model.

Fanned by temperatures in the nineties and winds gusting from 30 to 60 miles per hour, the fire quickly reached Beef Hollow, where the goat research plots were located. Technicians cut the fences and ran the goats about a mile down to the Field Ammunition Storage Point (ASP) surrounded by a twelve-foot chain link fence. Fire managers estimated that technicians had at least 45 minutes before the fire would enter Wood Hollow where we had a group of goats working on a logistics demonstration. But the fire increased in both speed and intensity. Thirty minutes later, with the goats penned on a safe zone of dirt and gravel, technicians left the area as flames leapt across the road and moved on towards the nearby subdivision. Four days, 12,000 acres and $500,000 later, the fire was declared out.

In the days after the fire, we took video and pictures to record the effects of the fire and the goat treatment sites. In Beef Hollow, where the fire was relatively young and cool, and winds were constantly shifting, there was a mosaic of burned and unburned areas. Goats had only completed the A sides of plots 1, 2, and 3. The fire did not enter any of these paddocks. In plot 1B, the only vegetation that burned was the twelve foot oakbrush at the roadside edge of the plot. The rest of paddock 1B remained unburned even though the goats had only been in that paddock for a day. Other B paddocks were fire-free as well. Posts and polywire at the edges of the plots melted, but firefighters later told us that they had seen 15 foot flame lengths drop to two feet and then burn out when meeting the goat plots. Most interestingly, plots 4, 5, and 6 remained unburned and green, though the goats had only worked there in 2000.

By the time the fire reached Wood Hollow it was much hotter and was burning everything in its path. The goat treatment site was not touched and it seemed that the vegetation behind it had received a degree of protection. Rather than burning, the oakbrush there only scorched. By the end of the summer, it had re-sprouted to green again. Meanwhile, the area thinned by the hotshot crew just the week before the fire burned over completely.

Where and When Does It Work?

The fire indicated that goat treatments do work, but the success of this tool, like any other fire management tool depends on its placement and size. Past fire history can play a role in determining where a fire is most likely to start and which direction it will head. The steepness of slopes, or width of canyons will dictate how wide, and how long treatment areas should be. Finally, timing of the treatment is critical. We were initially concerned that re-growth might render the treatment sites ineffective. The Camp Williams fire showed that the three weeks of re-growth in Wood Hollow did not reduce the treatment's fire resistance. This indicates that treatments can be done before the "heat" of the fire season. Suggestions for using Geographic Information System technology to map potential goat treatment zones are included on the CD handbook.

Start-Up Success Secrets

I would like to be able to give you a step-by-step plan for your startup, but creating one suitable for every situation is impossible. A short list of steps follows. I offer these suggestions with the expectations that you will adapt them to your own needs and level of experience.

First Rule of Success - Location, Location, Location

The site you choose must have three characteristics:

1. Suitable for fire prevention

Fire managers must be involved in the selection of a treatment site. Their experience with potential fire history, behavior, and placement of other firefighting resources is critical to working in a location and at a scale that will do the most good. A goat firebreak is not a guarantee that the fire will stop. It may, but if it doesn't, the firebreak can be a way to slow the fire so that strategically placed firefighters can stop it permanently. It provides them with a degree of safety when they are trying to defend private property.

2. Accessible for goat unloading, loading, and watering

Adjust the site location or starting point to ensure that animals can get to the area, and have access to water. Different herds and herders have different capabilities, so work with each other to achieve success. I'd recommend a place close to the road, so that you can move goats in and out and water them easily.

3. Provides the proper level of visibility for the project

Depending on the scale of the project and your level of experience, visibility may or may not be a good thing. If things go poorly for you, not only will your business or your agency suffer, it could also impact how others look at using goats down the road. Your success or failure could mean that goats become popular or become pariahs.

When we began, our project had very little visibility. This worked well because it gave us an opportunity to learn from our mistakes without impacting anyone else. Visibility increased with our skill and comfort level. I offer that if you are just getting started, make decisions about the size and visibility of the project that coincide with your level of experience. For example, if you are working in a very visible location, such as the backyards of a small subdivision, consider using a smaller number of goats initially, and increasing the herd size as you and the neighbor become more comfortable.

Pilot Projects

Get started with "Pilot Projects." They can show communities what goats are all about, can give you a chance to invite the media to a field tour, and allow you time to work out any bugs, test your assumptions, and adjust and adapt to unforeseen issues. A small, successful demonstration is much easier on you, on the goats, and on the growing fire/weed goat industry. Pilot projects are also good opportunities for partnering and sharing costs among communities, agencies and organizations.

Pen Size

Pen size is critical; too small, and you'll wear yourself out moving fence and too large the animals won't focus as well on their work. Land managers and goat service providers can work together to estimate the amount of forage in an area. Based on the estimate you can choose the right number of goats and select an appropriate pen size. The Goat Calculator in the CD handbook can also help you.

A Goat-Proof Fence

The right fencing is critical to your success. A fence focuses the animals on their task, keeps them from eating neighbors' landscaping, and provides some protection from predators. We tested a variety of fencing styles and the results are included in the CD handbook along with information on how to live by these "Five Fencing Commandments:"

1) Select the right fence for your job.
2) Build your fence correctly.
3) Do simple daily maintenance.
4) Train the goats to the electric fence BEFORE you put them in a working field situation.
5) Ensure that your goats have everything they need inside the fence so they won't want to leave.

Experienced, Healthy Animals

Goats are not born knowing what to eat. They learn from their mothers, from their peers and through trial and error. Thus having animals with prior experience with the forages you are working on decreases learning time, and increases productivity. You can also use their ability to learn in combination with supplements to help them eat more of forages containing toxins.

Keep your herd healthy and ready to eat by giving them their shots, worming them, and keeping their feet trimmed. Be aware of diseases such as Johne's that have the potential to silently contaminate your herd or keep them from being legally transported to other states.

Clear Contracts

A good contract describes what the area should look like when the goats are done, provides for public safety, and addresses things like mitigation for weeds, feral animals, damage to surrounding landscaping, etc.

Hard Work

Thomas Edison once said, "Opportunity is missed by most people because it is dressed in overalls and looks like work." This opportunity is no different. I think the successful goat entrepreneur is someone with a degree of marketing skill, who is willing to work long days in heat or cold, who can explain himself to people and to goats, and most importantly, is flexible and imaginative enough to find a variety of right answers to every problem. A sense of humor is also important, because there are days that if you don't laugh, you'll probably cry.

Conclusion

I fully expect that you will combine what you find here with your own expertise in fire or goat management and your understanding of the area in which you work. I hope this information will help increase the use of goats, and enhance protection of homes and communities.

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What Do Goats/Cows/Sheep Eat?
How Much Do They Eat?
How Can I Get Them to Eat More?

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Introduction

Animals are not born knowing what to eat. Rather, they learn what and where to eat based on individual experience, by watching their mothers and peers, and in response to pressure. By understanding their behavior, you can effectively modify it and manage your livestock as an economical alternative to chemicals to reduce fire danger, control weeds, improve pastures, rangelands, and wildlife habitat, and enhance your bottom line.

The Consequences of Nutrients and Toxins in Foods

Research indicates that an animal chooses what to eat based on consequences. Nutrients in foods give positive consequences and the animal will choose that food again. Toxins in the food give negative consequences, reducing the amount the animal will eat. All plants contain some level of nutrients and toxins and these levels can change in the course of the growing season. This means that animals are constantly adjusting their diets based on the feedback they experience. In most cases, they can regulate their intake of toxins and do not over-ingest and poison themselves.

Different species (goats, sheep, cattle, horses) have different abilities to tolerate toxins, and have different dietary preferences. If allowed to eat only the most preferred plants, they are unlikely to learn how to mix foods high in nutrients with foods high in toxins. In contrast, herbivores repeatedly pressured to forage on all plants learn to eat mixtures that mitigate toxicity, assuming appropriate choices are available or supplements are provided. In a recent feeding trial sheep given low percentage preferred forage in combination with forages containing toxins appeared to learn to eat mixtures of nutritious and toxic foods to mitigate toxicity (Provenza et al., 2002, 2003; Villalba et al., 2003). Those animals learning to mix their foods gained more weight than animals given a maintenance diet of their preferred forage in combination with low percentages of toxin foods (Shaw, Villalba, and Provenza, unpublished data). This ability to learn to eat combinations of palatable and toxic foods is passed from mother to young, from peer to peer, and is enhanced in younger animals thanks to their greater willingness to try new things.

These feeding trials indicate the importance of complimentary forages and foods to help animals to learn to select new forages. Ongoing research is now identifying supplements that producers can provide their animals to aid in toxin mitigation, and how to teach animals to self-medicate. Examples of supplements include polyethylene glycol (PEG) which allows animals to double the amount of tannin containing foods they eat, and foods high in protein to offset the effects of turpenes in sagebrush and pine. Likewise, molasses or corn in the rumen can aid in preventing nitrate poisoning (Knight and Walter, 2001).

As indicated by this research, animals tend not to try new things unless there is some kind of pressure to do so. Pressure might be due to a particular species' ability to tolerate toxins, or caused by reduction in vegetation due to drought or fire. It can also be a result of "satiety" or just being tired of the same old thing. We increase pressure by moving animals to an unfamiliar location, or by fencing them.

We hypothesize that grazing management systems reduce or increase pressure and cause animals to forage in different ways. Low stock densities for extended periods encourage selective foraging and re-grazing of individual plants, whereas high stock densities for short periods encourage diet mixing. This means that what was traditionally considered proper grazing management, rotational grazing at low stock densities, may have trained generations of livestock to use foods and habitats selectively – eat the best and leave the rest – thus inadvertently accelerating a decline in plant diversity and an increase in abundance of less desirable plant species. Conversely, high stock densities for short periods may be used as a tool to train animals to use a broader array of foods and habitats.

Learning to eat a variety of foods means an increase in biodiversity on the range because livestock are no longer selecting only a few, preferred species. More even utilization of all plants for short periods enhances the ability of plants to regrow and minimizes the competitive advantages that occur for plants not grazed (Briske and Richards, 1995). These results have been born out by an eastern Montana rancher, Ray Bannister. He altered his grazing management to encourage cattle to utilize unpalatable and palatable species simultaneously to mitigate aversive effects of toxins. Pastures are intensively grazed and then rested for 2 years. The result of this change in Bannister's grazing management is that his 7,200 acres has some of the highest vegetation cover and diversity in the state. The opposite can be seen across the west (Provenza, 2003)

Helping Animals Learn

Understanding how to use pressure in combination with food mixing and supplements can help us encourage animals to learn to eat a broader variety of foods. There is no textbook that outlines the steps and procedures one might use. However, here are some suggestions for beginning on your own. These are the steps we are using this year in a pilot project at Grant-Kohrs Ranch National Historic Site in Deer Lodge, Montana.

Begin With Young Animals

Young animals are less neophobic and more apt to sample and learn to eat a variety of foods. You might also look for animals whose mothers have experience eating a broad array of foods are less. Finally, animals have demonstrated peer-to-peer learning. By mixing experienced animals with inexperienced you increase the ability of novices to quickly learn.

Provide Experience

Experience with mixing foods increases an animal's tendency to sample a variety of foods. Consider providing your livestock opportunities to test a variety of nutritious foods, thus decreasing their willingness to experiment. This may involve using unfamiliar flavors on familiar foods (green apple and coconut are both commercially available and have been used as research tools), introducing them to molasses so that molasses covered foods will seem familiar, or providing them other supplements in unfamiliar forms (protein blocks, alfalfa pellets).

Create Expectations

Feeding a nutritious supplement at the same time daily in a recognizable food container may help when it comes time to introduce a food with a toxin. They may well come to the bucket expecting their treat, and try the new food.

Make Mixers Available

It is important that the availability of foods is such that animals can eat foods that are biochemically complementary, and thus mix their diets in ways that facilitate eating plants that contain toxins. Do not expect your animals to be successful in monocultures of weeds. Adequate diversity

allows livestock to successfully mix foods and mitigate for toxicity.

Pay Attention to Body Condition

Healthy animals, not starving animals, are more capable of mixing foods and processing toxins. At the same time, if they have a maintenance ration of preferred foods, they are unlikely to learn to mix their forages. Limited quantities of supplements (i.e., alfalfa pellets, protein blocks, molasses applied to thistle) can allow you to maintain pressure, while helping animals maintain good nutrition and assist them in their learning process. Consider using supplements as appropriate to enhance health and learning throughout the grazing season.

Use the Appropriate Stocking Density

Pressuring animals to eat all of the foods involves using high stocking density to reduce their ability to pick through and eat only what they like. You can use portable electric fencing to concentrate animals on their task of learning. Through trial and error, researchers have found that your teaching pen should include only as much forage as your animals can eat in one day.

You need three things to decide on pen size. In ascending order of difficulty they are: how many animals you'll be working with, how much they eat per day, and how much forage is available. I recommend you start with a small number of animals. As a producer you are probably familiar with your animals' consumption rates. For goats it averages 4 to 5% of their body weight per day.

Estimating forage production can be quite time consuming if you are doing it for research or legal reasons. For adaptive management, you don't need to be as precise or rigorous. Those of you attending this session will receive handouts describing relatively simple methods you can use to estimate forage production. You might also consider working partnering with your local extension agent, NRCS office, the Bureau of Land Management or Forest Service. At a minimum this can help you calibrate your own estimates.

Conclusions

By paying close attention to your animals, and being flexible and adaptive, you can have some success. You can use this ability to enhance your own operation or to provide services to your community and neighbors. If you plan to use your animals to provide weed or fire control services, the Handbook on CD "Goats! For Firesafe Homes in Wildland Areas" includes a "goat calculator" that can help you estimate labor, fencing and watering costs, and the time it will take to clear your pasture or create a fuel break (Voth, 2003). For more information on using behavior to manage animals and vegetation, visit http://www.behave.net.

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Basic Goat Husbandry

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Introduction

Interest in goats has mushroomed over the past fifteen years. Increased interest in goats and the value of these animals has made us do a better job in managing them. Kid management from birth to breeding is an essential component of the dairy goat enterprise. The kid management along with the nutritional management of the doe herd has the greatest effect on the long-term productivity of the goat herd. The dairy goat kid at birth represents a genetic resource necessary to replenish the herd gene pool, which has a changing composition due to death, culling, and sales for breeding stock. While the genetic characters of the kid are determined at the hour of conception, survival to lactation, and an adequate body size are necessary to realize inherent genetic potential for lactation. Kid mortality has a direct effect on genetic progress and, thus, we need to maintain low mortality from birth to weaning.

Pre-Parturition

The kid management program should actually begin prior to parturition, with attention to the nutritional needs of the gestating doe in late lactation and during the day period. The tendency is to regard the late-lactation and dry doe as a non-productive part of the milk-producing system. On the contrary, however, an adequate diet for the dry doe is essential to reproduce healthy kids. Pregnant does should receive plenty of exercise. An obese doe should be avoided, but the high-producing doe needs to recover body weight lost during the previous lactation. Clean, cool water and free-choice trace mineralized salt should be available.

Vaccination booster for Clostridium perfringens C and D and tetanus toxoid should be given not less than 3 weeks prior to kidding. Vitamin E/selenium injections are given during the dry period to prevent white muscle disease in the kids, especially in areas where soils are selenium deficient. Does should be wormed at dry off and also before kidding.

Parturition

The doe should kid in a clean environment, either a well-rotated pasture or stall bedded with straw or other absorbent material. The kid prior to birth has been existing in a germ-free environment and parturition represents exposure to common disease organisms to which the mature animal has developed resistance. The location of the kidding stall or pasture should be near a well-traveled area so that the doe can be frequently observed for kidding difficulties. Few adult does require assistance at the time of kidding though problems are always a possibility. First-freshening does should be closely watched, especially if bred to bucks known to sire large kids.

Kid Management

At birth, two management practices are critical to the future health and survival of the newborn kid. The navel cord should be dipped in a solution of tincture of iodine to prevent entry of disease-causing organisms through the navel cord and directly into the body of the kid. If necessary, a long navel cord can be cut to 3 or 4 inches in length. A bleeding cord should be tied with surgical suture

material. Dipping of the cord in iodine not only prevents entry of organisms but promotes rapid drying and the eventual breaking away of the cord from the navel.

The second critical practice is the feeding of colostrum milk as soon after birth as possible. The colostrum, or first milk, contains antibodies which the doe did not pass to the fetal kid *in utero*. Consumption of colostrum must occur as early as possible and prior to 18 hours after birth, as there is a rapid reduction in the permeability of the intestinal wall of the newborn to the antibodies. The colostrum milk should be bottle-fed to the newborn to insure adequate consumption. Excess colostrum can be frozen for use in orphan or bonus kids. Recent research indicates that disease organisms, especially caprine arthritis encephalitis (CAE), may pass from doe to kid through the milk; transmission might be avoided through the use of extra colostrum frozen from does tested and shown to be CAE-free or heat treated colostrum. An additional practice at birth that enhances the health of the newborn kid is to give 3 injections of iron dextran and vitamins A and D after birth. A vitamin E/selenium injection may be beneficial in areas of selenium-deficient soils.

Kids should be checked carefully at birth for any deformities or abnormalities. Pneumonia is a major killer of young kids. A dry, draft-free environment is an excellent preventative measure. Kids should receive colostrum 10% of their body weight within 24 hours. For example, a six pound kid will receive 300 mL of colostrum within 12 hours. Kids could be left on does to nurse or started on a good quality milk replacer after they get their colostrum. A lamb milk replacer may be the best substitute for goat milk. Typical lamb milk replacers contain 22 to 24 % protein and 28 to 30% fat. Casein, a protein in lamb milk replacer, can be completely replaced with whey protein concentrate, which allows acidification. Acidification helps maintain the quality of the unused milk and reduces the incidence of diarrhea. Maintaining milk replacer quality after mixing is particularly important when kids are fed ad libitum.

The biggest problem with using lamb milk replacers occurs with the feeding schedule. Frequently, kids become "pets." There is a tendency to feed them as much milk as they will consume each feeding. Unfortunately, this may result in bloat and sudden death from diarrhea. A restricted feeding program is beneficial.

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

Kids will nibble at fine-stemmed leafy hay at one or two weeks of age. At three to four weeks, a calf starter should be offered. As the hay and grain consumption increases, gradually reduce the milk being fed. When the kid is eating ¼ pound of grain per day plus some hay and is drinking water from a bucket, it is time for weaning.

Birth to Weaning

Milk is the principal component of the diet of the pre-weaning kid. There are numerous ways to feed milk including the use of bottles or pails, suckling the dam or nurse does, and self-feeder units. The method chosen will depend upon such factors as the size of the herd and available labor, as well as personnel preference. With any system, the health of the kid, sanitation, and available labor are the major factors to consider. Under natural suckling, kids consume small amounts of milk at very frequent intervals. Ideally, artificial rearing should mimic natural suckling, but the constraint of available labor precludes frequent feeding. Nevertheless, kids should be fed two to four times daily for the first week

or two and twice daily thereafter. Bottle feeding is more labor intensive, but kids receive more individual attention and are easier to handle post-weaning than kids that are allowed to suckle does. Pail or pan feeding may reduce labor somewhat, but body weight loss and need for extra "training sessions" at the beginning must be expected.

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

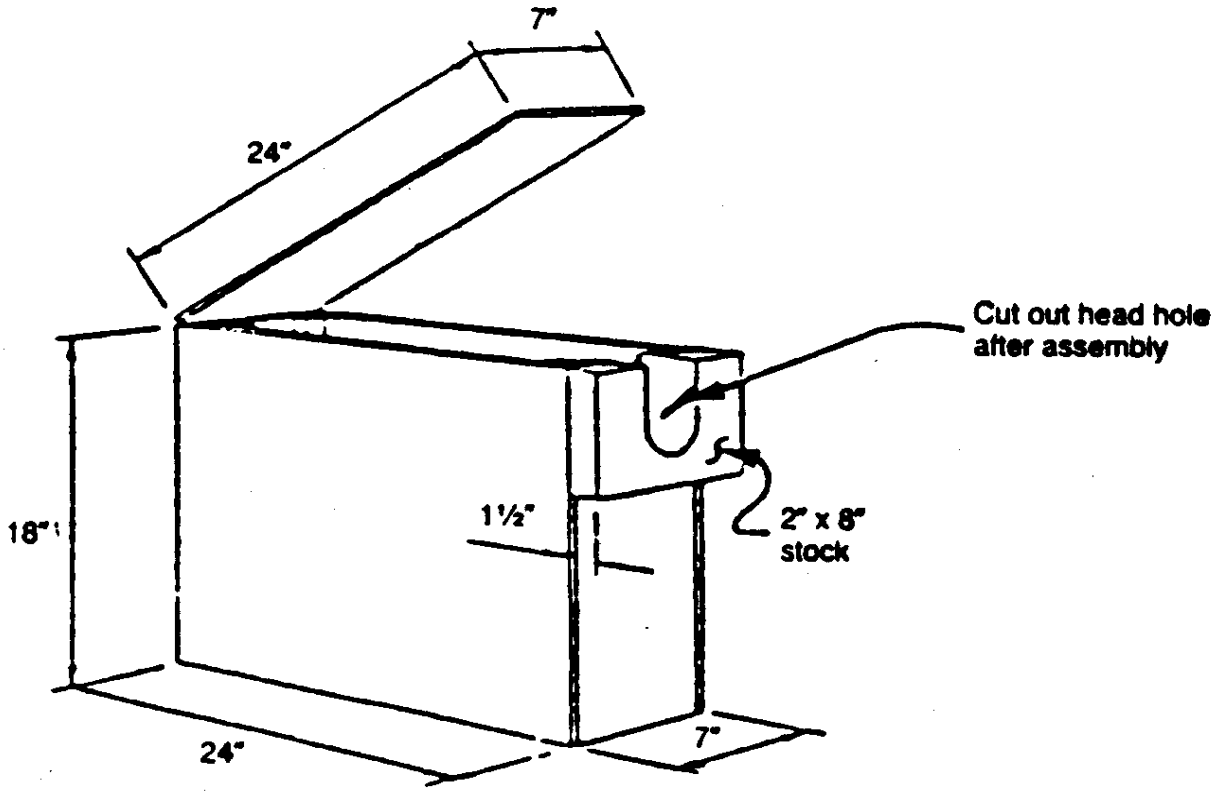
In raising dairy goat kids, increases in size and weight are not the only measures of success. A well-formed skeleton and proper development of internal organs are often neglected when the emphasis is on rapid gain. An average daily gain of 250 g during the first weeks of life should be the goal. By limiting daily milk consumption to about 2 quarts, daily consumption of dry feed will be encouraged. Dry feed consumption is important in developing body capacity. By increasing body capacity, feed intake and digestion increase. Research has shown that at two months of age a weaned kid has a reticulo-ruminal capacity five times as large as suckling kids of the same age.

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

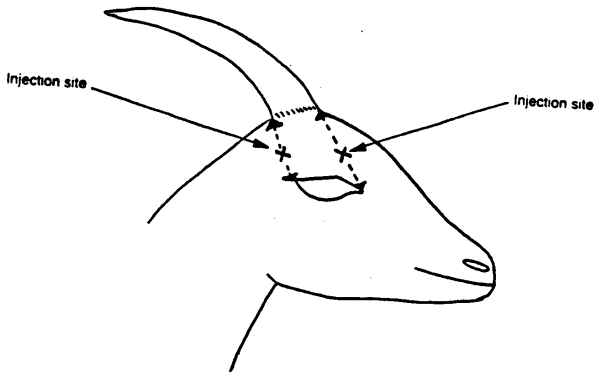
Several factors need to be considered when making the decision as to when to wean dairy goat kids. The most important consideration is whether or not the average daily consumption of concentrate and forage is adequate for growth and development to continue in the absence of milk. Fixed weaning ages are less desirable than weight goals such as 2.0 to 2.5 times birth weight. Many producers who have an erratic or marginal market for their milk delay weaning for longer periods than necessary. While milk feeding may promote more rapid growth than a concentrate-forage diet, maintaining kids on milk may delay the attainment of the dry feed intake level necessary for weaning and also leaves the kid disposed to diarrhea.

Disbudding

Kids should be disbudded in the first two weeks of life. Buck kid horns grow faster than doe horns. Some large single buck kids should be disbudded within the first week. Disbudding a buck kid is the true test of proficiency and many fail it, judging by the number of scurs seen on adult bucks. If you try to de-horn a buck kid whose horn base is wider than a regular de-horning iron, you will get re-growth of the horn in a crown outside the burned area. If you try to de-horn a small kid with a wide calf de-horner, you may get re-growth of the horn from the center of the ring. If one person is doing the job, a de-horning box offers the best and safest restraining.



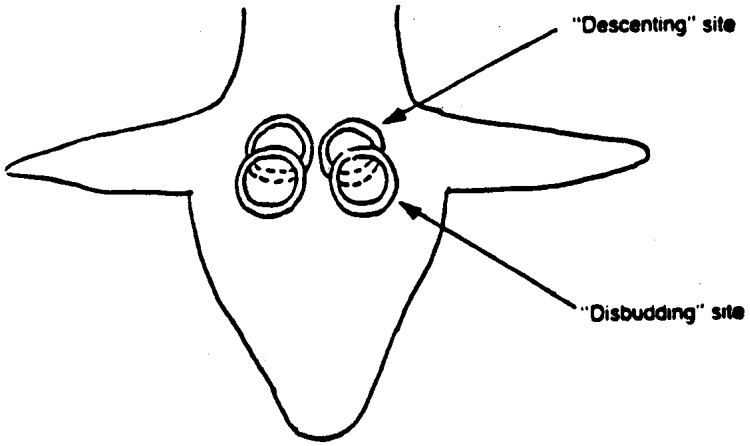
Although local anesthetic is commonly advocated, the actual technique is not easy and the baby goat will scream while being held in preparation for a ring block or a cornual nerve block.



Goats are more sensitive than other ruminants to local anesthesia, which results in adverse reactions as a result of overdosing. If kids are brought to the clinic, the easiest and fastest technique is masking them down with halothane and oxygen. However, remove the mask and gas flow during cautery; otherwise a flash of fire in the goat hair may result. Xylazine at 0.3 to 0.4 mg/kg is commonly used for injection anesthesia, and kids should be kept warm during the prolonged recovery period.

The equipment most commonly used is an electric-heated metal rod with a hollowed-out end. None of the irons can be relied upon to maintain a constant temperature, and it is extremely important

to match temperature and time. Underburning will result in scurs and overburning will lead to brain damage or death. The horn bud is located over the sinus close to the cranium in kids. After the dehorning iron is hot, apply the de-horner firmly over the horn area and rock it around slowly for 3.5 to 4 seconds. Remove the iron and repeat if necessary and do the other side. Descenting could be done at the same time if necessary. Inject the kids with 150 IU tetanus antigen. Although the risk of tenanus after disbudding is not great, it is a good practice to do it.



Dewattling

Many goat breeders believe that wattles detracts from the appearance of a show goat, and it is difficult to show clip the hair evenly and smoothly, so wattles are removed at birth.

Castration

Dairy and pygmy goats should be castrated if they are intended to be companion animals. This will reduce the smell and aggressive behavior. Angora goats are castrated so they can be run in either flocks for mohair production. Angora goats are usually castrated at 6 to 12 months of age so that they can develop bigger horns.

Rubber ring
Burdizzo
Surgical

Reproduction

Doelings are usually bred when they reach a weight of 80 to 95 pounds. Breeding season is usually September to February but some does, particularly Nubians, will breed at any time of the year. They are seasonably polyestrous and cycle every 20 to 21 days. Estrus lasts about two days and is detected by frequent urination, tail erect and swishing, drop in milk production, riding and being ridden by other goats, and hanging around the buck pen. Ovulation is usually towards the end of estrus and gestation is 144 to 157 days.

The proper citation for this article is:

Dawson, L. 2004. Basic Goat Husbandry. Pages 22-26 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Administration of Injectable Drugs and Vaccines in Goats

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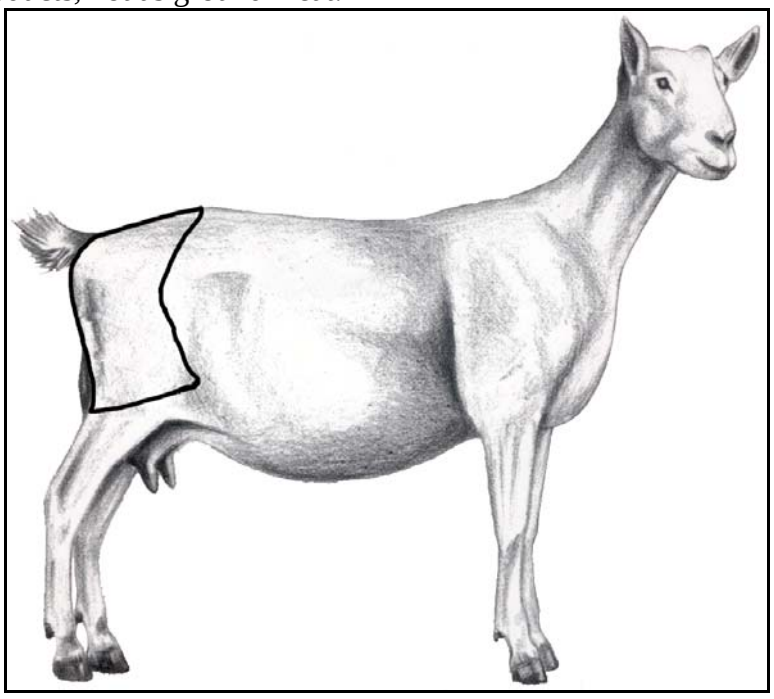
Live animals are considered unprocessed food, especially if those goats are intended for slaughter and later used in the food chain. Injection site lesions should be a major product quality concern for goat producers raising goats for meat. Therefore, persons involved with raising, handling, transporting, holding and marketing meat and milk products are encouraged to establish systems to ensure that animal drugs are used properly and to prevent illegal drug residues.

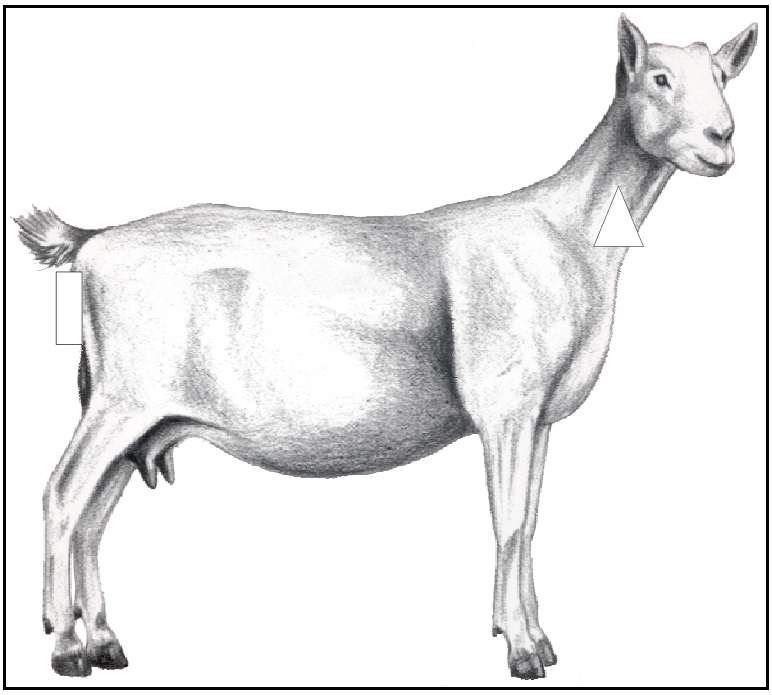
Injection-site defects are lesions or scars found in different cuts of meat. They result from tissue irritation caused by the administration of intramuscular (IM) or sometimes subcutaneous (SC) injections. Tenderness of the meat is also significantly reduced in the injected area, that extends out at least 2 inches in all directions from an injection site.

Commonly seen injection-site defects on a goat carcass are in the round. Round is an area on the rear leg, midway behind the hook bones (tuber coxae), to about six inches above the hocks. The muscles in this area are the middle gluteal, gluteobiceps, semimebranosus and semitendinosus muscles. Rounds from goats are economically important, because they are commonly processed and marketed as whole muscle products, not as ground meat.



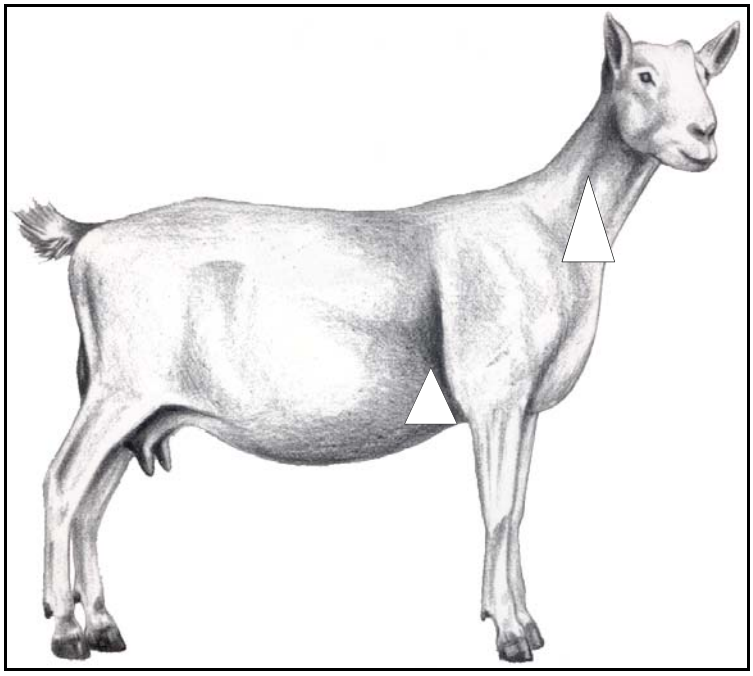
When injection-site defects occur, the packers must trim and discard the damaged tissue. This greatly reduces the marketability and economic value of the meat.

Intramuscular injection sites



Intramuscular injections are commonly given in the triangular area of the neck, bounded caudally by the shoulder, dorsally by the cervical vertebra and ventrally by the nuchal ligament of the spinous process. Do not give intramuscular injections on the round for goats used for meat purposes. Volume given in the muscle should not be more than 3 millilites per site.

Subcutaneous injection sites



Subcutaneous injections are usually given in the axillary region, behind the elbow joint. They can also be given in the triangular area in front of the shoulders.

The following are recommended needle sizes and lengths used in goats.

Age	**Gauge**	**Length**
<4 weeks old	20	1/2 inch
4 to 16 weeks old	20	5/8 to 3/4 inch
4 to 6 months	20	1 inch
>6 months	20 or 18	1 inch

Vaccination Schedule for Goats

Period	**Time to Vaccinate**	**Disease**	**Booster**
Kids	2, 4, and 8 weeks	CL perfringens C&D CL tetani-toxoid	Annual
Kids	4 to 6 weeks	Contagious ecythma (if a herd problem)	Annual or 2 months before the show season
Kids	8 and 12 weeks (optional)	Caseous Lymphadenitis	Annual
Prebreeding			
Doe	30 days prior to breeding	Chlamydia (abortions)	Annual
Bucks	30 days prior to breeding	CL. Perfringens C&D CL tetani-toxoid	Annual
Gestation			
Doe	30 days prior to kidding	CL. Perfringens C&D CL. tetani-toxoid	Annual

The proper citation for this article is:

Dawson, L. 2004. Administration of Injectable Drugs and Vaccines in Goats. Pages 27-29 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Tanning of Goat Hides

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Introduction

Recently, there seems to be a renewed interest in tanned hides for use in the home as decoration, rugs, or coverings for chairs or other uses. A local farm supply store has even begun to carry tanned calf and cow hides. While attractive, the cost of purchasing may be prohibitive for many people. Tanned sheep hides have been commonplace for years. Why not a tanned goat hide? Many goats have attractive hides that could be tanned, hair-on, and used in many ways. Learning the art of tanning hides can be very rewarding, through acquisition of new skills and through the attractive products resulting from the endeavor. Tanning at home is also less costly than purchasing a tanned hide. When sending hides to a tanner costs may be on a per hide or per square foot basis. Deer hides generally range from $45 - $60 unless it is exceptionally large. Calf, cow and other larger hides will be on the square foot basis. Kits designed to tan up to 20 pounds of hide (the equivalent of two deer skins) can be bought for between $25 and $35. The other equipment needed to tan hides can be purchased or much of it can be fashioned from items found around most households or farms. Although home tanning may not match the quality of a professional tannery, good quality, long-lasting products can be made. However, if you do have a special hide, it is best to send it to a professional rather than attempting it yourself. This is particularly true if you are new to the art of tanning.

Where Can One Find Information?

While there are books dedicated to tanning hides, much of the information available will be found in conjunction with information on taxidermy. Thus, a local taxidermy shop would be a good place to start. The taxidermist either tans hides or sends them off to be tanned. He or she may also sell tanning chemicals or supplies. Many of the books available on tanning were written between twenty and thirty years ago. While they contain valuable information on hide selection and preparation, the tanning process, and working with leather, many newer tanning methods are not contained in those texts. Magazines dedicated to the taxidermy trade will also contain information on tanning hides.

A large amount of tanning information can be found on the internet. Much if it will be good but some may be confusing or incorrect. There are tanning chemical suppliers, taxidermy supply companies, and other outdoor sporting goods companies that sell tanning chemicals and supplies on-line or via catalogs. Some of their web pages and catalogs have “How to” sections that provide good information on hide handling and newer tanning methods. Performing an internet search on hide tanning will result in a list of numerous web pages that contain information on tanning or that are selling supplies or services. Interestingly, there is an increasing amount of information on tanning using animal brains to make buckskin in the traditional way of Native Americans. In addition to these websites dedicated to “brain tanning,” several good texts have been written on the subject. At the end

of this article is a list of texts and websites of companies and distributors of tanning chemicals and supplies[1]. Finally, the directions for use included with many tanning chemicals provide good detail and instruction on hide preparation and chemical usage.

Different Tanning Processes

Before selecting a particular type of tanning method to try, it is best to familiarize yourself with some of the tanning processes available. Tanning methods can be vegetable, mineral, aldehyde, or synthetic. There are also oil tanning methods that are used in the production of chamois leather. Vegetable tanning is the oldest method and uses tannins found in the bark and other parts of certain trees and shrubs. Extracts from oak, sumac, chestnut, and quebracho are a few of the "vegetable" tanning materials available. Vegetable tanning is used to produce heavy leathers, such as harness or sole leather, and the material used gives leather its characteristic color. It is not suitable for hair-on tanning and can result in stiff leather. Vegetable tanning can be tried at home, however, by grinding bark, leaves, twigs, seeds, and other parts of tanning-containing plants into a solution into which small hides could be immersed. The tanning process is slow and thick hides can take months to finish. To test if the tanning process is complete, cut a thin strip of the hide and see if the color is the same throughout without a lighter middle layer indicating incomplete tannin penetration. The ultimate test of a properly tanned hide is to put a small piece into boiling water. If incompletely tanned, the piece will curl up; a properly tanned hide should be unaffected by boiling water (Hobson, 1977) or withstand at least two minutes of boiling before it begins to curl (G. Dimaio, Industrial Specialist, USDA-ARS Hides, Lipids, and Wool Research Unit, Eastern Regional Research Center, Wyndmoor, PA, personal communication).

Of the mineral tanning methods available, chrome tanning is the most common and uses chromium sulfate as the tanning agent. It is mainly an industrial process used for leather production on dehaired hides. Tandy Leather Co. does sell a chrome sulfate-based tanning kit called "Tannery in a Box" that includes chemicals for hair-on or hair-off tanning. Aluminum salts are another mineral tanning method. Alum tanning is a method that many texts include. A disadvantage of alum tanned hides is that they may "sweat" if atmospheric humidity becomes too high. Additionally, inadequate washing of the hide after tanning to remove excess chemicals may leave acid residues that could react with moisture and damage the hide. Lutan F, made by BASF, is a mineral powdered tanning agent that is very popular in tanning hides for taxidermy and can be used at home with good results. It is available from many suppliers.

Synthetic tanning agents or syntans have been developed as a result of advances made in the chemical industry. Syntans are described by Rittel (1994a) as man-made tanning agents that are highly reactive, form strong bonds, and when used properly result in well-tanned, long-lasting hides. Syntans may be used by commercial tanneries in conjunction with mineral tans as they improve the dyeing ability of leathers (Rittel, 1994a). At home, syntans can be used alone or in combination with mineral tanning agents. One example of a syntan is EZ-100 by Rittel. EZ-100 is administered as a soak or bath in which the hides are placed after pickling and neutralizing. EZ-100 also touts itself as environmentally safe by using acids and tanning agents that are biodegradable. However, the salt used in the tanning solution still means that careful disposal is warranted. Hides tanned with EZ-100 can be washed in lukewarm water. Other tanning agents such as many of the "paint-on" tans discussed below may also contain synthetic tanning agents (Rittel, 1994a).

Aldehyde tanning uses formaldehyde or glutaraldehyde. Information exists on tanning hides at home with glutaraldehyde but newer tanning methods, many using syntans, are safer for home use.

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[1] Mention of trade names, proprietary products or vendors does not imply endorsement by Langston University or the E (Kika) de la Garza American Institute for Goat Research of the products or vendors named or criticism of similar products or vendors not mentioned.

Oil tanning is a means of preservation and not a true tanning method. A warm oil is brushed into the hide and the hide is left in a warm place for the oil to soak in. Several applications are needed and this method is not suitable for hair-on tanning.

Selecting a Tanning Method

A final consideration in selecting the tanning method is the form of the tanning agent and its ease of use. Tanning agents are available in powder, liquid, or cream form. The powdered forms, and some liquid forms, require the mixing of the chemical into a water and salt solution and immersing the prepared hide for the time period specified in the instructions. Most liquid and cream tanning agents are designed to be applied directly to the prepared hide using a paint brush or by hand wearing gloves. There are advantages and disadvantages to both systems. While paint-on tans mean one less solution to make and dispose, they require careful application. They may stain the fur or hair of the hide so care is needed around hide edges; however, all areas of the skin must be covered for absorption of the tanning agent. The amount to use may be difficult to gauge. If too heavy an application is used on thin skins the tanning liquid may be absorbed through the skin resulting in potentially discolored and(or) greasy, oily feeling fur. While the greasiness can sometimes be washed out with detergent, the stains remain. However, paint-on tans are easy to use, result in a well-tanned hide, and are preferred by many tanners and hobbyists. Examples of paint-on tans available include: Liqua-Tan™, made by Knobloch's and available through many distributors; Kwiz-n-Eze by Rittel's; McKenzie Tan, available from McKenzie Taxidermy Supply; Tannit® Solution, offered by Tandy Leather Co.; Bollman's Mammal Tanning Cream; and Trapper's Hide Tanning Formula™. Others may also be available.

When using powdered or liquid tanning agents requiring creation of a tanning solution, usually, the pH of the solution must be monitored. Monitoring can be done using simple pH paper available from suppliers and adjustments made using acids or alkaline substances such as sodium bicarbonate. If a tanning kit is purchased these chemicals are usually included. Generally, no other monitoring is required in using the tanning agent except adhering to specified soaking times to prevent overtanning. Tanning solutions should be neutralized and disposed of properly. Do not dump or dispose of solutions where they can contaminate streams or ground water. Chemical and salt water solutions should never be put into septic systems as these can kill the microflora needed to break down waste. Contact local authorities about proper disposal methods.

Use of immersion tanning methods negates problems with discolored or greasy hair sometimes encountered with paint-on tans. Through soaking the tanning agent has access to both sides of the hide, although the hide should be moved occasionally while in the tanning solution to ensure that there are no folds in the hide preventing adequate chemical penetration. This can be done with the blunt end of an old wooden broom or shovel handle. Professional tanneries may use rotating drums containing tanning solution and hides. Please note that the hair of deer is hollow and deer hides will float so stirring may need to be more frequent. If tanning is done correctly, weighting a deer hide to keep it submerged in the solution is not necessary. Goat hides do not have this problem.

There are many kinds of immersion tanning agents. For initial attempts at tanning, it may be beneficial to purchase a kit complete with tanning chemicals, instructions and a list of the needed equipment. Rittel's manufacturers a many types of kits that are available from various distributors. Examples include: EZ100 Kit, Trapline Tanner Kit and Rancher Tanning Kit that both utilize Rittel's Kwik-Tan, and Dehairing and Leather Tanning Kit. Kits containing Lutan F as the tanning agent are available from Van Dyke Supply Co. Inc. and WASCO. Of course it is possible to purchase tanning chemicals individually and there are many other chemicals on the market, one example being Para Tan manufactured by Knobloch's. Authentic Taxidermy Supply Company sells a product called "One Hour Tan" that requires hides to soak for only one hour in the tanning solution. Finally, while not covered in this article, chemicals and kits are available for tanning birds and reptiles.

Basic Tanning Steps

Whatever method is chosen to use in tanning a hide - chemical or paint-on, kit, or purchase of separate chemicals - many of the basic steps are the same: skinning the animal; preserving the hide; fleshing the hide; pickling and neutralizing; the actual tanning process; oiling; drying, and softening; and finishing. As with any craft there are many variations on the main themes and different texts will provide different tanning recipes, order of steps, chemicals to use and tips on how to successfully follow their method. It is a good idea to read through several methods and speak with someone knowledgeable on tanning hides before selecting a particular one. As each method or tanning recipe is slightly different, it is best to follow the instructions and learn the basics. One can then experiment in the future.

It is not the goal of this paper to present all of the tanning variations available. Rather, some pertinent information on each of the basic steps will be given. More detailed information can be found in the texts listed at the end of this paper or one of the other information sources previously mentioned. Further, the information presented is designed for the hobbyist tanner and, as such, no use of tanning machinery is required.

Skinning

Most people who want to tan a hide will also use the carcass for meat and will take the animal to a meat locker or abattoir where it will be expertly skinned. If you wish to skin an animal for its hide, be sure the carcass is fresh as putrefication and decay begin immediately upon death. Bacteria become active breaking down tissue, damaging the hide, and causing hair slippage. Also, ligaments under the skin can shrink as the carcass cools making skinning more difficult. If you do your own butchering ensuring that a carcass is fresh is no problem; however, if an animal is found dead caution is warranted. In addition to possible problems with skinning and hair loss you may be in danger of contracting a disease. *Some animal diseases, such as rabies, tetanus, and anthrax, can be transmitted to humans through contact with infected animals. If an animal is seen to be ill, acting strangely, or found dead for an unknown cause it should be buried or disposed of and not skinned, even with gloves on (Hobson,1977).* Chronic Wasting Disease (CWD) in deer is also of concern and while there is currently no evidence that CWD can be transmitted to humans, wearing gloves when skinning and butchering deer has been recommended. Hunters are advised not to consume meat from suspect animals. As the disease agent is found in central nervous tissue, the practice of brain-tanning has been discouraged in some areas. More information on CWD can be found at the USDA Animal Plant Health Inspection Service CWD website, http://www.aphis.usda.gov/lpa/issues/cwd/cwd.html; the Chronic Wasting Disease Alliance Website, http://www.cwd-info.org/; and state wildlife departments, and websites.

Many people who hunt or butcher at home have experience skinning and have their own favorite tools and methods. Skinning can be done with the carcass hanging or lying. Generally, hanging is easier as after the initial cuts are made the skin can be pulled downwards and "fisted" away from the body, thereby lessening the need to use a skinning knife. A skinning knife should be very sharp and used sparingly to decrease the chance of cutting the skin which mars the hide. Hides can also be removed using mechanical means. No matter how the hide is removed, large amounts of fat or meat should not be taken with the skin as this material will have to be removed later and can impede salt penetration when preserving (see following section). Any obvious blood spots or dirt should be washed off. A good job in skinning will make tanning easier.

Preserving

If the hide is not to be tanned immediately it must be preserved. The goal of preservation is to stop the putrefication and decay begun by bacteria immediately upon death. Never leave fresh hides rolled up or stacked. The heat remaining in them will encourage bacterial growth and the possibility of hair slippage increases. If skinning takes place in a different location than preservation, try to cool the hide as quickly as possible by laying it open. This discourages proliferation of bacteria. While plastic garbage bags are useful in handling a wet, bloody hide, do not leave hides in a closed bag. This traps the heat allowing decay to start. Begin your preservation technique as quickly as possible.

The main methods of preservation are salting, freezing, and drying. In any method, the first step is to remove any large amounts of meat or fat remaining on the hide. Salting the hide to remove moisture and create an unfavorable climate for bacterial growth is the most common preservation method. In salting a hide use only non-iodized salt such as non-iodized table salt or pickling and curing salt. Rock salt should never be used as it has impurities. A fine grain salt is preferred as large grain salt does not penetrate the hide well. To salt a skin, lay it flat and pour a generous amount of salt down the middle of the hide, approximately one pound salt per pound hide, and rub it in thoroughly covering every portion. Fold the hide flesh to flesh, roll it up and place it on a slanting board to drain. The following day shake off the wet salt and resalt with new salt. Once the skin has finished draining it can be laid out flat to dry which may take several days or longer depending upon the weather. Hides should not be dried in direct sunlight or where temperatures are very high. Dried skins can be stored in a dry place until tanning.

When preserving by freezing, the goal is to reduce the hide temperature quickly. To best do this, lay the hide flat in the freezer and when it begins to stiffen fold it flesh to flesh, roll and place inside a plastic bag. A frozen hide will last for months or even years with no damage to the hide (G. Dimaio, Industrial Specialist, USDA-ARS Hides, Lipids, and Wool Research Unit, Eastern Regional Research Center, Wyndmoor, PA, personal communication). However, it has also been written that hides to be tanned with the hair on should not be frozen as this can cause hair to fall out (Tannery in a Box Instruction Sheet). As few people own a freezer in which they wish to freeze goat hides, salting will likely remain the preferred method of preservation. Air drying, also called flint drying, is a less effective preservation method than salting. It is extensively used in developing countries where hides are stretched and staked to the ground or tied in frames to air dry (Kniefel, 1991).

Once you are ready to begin the tanning process, the preserved skin must be rehydrated in preparation for fleshing. Frozen hides should be soaked in water to thaw them. Salted hides should be soaked in a brine solution of one to two pounds salt for each gallon of water needed to completely cover the hide. Hides should be soaked for 24 hours or until they are like a wet dishrag. If a hide is very dry care must be used in getting it into the solution so it does not crack upon bending. Additionally, very dry hides may have to be soaked for longer than 24 hours.

Hides that are excessively dirty will likely need to be washed. This can be done prior to fleshing after the hide is rehydrated or fully thawed. If slaughtering one of your own animals you can minimize hide dirt by care prior to slaughter and during the slaughter process. Angora hides can be a problem if excessively dirty and have hay or grass matted in the mohair.

Fleshing

To flesh a hide means to scrape all fat, meat and membranes off the skin in preparation for the actual tanning process. This can be done before the hide is salted to allow easier salt penetration. Fleshing is most easily accomplished through the use of a fleshing beam and a fleshing knife. A fleshing beam is a piece of wood over which the hide is draped for scraping. A common type of fleshing beam can be fashioned out of a 2"× 6" or 2" × 8" board five or six feet long. One end should be cut to a blunt point and all edges rounded and smoothed. Legs are attached near the pointed end so that the fleshing beam slants upward from the ground to waist level. While this is the most common type of beam, others such as rounded logs are used. A fleshing knife is a blade with a handle on both ends allowing even pressure to be exerted as the blade is pushed down the hide. Blades should be dull as the goal is to push and scrape all fat, meat and membranes off the hide, leaving only the skin. A blade that is too sharp can cut the hide exposing hair roots leading to subsequent hair loss. Fleshing knives are available from many taxidermy supply stores at a reasonable cost. Alternatively, a dull draw knife or butcher knife driven into a block of wood for a second handle can be used. Churchill (1983) describes methods to make fleshing knives and other knives from used industrial hacksaw blades. Mill planer blades from logging mills can also be fashioned into fleshing knives and these types of knives are available on the internet.

To flesh a hide drape it over the pointed end of the fleshing beam and let it drain briefly. Using the fleshing knife, push downwards scraping off unwanted material. To make fleshing easier and lessen the chance of cutting the hide, it is important to flesh with the lay of the hair. The legs should be fleshed towards the belly and the hide from the tail pushing towards the neck (Rittel, 1994b). Fleshing takes practice and initially can be time consuming but must be done properly, removing even the thin membrane held tightly onto the skin. Once a hide is fleshed any remaining dirt or blood should be removed from the coat in preparation for the next step.

Electric fleshing machines, found in taxidermy supply catalogs, are available for fleshing and shaving hides. The cost is usually prohibitive for the hobbyist tanner as the least expensive handheld models cost approximately $200 and bench models cost over $600. Even with machines, many professionals still do initial fleshing with a traditional fleshing knife and beam. Fleshing machines do have distinct advantages in shaving hides. Shaved hides are thinner, use less tanning chemicals due to reduced weight and result in a softer finished product. This is especially true for hides from thick-skinned species. While shaving can be accomplished using a very sharp knife, it is very difficult to produce a consistent thickness and to avoid cutting the hide. Generally, goat hides can be tanned and softened without shaving.

Pickling and Neutralizing

Pickling, as described by Rittel (1993), is the use of an acid solution to acidify and temporarily preserve a skin while physically and chemically preparing it for tanning. Most tanning recipes will call for an acid pickle, though it may be included in the tanning process itself and not a separate step. Some paint-on tans, such as Tannit® solution and Liqua-Tan™, are applied directly to the fleshed hide without the skin undergoing a pickle.

Pickling solutions are mixtures of water, salt, and acid made in a plastic barrel. Enough solution should be made to completely submerge the hide while not resulting in overcrowding if several hides are done together. If in doubt about proper quantity, Rittel (1993) suggests to making two quarts of pickling solution for every pound of wet, drained hide. The pH must be carefully checked and proper precautions, i.e., use of eye protection, a protective apron, and rubber gloves, should be followed when using acids. Acids should be added slowly to the pickle, pouring them along the side of the container so as to run gently into the solution. Mix slowly, but well. There are a number of acids and formulas that are used in pickling and the tanning recipe one follows, or kit that is used, will have specific instructions.

Skins are usually left in the pickling solution for a minimum of three days after which time they must be neutralized. Neutralizing raises the pH of the skin through the use of a solution containing an alkaline substance such as sodium acetate, sodium formate, sodium bicarbonate, or other similar compound. Neutralization is generally brief, 15 to 20 minutes, after which the skins should be rinsed with clean water, drained, and put into the tanning solution (Rittel, 1993). Again, the tanning recipe or kit should have complete instructions on the neutralization method. After draining and prior to tanning, any holes in the hide should be sewn closed.

Care should be taken in disposing of the pickling and neutralizing solutions. Acid pickles should be raised to a pH of 6.5 to 7.0 before dumping. Rittel (1993) states that sulfates can be considered as hazardous solutions and if an acid is used in which sulfates are formed local health authorities should be contacted concerning proper disposal. If no other disposal means is available, neutralized solutions should be dumped in a driveway or other area where vegetation does not grow.

Tanning

To describe the varying tanning recipes and methods is beyond the scope of this paper and those can be found in various texts, taxidermy supply, or tanning chemical dealer catalogs and in the instructions included with tanning kits or chemicals. The main tanning process may be as simple as one of the paint-on tans mentioned earlier or more complex entailing the application of tanning chemicals in a tanning soak or bath.

Powdered tanning agents will be mixed into a salt:water solution at the recommended rates. Generally, the tanner would weigh the skin after neutralizing and draining. That weight is used to calculate the amount of tanning agent needed. Alternatively, one could mix enough solution to completely submerge the hide, although this tends to be more wasteful of chemicals. Tanning agents will come with instructions on calculating needed amounts and how to mix solutions. As discussed in a previous section, solution pH may need monitoring and adjusting and hides should be stirred occasionally. When making and disposing of solutions, follow safety guidelines discussed above. Upon removal from the solution, hides should be drained briefly. Some tanning methods call for a short rinse. The hides are then ready for oiling and drying.

Paint-on tans that call for pickling and neutralizing also require draining before tanning. Others, such as Liqua-Tan™, that do not require pickling call for the hide to be washed and drained well prior to application. The well-drained hide is laid flat on a plastic tarp and the tanning agent applied. After several hours, the excess is worked into the skin. Oiling may or may not be included in the instructions.

Some paint-on tans state that oils are included in the tanning liquid, others suggest use of a separate oil for optimum softness. As an example, Knobloch's recommends applying Liqua-Soft™ tanning oil the day following application of Liqua-Tan™ if the tanned hide will be used for a flat skin or rug.

Oiling

Oiling is done to increase the softness of the finished product and many oils are available in the marketplace. If a tanning kit is purchased the recommended oil will be included. To oil the hide lay it flat with the flesh side up. One part oil is mixed with one to two parts hot water and liberally applied to the skin. The hide is folded in half skin to skin and again hair to hair. The folded hide should then be allowed to "sweat", or absorb oil, for approximately 4 to 6 hours. After that time, open the hide up and begin the drying process.

Drying and Softening

Drying methods can range from simple hanging or laying flat to tacking on wood or tying in a frame. Hanging the hide is generally the easiest. Artificial heat should not be used in the drying process. Check the hide frequently during drying to determine when softening should begin. If a white line appears when the hide is folded it is dry enough to begin softening. The thinner hide edges will dry out more quickly than the thicker center line. If the hide is stretched and pulled while it is too wet it can become misshapen. If one waits too long the hide stiffens and becomes difficult to soften. However, if the hide does become too dry to soften adequately it can be rewetted using damp towels and the softening process begun again.

Softening, referred to as staking, involves stretching and bending the hide to break up fibers in the skin. The time and effort spent in staking directly determines the suppleness of your final product. A common method involves use of a staking beam. This is a 2" × 6" board cut and fashioned in the shape of a braced, inverted T with the upright end rounded to a blunt edge. The flesh side of the damp hide is rubbed across the edge in much the same way as one shines shoes to pull, stretch and break up skin fibers. A highly effective method involves stretching and pulling the hide around a cable. Regular rope can be used but aircraft cable clamped around a pole works very well and can result in an extremely soft hide.

Commercial tanneries use equipment for softening such as large, rotating drums that tumble the hide, generally with sawdust, as it dries. In addition to softening the hide, a solvent may be added to the sawdust to help clean hair or fur. Some texts recommend using an old laundry dryer with the holes plugged for tumbling hides. Whereas this will help clean the hair, it will not help significantly in softening the hide. To do this requires a tumbler with at least a six foot drop along with 100 pounds of hardwood sawdust (P. Helms, McKenzie Taxidermy Supply, personal communication).

Finishing

Finishing the softened hide entails cleaning or brushing the hair, sanding or rasping the skin side, and trimming off rough or uneven edges. The hair on some hides may only need combing or

brushing whereas the hair on other hides may need a deeper cleaning. Cleaning the hair can be done with a tumbler or by simply rubbing sawdust or corn cob grit into the hair. Rittel (1994a) recommends that local sawdust not be used as it may contain pitch and be unevenly grained. Taxidermy or tanning chemical supply houses sell sawdust and solvents to be used in cleaning. Hobson (1977) explains how to use cleaning substances such as cornmeal, oatmeal, bran, chalk and plaster of Paris.

Once the hair is clean and brushed, the skin side can be sanded or rasped. This helps to remove rough spots and further soften the hide. Some staking methods can make the hide appear brown and dirty and sanding or rasping will make it look cleaner and more professional. Hide edges are usually uneven and may be stiffer than inner portions and removing results in a more attractive product.

Optional Steps

When reading about tanning, additional steps such as dehairing and degreasing will be found. Dehairing is accomplished by soaking the hide in a lime or caustic lye solution after which the hair is scraped off. The hide is then tanned for leather using the same or similar methods as those described. Degreasing is done on hides with large amounts of oil, such as raccoon, bear, and the like. It is unlikely that goat hides would need degreasing.

Use of Tanned Hides

Tanning is not easy and some difficulties can be expected. But, through practice and experimentation the techniques can be learned and good quality hides produced. The uses for tanned goat hides are limited only by the quality of the finished product and the imagination of the tanner, or purchaser. Rugs, seat covers, decorative wall hangings, or other handicrafts are possible.

References

Churchill, J.E. 1983. The Complete Book of Tanning Skins and Furs. Stackpole Books, Harrisburg, PA. 197 pp.

Hobson, P. 1977. Tan Your Hide! Storey Communications, Inc., Pownal, VT. 135 pp.

Kneifel, E. 1991. Goat skins supply, demand and utilization. In: T.H. The (Editor) Proceedings of the National Symposium on Goat Meat Production and Marketing. pp. 42-47. Langston University Agricultural Research and Extension Program and E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.

Rittel, B. 1994a. Syntans as a tanning agent. Breakthrough 38:26-31.

Rittel, B. 1994b. When fleshing or shaving- the only way is the right way. Breakthrough 36:22-24.

Rittel, B. 1993. The basic principles of pickling and neutralizing. Breakthrough 33:48-52.

Partial List of Supplies Needed to Tan Hides

- skinning knife if needed
- sharpening stone
- non-iodized salt, not rock salt
- fleshing knife
- fleshing beam
- plastic garbage can or barrel (metal containers should never be used)
- wooden pole or paddle to stir tanning solutions
- tanning kit or chemicals
- rubber gloves, protective apron, and eye protection for handling chemicals and solutions
- pH paper if pH of solutions must be checked
- staking beam, cable or other softening device
- comb or brush for hair
- suitable place for tanning, not too hot or cold
- area where hides can be laid upon wood or a bench, not concrete floors
- scale to weigh hides and chemicals
- source of hot water to mix solutions

List of Some Available Books on Tanning and Taxidermy

The Ultimate Guide to Skinning and Tanning: A Complete Guide to Working with Pelts, Fur, and Leather. 2002. Monte Burch. The Lyons Press. Guilford, CT. 240 pp.

Buckskin: The Ancient of Art of Braintanning (Originally titled "Wet-Scrape Braintanned Buckskin). 2001. Steve Edholm, Tamara Wilder and Jim Riggs. Paleotechnics, Boonville, CA. 307 pp.

Deerskins into Buckskins: How to Tan With Natural Materials: A Field Guide for Hunters and Gatherers. 1997. Matt Richards. Backcountry Publishing, Rexford, MT. 160 pp.

How to Tan Skins the Indian Way. 1991. Evard H. Gibby.. Eagle's View Publishing, Liberty, UT. 28 pp.

Outdoor Life Complete Home Taxidermy. 1987. Tim Kelly. Outdoor Life Books, Danbury, CT. 271 pp.

Home Tanning & Leathercraft Simplified. 1984. Kathy Kellogg. Williamson Publishing Co., Charlotte, VT. 192 pp.

The Complete Book of Tanning Skins and Furs. 1983. James E. Churchill. Stackpole Books, Harrisburg, PA. 197 pp.

The Complete Book of Taxidermy. 1979. Nadine H. Roberts. TAB Books, Blue Ridge, Summit PA. 351 pp.

Tan Your Hide! 1977. Phyllis Hobson. Storey Communications, Inc., Pownal, VT. 135 pp.

Home Book of Taxidermy and Tanning. 1969. Gerald J. Grantz. Stackpole Books, Harrisburg, PA. 160 pp.

Where to Find Tanning Supplies and Chemicals

The following is a partial list of companies and dealers that sell tanning supplies and chemicals. Other companies, dealers, or distributors can be found on the Internet at http://taxidermy.net or through using any internet search engine. Local taxidermists and tanneries can also be a source of information and(or) supplies.

Adirondack Outdoor Company
P.O. Box 86
Elizabethtown, NY 12932
Phone: 518-873-6806
http://www.adirondackoutdoor.com/tanning.htm

Jonas Supply Company
2260 Industrial Lane
Broomfield, CO 80020
Phone: 800-525-6397
http://www.jonastaxidermy.com

Knobloch's
10675 Empire Road
Lafayette, CO 80026
Phone: 303-666-9045
http://www.knoblochs.com/

McKenzie Taxidermy Supply
P.O. Box 480
Granite Quarry, NC 28072
Phone: 800-279-7985
http://www.taxidermyonline.com/

Rittel's Tanning Supplies
51 Summer Street
Taunton, MA 02780
Phone: 508-822-3821
Fax: 508-828-3921
http://rittelsupplies.net/

Tandy Leather Co. (Has locations throughout the U.S.)
1339 SW 59th Street
Oklahoma City, OK 73119
Phone: 877-428-5754
http://www.tandyleather.com/

Van Dyke Supply Co. Inc.
Phone: 800-737-3355
http://www.vandykestaxidermy.com/

WASCO
1306 West Spring Street
P.O. Box 967
Monroe, GA 30655
Phone: 800-334-8012
http://www.taxidermy.com/

The proper citation for this article is:

Merkel, R. C. 2004. Tanning Goat Hides. Pages 30-40 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Oklahoma Milk Regulations

Frank Harris

Oklahoma Department of Agriculture
Food Safety Division
Dairy Services
2800 N. Lincoln Blvd.
Oklahoma City, OK 73105

Dairy Farm and Plant Inspection

Oklahoma Department of Agriculture
Food Safety Division
Dairy Services
Frank Harris, Director
2800 N. Lincoln Blvd.
Oklahoma City, OK 73105

Dairy Services Staff

Frank Harris,	Director, Rating Officer
Ellen Pennington,	Secretary
Don Stockton,	Rating Officer
Sam Carter,	Dairy and Plant Inspector
Pete Echelle,	Dairy and Plant Inspector
David Moss,	Dairy and Plant Inspector
Chris Stogsdill,	Dairy and Plant Inspector
Charles Woods,	Sampler

Regulations are from Several Sources

- PMO
- DMO
- Code of Federal Regulations (by reference)
- Single Service Container Fabrication
- State Statute (Ok Milk & Milk Products Act)

Inspections are Required on Several Levels

- Routine
- Confined Animal Feeding Operations
- State Surveys
- FDA- oversight & auditing

Enforcement is Based on Inspections & Lab Analysis

- Warning
- Notice of Intent
- Permit Suspension
- Permit Revocation
- Embargo

We Require Permits

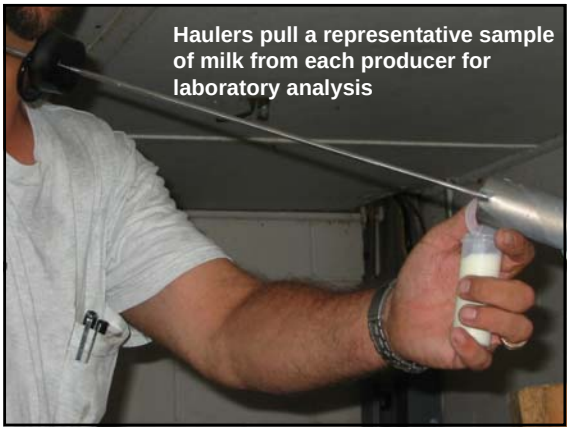
- Grade A Dairies – 445
- Grade A Milk Plants – 9
  - IMS Plants - 5
- Transports - 49
- Milk Haulers/Samplers - 103
- Manufacture Grade Plants - 8
  - Ice Cream Plants
  - Cheese Plants
- Bottle Manufacturing plants for Grade A Products - 1
- Imported Milk and Milk Products

What Do We Inspect?

- Dairy Farms
- Milk Plants
- Milk Hauler/Sampler
- Transport
- Single Service Packaging
- Dairy CAFOs
- Laboratories

What does an Inspection at a Dairy Barn Involve?

- Equipment
- Tank Room
- Milking Parlor
- Cow yard – Surroundings
- Waste Handling
- Drugs
- Water Supply



What does an Inspection at a Milk Processing Plant Involve?

- Receiving Area
- Equipment Checks
- Record Reviews
- Processing Area
- Production Area
- Vault Storage
- Warehouse & Dry Goods
- Container Manufacturing

HTST Pasteurizer

Chart Recorder

We do Laboratory Analysis on

- Raw Milk – farm & load samples
- Retail – finished product
- Well, chill water & glycol systems

We Check Raw Milk from the Dairy Monthly for

- Bacteria
- Temperature
- Somatic Cell Counts
- Inhibitor (drug residue)

We Check Retail Milk Samples Monthly

- Bacteria
- Coliform
- Phosphatase
- Inhibitor (Drug Residues)
- Butterfat
- Temperature
- Vitamin Assays

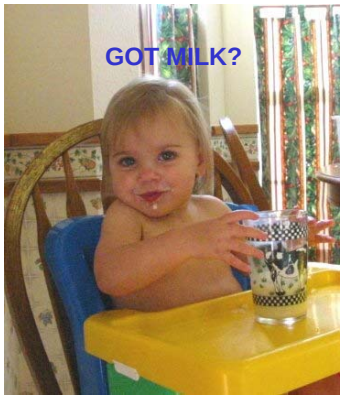
Raw Milk is Checked At the Processing Plant when a Load is Delivered Daily for

- Drug residues
- Temperature
- Aflatoxin

Industry Training

Certification Training for Milk Hauler/Samplers

The inspections we do at the dairies and plants are to insure that the products sold to the consumers are safe.



The proper citation for this article is:

Harris, F. 2004. Oklahoma Milk Regulations. Pages 41-46 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Goat Milk Cheese Manufacturing

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Goat cheese consumption in the United States has been on the rise in recent years. Besides liquid milk consumption, presently a lot of surplus goat's milk was used or sold for feeding calves, greyhounds and hogs, with some for powdered milk processing. Cheesemaking can definitely add value to high quality goat milk and create another source of income for the goat producers. To meet the demand for goat cheese and to increase profitability of goat dairying, dairy goat producers need skills and techniques to produce high quality goat's milk cheeses. Hands-on cheesemaking workshops allow participants to learn basic principles and practical techniques through actual cheesemaking processes.

In this cheesemaking workshop, manufacturing of a hard cheese, a soft cheese and a quick-method Mozzarella cheese will be demonstrated. Following are step by step procedures.

1. Cheddar Cheese Make Procedure

(100 gallons of milk)

STEP	**TIME**	**pH/TA**	**COMMENTS**
Raw Milk	0 min	6.55 /0.15-0.16	Pasteurize, standardize, and temper the milk to 88-90 ^{o}F (32^{O}C).
Add Starter	60 min (DVS)		DVS cultures are used at one of the following rates: Original DVS – 50-60 g DVS and bulk starter cultures normally consist of *Lactococcus lactis* subsp. *cremoris* and *Lactococcus lactis* subsp. *lactis*.
Add calcium (optional)	1 h 15 min		Cal-Sol (calcium chloride) may be added at this time.
Add Color (optional)	1 h 15 min		If desired, Cheese Color (annatto) may be used at the rate of 1.0 to 1.5 oz. Dilute the coloring with cold water (do not use hard water) at a minimum ratio of 1:20.
Add Rennet (Coagulant)	1 h 20 min	6.49/0.16	Liquid rennet is used at the rate of 1 to 1-1/2 oz. According to the manufacturer's instruction. Dilute with water at 1:40 prior to addition.

Cutting	1 h 50 min to 2 h	6.51/0.10	Cut the curd with 3/8 to ½ inch knives.
Healing	2 h 5 min		Heal the curd for 5 min without stirring.
Heating	2 h 35 min		Cook the curd to 101-102º F. in 30 min. During the first 15 minutes, do not increase the temperature more than a total of 5-6º F.
Cooking	3 h 5 min		Cook the curds at this temperature for another 30 min
Draining	3 h 20 min	6.12/0.24	Drain the whey from the vat or pump the curd and whey to the drain table.
Cheddaring	5 h 20 min	5.35/0.50	Cut the matted curd into slabs and turn the slab every 15 min for 2 h.
Milling	5 h 30 min		Mill the slabs into 1 in. cubes
Salting	5 h 45 min		Salt the curd using a minimum of two applications for a total of 2.0-2.5 lb.
Hooping	6 h		Hoop the salted curds into Cheddar cheese molds.
Initial Pressing	8 h		Press the cheese initially at 30 – 35 psi for 2 h.
Final Pressing	24 h		Increase the pressure to 60-70 psi and press overnight.
Vacuum-packing			Vacuum-pack the cheese blocks in proper films
Alternatively, Air-drying for wax-coating	2 – 3 days		Place the cheese blocks in an aging room at 55ºF with 70% humidity for 2 – 3 d for easy waxing.
Ripening	3 – 6 months		Ripen the cheese in a cheese ripening room at 50 - 55ºF with 70 - 80% humidity for at least 3 months.
Sales-packing	3 – 9 months		Cut the cheese blocks into retail sizes, wax-coat and/or vacuum-pack with shrinking films.

2. Low Fat Cream Cheese Make Procedure

(10 gallons of milk)

Cream Cheese is a fresh cheese with at least 50% of fat in dry matter, which is consumed without any ripening. Low fat cream cheese may be produced with fat contents ranging from 30-40% of fat in dry matter. This low fat cream cheese is white to yellowish, the consistency smooth and pasty without being too dry and grainy, and it is easy to spread. The flavor is fresh and acidic, and the pH value is normally between 4.6 and 4.8.

Milk	Whole milk is pasteurized and homogenized (optional). After homogenization, the milk is cooled to ripening temperature, i.e. 21°C (70°F).
Culture	Freeze-dried DVS (20 - 25 u) or Frozen DVS (20 – 25 u)
Rennet	To improve the curd formation and the whey drainage, it is recommended to add 1 – 2 ml of liquid rennet which is diluted with water prior to addition (1:40).
Curd forming	The milk is covered and left at room temperature overnight (14-16 h) or until pH reaches 4.7.
Dipping the curd	The curd is dipped or scooped into perforated colander or proper container lined with cheese cloth.
Draining	Drain the curd in the room for a few hours and move the curd to a cooler and continue to drain overnight.
Moisture (%)	The moisture content after 24 h of draining should be around 50 - 55% and pH 4.7.
Final treatments	A mix of 1% salt (0.15 – 0.2 lb) and 0.25 - 0.5% stabilizers (20 – 50 g) is blended with the cheese curd in a high speed blender and the cheese is cold-packed. Or, the curd and the salt-stabilizer mix is pasteurized in a container by indirect heating to 78-80°C (172-176°F) for 5-10 min for better consistency and longer shelf-life. The pasteurized low fat cream cheese is then hot-packed and stored cold.
	(For strawberry flavored cream cheese, add 15-20% sterilized strawberry base to the final mix before blending in the blender.)

3. Quick-Method Mozzarella Cheese
(2 gallons of milk)

Milk	High quality standardized milk is used.
Heat treatment	Pasteurize at 63°C (145°F) for 30 min and then cool to 32°C (90°F). Optional: use raw milk.
Culture	No culture is needed.
Citric Acid	Add 4 teaspoons (16-18 g). The pH should be around 5.1-5.3.
Rennet	Liquid rennet at 2 ml (½ teaspoon), diluted with 2-3 tablespoons of water.
Cutting	When a soft curd is developed after 15 min, the curd is cut.
Heating and stirring	The temperature is increased to 43-45°C (110-115°F) for 15-30 min with stirring depending on desired moisture.
Draining	Drain the whey and hand-squeeze out excessive whey from the curd.
Microwaving	Microwave the curd for 1 min
Knitting and stretching	Hand-work the curd and the curd is stretched.
Microwaving again	Microwave the curd for the second time for 30 sec. Or before microwaving, add dry salt (2 teaspoons) at this time.
Stretching and shaping	Work the curd into desired shapes.
Salting	Salt the cheese in a saturated salt brine at a temperature of 10°C (50°F). Or dry-salt, heat and mix.

Goat Milk &
Goat Milk Products

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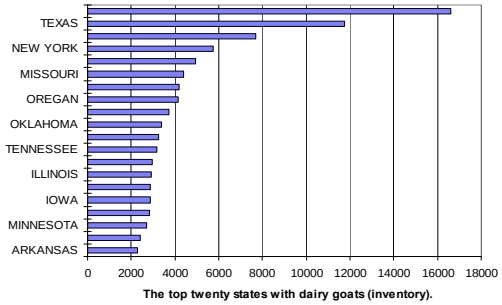
300 Million Heads of Goats in the Whole World

Paradise in France

Dairy Goat Facts

- 300 million in the world
- A larger proportion of the world population consuming goat milk
- Averaging one gallon of milk/doe per day during peak months
- High production efficiency
- Cheaper than cow milk in many developing countries

1 to 1.5 million dairy goats in the US



The top twenty states with dairy goats (inventory).

Merits of Goat Milk

- A natural source of nutrients
- An alternative to cow milk
- A “cure” to cow milk allergy
- Easy digestion
- Exotic and characteristic flavor
- Medicinal properties

An alternative to cow milk

- Personal preference
- Geographic location
- Weather cond
- Vegetation
- Religion

A “cure” to cow milk allergy

- Cow milk allergy (CMA):
  - 6-7% Americans
  - 10-15% Orientals and Oceania
- Vomiting, diarrhea, malabsorption, bronchitis, asthma, migraine
- Caused by Lactalbumin and β–lactoglobulin- both species specific
- Up to 90% CMA patients can be “cured” by switching to goat milk
- (Lactose intolerance)

Easy digestion

- Homogeneous (small diameters) fat globules
- Naturally higher concentration of short chain fatty acids
- Fragile and soft milk curd

Goat Milk

Exotic and characteristic flavor

- Unique
- Ever more popular in fancy hotels and cooking shows

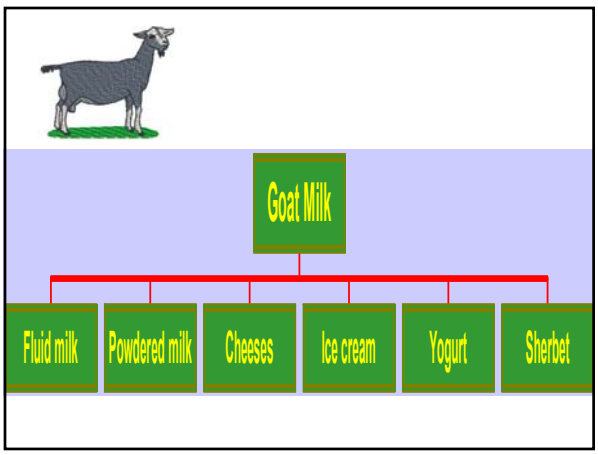
Exotic and characteristic flavor

- Goat milk and dairy products, particularly cheeses, are being considered as "a reminder of holidays spent in the Mediterranean countries."

Goat Cheese & Wine

Medicinal benefits

- Distinct alkalinity
- Buffering capacity, particularly Nubian goats
- Hypo-allergenicity- low α_{s1}-casein in goat milk
- Short-chain fatty acids used for malabsorption patients
- (Goat milk anemia - lack of iron)



Powdered Goat Milk

Go Specialty:

Buried Goat Cheese

Research Interests

- Somatic cell counts
- Antibiotic residue
- Milk quality
- Cheese quality
- Cheese yield predictive models
- Conjugated linoleic acid

Conjugated Linoleic Acid

- CLA
- Abundant in milk fat and red meat
- Anti-carcinogenic – breast cancer, prostate
- Reducing body fat
- Magical #: 3.5 g/d

New Product Development

- Goat milk smoothies
- Goat milk ice cream for diabetes

Goat Milk Powder Pills

Promoting Dairy Goat Products

- In Martha Steward TV Show, she used goat cheese to make a specialty dish in the mid 1990s
- In March 2004, Chef's Cooking Institute in Oklahoma City used goat cheese for demonstration

The Power of Newspaper

Ever Popular Goat cheeses!

- 80 entries of goat milk cheeses in the American Cheese Society Championship this year, up 23 entries two years ago (The Cheese Reporter, 2004).

IS THERE A MARKET FOR GOAT Milk CHEESES IN MID-WEST STATES?

In southern Kansas

In Central Kansas

In southern Oklahoma

In Southeastern Oklahoma

In western Oklahoma

In Kansas City, Missouri

The proper citation for this article is:

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Web-based Goat Nutrient Requirement Calculation System: Usage Notes and Some Examples

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Introduction

A project was conducted to develop expressions of energy and protein requirements for goats, as well as prediction of feed intake, which is discussed in a Special Issue of Small Ruminant Research (2004, Volume 51, published by Elsevier Science). However, expressions from this project as well as requirements for other livestock species sometimes can be difficult for producers to use if presented only in hard copy or not in a simple format. With the already widespread and still increasing use of the internet, a web-based approach offers considerable promise to reach a large audience and can be easily updated. Therefore, a web-based goat nutrient requirement calculation system based on results of this project was developed, which is available at www2.luresext.edu/goats/research/nutreqgoats.html. In this regard, objectives of this paper are to overview practical use of the calculation system and to provide examples of some of the different calculators.

Getting Started

First, it is necessary for JavaScript to be enabled on the computer for all but the total mixed ration (**TMR**) calculator. For the TMR calculator, Cookies must be enabled. The Introductory window has messages indicating if JavaScript and Cookies are enabled or disabled.

The calculation system has been designed to be flexible and complete in regards to energy and protein requirements and feed intake prediction, user friendly, and usable by a diverse audience. Also, there may be some components that have instructional value, such as in feeding or nutrition classes. Each calculator lists the requirements, describes calculations, provides example production conditions, and states sources of the requirements and any assumptions used. However, once a user is familiar with a calculator, the text can be hidden to lessen the scrolling necessary. There are boxes for converting from English to metric units, which are used in the calculations, as well as for using total digestible nutrient (**TDN**) concentration to determine the level of metabolizable energy (**ME**). A printer friendly option or version is in place to print inputs and outputs. And to give the calculators 'eye-appeal,' topic-appropriate pictures have been inserted.

Listings of feed intake and nutrient concentrations are on a dry matter (**DM**) basis. Therefore, to determine feed intake on an "as fed" basis, DM intake should be divided by the DM concentration in the consumed diet. For example, if 1.5 kg of DM of a diet consisting of forage is consumed that has a DM concentration of 93%, "as fed" intake would be 1.67 kg (1.5 kg DM / 90% or 0.90).

At the bottom of the Introductory window, there are hyperlinks to the different calculators, with key words highlighted to make deciding which calculator to use quicker. In addition to the different calculators listed on the Introductory window, many have links to other calculators as pop-up windows to derive needed information. For energy requirement calculators, links to ones for feed intake prediction facilitate a fast checking of whether or not a required level of intake of a particular diet to meet the energy requirement is reasonable or likely to occur. Relatedly, it is important to note that unreasonable inputs yield unreasonable outputs. Similarly, it is not possible for any system to accurately predict requirements with inaccurate inputs, and predictions are only as good as the

description of conditions.

Energy

One of the first decisions to make in use of energy and protein calculators is the class of goats. Growing non-Angora goats are defined as ones weaned up to 1.5 years of age, and Angoras are classified as growing from weaning to 1 year of age. Also, biotype must be chosen. Meat goats are ones of 50% or more Boer breeding, and the dairy biotype consists of breeds developed by selection for milk production such as Alpine, Saanen, and Nubian. Indigenous or local goats are all others, except for Angoras.

In order to estimate ME requirements, it is necessary to specify body weight (**BW**) and level of production, such as BW change and(or) milk production. If the goat is lactating, in addition to milk yield, the fat concentration in milk must be entered in order to determine milk energy yield. Likewise, milk fat concentration is required to estimate the quantity of milk required by a suckling goat to meet the determined energy requirement. If in the last 56 days of gestation, then energy for pregnancy tissue development should be accounted for with a gestation requirement pop-up window available in calculators for mature and Angora goats by specifying the predicted birth weight per kid and litter size and day of gestation. Such inputs can be based on past experience or production records for a herd or particular animal. For milk fat concentration, there is a pop-up window available that lists some examples values.

The quantity of energy used to maintain an animal's BW or energy status can be affected by various factors, such as grazing behavior and previous nutritional plane. These factors may be addressed by some of the energy requirement calculators, but do require additional inputs. To adjust the maintenance energy requirement for grazing activity, four inputs are required. First, the factor having greatest effect, time spent grazing plus walking, must be entered. Other inputs are distance traveled, forage digestibility or TDN concentration, and terrain score. Terrain score ranges from 1 to 5, with 1 being very level and open conditions and 5 very rugged, mountainous terrain. The appropriate terrain score can be selected by viewing example pictures and descriptions presented in a pop-up window. Another adjustment is for previous nutritional plane, which is assessed by input of the time after change in plane of nutrition (i.e., low to adequate or high) and body condition score (**BCS**) at the time of the change in nutrient intake. As for terrain score above, there is a pop-up window with pictures of goats in various BCS to aid in the selection.

The inputs listed above allow the absolute quantity of energy required to be estimated. However, in order to put requirements on the basis of feed intake, the ME concentration in the diet consumed must be entered. But, since many users are more familiar with TDN than ME, a box for converting TDN to ME is available. TDN concentrations can be derived through analyses at commercial laboratories or from feed composition tables. However, since forages vary in quality with factors such as maturity at harvest, fertilization, etc., 'book values' may not be as accurate as lab determinations. Regarding the energy requirement calculator for suckling goats, with input of starter diet intake and its TDN or ME concentration, ME from the starter diet and required from milk can be determined.

Protein

Inputs for the protein calculators are similar to those for energy. However, for mature goats, both lactating and non-lactating, an estimate of feed intake is required to determine the maintenance requirement for protein. This can be entered directly based on previous experience or derived by using a link/pop-up window for a feed intake calculator. In addition to specifying milk yield by lactating goats, the milk protein concentration must be given, for which there is a pop-up window that lists some typical values that can be used if actual ones are not available. There is also a pop-up window for the gestation requirement in the calculator for mature goats.

Protein calculators for growing, mature, and lactating goats deal with metabolizable protein (**MP**). However, since many users may not be that familiar with MP, there is a simple conversion of MP to crude protein (**CP**) requirements. CP requirements are listed for diets with 20, 40, and 60% rumen undegraded intake protein (**UIP**). The 20% UIP requirement would be appropriate for most forage-based diets and the one with 40% UIP for typical moderate to high dietary concentrate levels.

Energy and Protein

There are two calculators dealing with both energy and protein. The first is for Angora goats and the second for the last 56 days of gestation, which was mentioned earlier. For Angora goats, in addition to inputs such as BW, it is necessary to specify daily clean mohair fiber gain and loss or gain of non-fiber tissue. The Angora calculator also has input boxes to account for lactation requirements and a pop-up window for gestation requirements.

Feed Intake

Inputs for feed intake calculators are very similar to those for energy requirements. Calculators for mature and Angora goats require the input of the dietary CP concentration, whereas ones for growing and lactating goats do not. Therefore, accurate predictions of feed intake by growing and lactating goats will occur only if CP intake is adequate to support the level of production entered. Each intake calculator has two options, one without and one with adjustments of the maintenance energy requirement for various factors such as gender, grazing, and acclimatization. It would seem desirable to use the adjustment calculator at least to specify gender.

Diet Formulation

There are two calculators for diet formulation. One determines the quantity of a particular concentrate supplement for a specific goat and basal forage in order to meet both energy and protein requirements. It also determines the optimal concentration of the one in excess in the supplemental concentrate, in order for requirements of both energy and protein to be met exactly. The allows the determination if a particular type of supplemental concentrate is most appropriate for a particular animal and basal forage, or if an alternative supplement would be advantageous. This calculator as well as the one for TMR has many links/pop-up windows for other calculators to determine requirements and predict intake. Therefore, both diet formulation calculators necessitate the same requirement inputs as noted earlier, as well as composition values for the dietary ingredients. For the TMR calculator, the user varies the dietary levels of ingredients in order to meet energy and protein needs, and ration cost can be determined as well with user input of dietary ingredient costs. Feed composition tables are available in these calculators, although for TMR the user has the option of entering values for other feedstuffs or changing some composition values for feedstuffs in tables.

Examples of Inputs and Outputs

Inputs and outputs for the suckling goat energy requirement calculator are given on page 61. The amount of 3%-fat milk to meet the ME requirement was estimated in a scenario with consumption of a starter diet. An example of use of the growing goat energy requirement calculator is given on page 62. The dietary ME concentration of 9.30 MJ/kg DM assumed is equivalent to a TDN concentration of about 60%. Adjustments of the maintenance energy requirement were performed for grazing (8 hours of grazing plus walking time, 4 km of distance traveled, and terrain score of 2), previous nutritional plane (3 weeks past the change in nutritional plane and initial BCS of 2.5), and acclimatization (average temperature in the previous 30 days of 22°C or 68°F and mid-point thermoneutral zone temperature of 20°C or 71.6°F). The predicted quantity of DM intake necessary to meet the ME requirement was 3.94% BW. The adjusted maintenance energy requirement-feed intake calculator was then used to see if this is a likely level of intake or not (page 63). Predicted DM intake was 3.67% BW, suggesting that it is somewhat questionable whether or not the level of

performance specified would be achieved with these assumptions.

There are two examples for energy requirement calculators given for mature goats, the first for a non-pregnant goat (page 64) and the second on day 130 of gestation (page 65). The estimate of DM intake required for the non-pregnant goat is 2.28% BW, which compares to a similar value derived with the adjusted maintenance energy requirement-feed intake calculator (page 66) of 2.22% BW. 0.37% BW of DM intake was required for pregnancy tissue development, which equates to about 0.16 kg/day for this 100-pound goat. The example of the calculator for energy requirements of lactating goats includes consumption of a fairly high energy diet by a confined goat and a slight amount of BW loss (page 67). The required DM intake estimate to meet the requirement is only slightly greater than that predicted with the lactating goat feed intake calculator (page 68), suggesting that this level of production might be achieved with these assumptions of diet and animal characteristics.

The example for the growing goat protein calculator entails a biotype of dairy, BW of 55 pounds, and BW gain of 100 g/day (page 69). With these conditions, the total MP requirement is 7.24% of DM intake, which is equivalent to a CP requirement of 10.3 to 10.8% for diets with UIP levels of 20 to 40%. Requirements are lower for the mature goat protein calculator (4.8% MP and 6.8 to 7.1% CP), with assumptions of the meat biotype, BW of 65 kg, BW loss of 10 g/day, and DM intake of 1.79% BW (page 70). Conversely, protein requirements in the lactating goat protein requirement calculator are greater due to needs for milk protein synthesis (page 72). Assuming BW of 60 kg, BW change of 0 g/day, 5.1 pounds of milk produced, milk protein concentration of 3.2%, and DM intake of 3.41% BW, the MP requirement is 9.1% of DM intake and that for CP is 12.4 to 13.5%.

The energy and protein requirement calculator for Angora goats requires a number of inputs, as shown on page 74. The estimate of DM intake necessary to meet the energy requirement is 2.76% BW, and the corresponding estimate with the feed intake calculator is 2.74% BW assuming a dietary CP concentration of 12% (page 76), which is slightly greater than the estimated requirement (9.0 to 9.4% of DM intake).

The example for the supplemental concentrate calculator is for a mature female indigenous or local goat with a BW of 50 kg and no change in BW (page 77). The basal forage has a CP concentration of 6% of DM, and its TDN concentration is approximately 53% of DM (8 MJ/kg DM of ME). It is assumed that supplemental concentrate is 20% CP. With these conditions and assumptions of 20 and 40% UIP in forage and concentrate, respectively, the amount of supplemental concentrate was considerably lower than the assumed level of 20%. Hence, a less expensive supplement lower in CP would be more profitable.

Conclusions

In order for nutrient requirement expressions to be of value, they must be readily accessible and reasonably simple to apply. Therefore, a web-based goat nutrient requirement system was developed based on nutrient requirements determined in a recent project. With accurate inputs of animal and diet characteristics, nutrient requirements and feed intake can be easily projected, which hopefully will lead to improved nutritional management of goats for increased profit.

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Metabolizable Energy (ME) Requirement For Suckling Goats

(In Confinement; pen, stall, small pasture)

INPUTS

Gender	female or wether
Body weight	6.8 kg (15.0 lbs)
Average daily gain	100 g/day (0.22 lbs/day)
Milk fat concentration	3%
Starter diet intake, dry matter	0.07 kg (0.15 lbs)
ME concentration in starter diet (TDN concentration in starter diet)	12.09 MJ/kg dry matter (80.4% dry matter)

OUTPUTS

ME requirement for maintenance	1.89 MJ
ME requirement for gain	1.34 MJ
Total ME requirement	3.23 MJ
ME from starter diet	0.85 MJ
ME needed from milk	2.38 MJ
Amount of milk needed per day	0.89 kg of 3% milk (1.96 lbs of 3% milk)

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Metabolizable Energy (ME) Requirement For Growing Goats

(Meat, Dairy, And Indigenous; ≤1.5 Years Of Age)

INPUTS

Biotype	meat, 50% or more Boer
Gender	female or wether
Body weight	25 kg (55 lbs)
Average daily gain	130 g/day (0.29 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	9.30 MJ/kg dry matter (61.8% dry matter)
Grazing factor	1.22
Body condition score factor	0.975
Acclimatization factor	-0.09
DM in diet	90%

OUTPUTS

ME requirement for maintenance	5.93 MJ
Dietary ME used for maintenance	5.93 MJ
ME requirement for gain	3.00 MJ
Total ME requirement	8.93 MJ
Unadjusted dry matter intake for dietary ME requirement	0.96 kg
Adjusted dry matter intake for dietary ME requirement	0.98 kg (2.17 lbs)
Adjusted dry matter intake for dietary ME requirement (% body weight)	3.94 %
As fed intake for dietary ME requirement	1.09 kg (2.41 lbs)
As fed intake for dietary ME requirement (% body weight)	4.37 %

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Feed Intake (Dry Matter; DM) by Growing Goats

INPUTS

Biotype	meat, 50% or more Boer
Gender	female or wether
Body weight	25 kg (55 lbs)
Average daily gain	130 g/day (0.29 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	9.3 MJ/kg dry matter (61.8% dry matter)
Grazing factor	1.22
Body condition score factor	1
Acclimatization factor	-0.09
DM in diet	90%

OUTPUTS

Predicted ME intake	8.41 MJ
Predicted DM intake	0.92 kg (2.02 lbs)
Predicted DM intake (% BW)	3.67 %
Predicted as fed intake (kg)	1.02 kg (2.25 lbs)
Predicted as fed intake (% body weight)	4.08 %

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Metabolizable Energy (ME) Requirement For Mature Goats

(Meat, Dairy, And Indigenous; > 1.5 Years Of Age; Non-lactating And Lactating)

INPUTS

Biotype	indigenous or local
Gender	female or wether
Body weight	45.4 kg (100 lbs)
Average daily gain	0 g/day (0.00 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	8.18 MJ/kg dry matter (54.4% dry matter)
Grazing factor	1.23
Body condition score factor	0.933
Acclimatization factor	0
Gestation energy requirement	0 MJ based on: 0 kg birth weight (0.0 lbs), day of gestation = 0, litter size = 0
DM in diet	90%

OUTPUTS

ME requirement for maintenance	8.48 MJ
Dietary ME used for maintenance	8.48 MJ
ME requirement for gain	0.00 MJ
Dietary ME used for maintenance and gain	8.48 MJ
ME requirement for gestation (MJ)	0.00 MJ
Total ME requirement	8.48 MJ
Dry matter intake for dietary ME requirement	1.04 kg (2.28 lbs)
Dry matter intake for dietary ME requirement (% body weight)	2.28 %
As fed intake for dietary ME requirement	1.15 kg (2.54 lbs)
As fed intake for dietary ME requirement (% body weight)	2.54 %

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Metabolizable Energy (ME) Requirement For Mature Goats

(Meat, Dairy, And Indigenous; > 1.5 Years Of Age; Non-lactating And Lactating)

INPUTS

Biotype	indigenous or local
Gender	female or wether
Body weight	45.4 kg (100 lbs)
Average daily gain	0 g/day (0.00 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	10.23 MJ/kg dry matter (68.0% dry matter)
Grazing factor	1
Body condition score factor	1
Acclimatization factor	0
Gestation energy requirement	4.92 MJ based on: 0 kg birth weight (0.0 lbs), day of gestation = 0, litter size = 0
DM in diet	90%

OUTPUTS

ME requirement for maintenance	7.39 MJ
Dietary ME used for maintenance	7.39 MJ
ME requirement for gain	0.00 MJ
Dietary ME used for maintenance and gain	7.39 MJ
ME requirement for gestation (MJ)	4.92 MJ
Total ME requirement	12.31 MJ
Dry matter intake for dietary ME requirement	1.20 kg (2.65 lbs)
Dry matter intake for dietary ME requirement (% body weight)	2.65 %
As fed intake for dietary ME requirement	1.34 kg (2.95 lbs)
As fed intake for dietary ME requirement (% body weight)	2.95 %

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Feed Intake by Mature Goats

(Non-lactating, Not in Late Pregnancy)

INPUTS

Biotype	meat, 50% or more Boer
Gender	female or wether
Body weight	45.4 kg (100 lbs)
Average daily gain	0 g/day (0.00 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	8.18 MJ/kg dry matter (54.4% dry matter)
Dietary CP concentration	10% DM
Grazing factor	1.23
Body condition score factor	1
Acclimatization factor	0
DM in diet	90%

OUTPUTS

Predicted ME intake	9.47 MJ
Predicted DM intake	1.01 kg (2.22 lbs)
Predicted DM intake (% BW)	2.22 %
Predicted as fed intake (kg)	1.12 kg (2.46 lbs)
Predicted as fed intake (% body weight)	2.46 %

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Metabolizable Energy (ME) Requirement For Lactating Goats

INPUTS

Biotype	dairy
Body weight	65 kg (143 lbs)
Average daily gain	-20 g/day (-0.04 lbs/day)
Milk production	4.1 kg (9.0 lbs)
Milk concentration of fat	3%
Dietary ME concentration (Dietary TDN concentration)	11.16 MJ/kg dry matter (74.2% dry matter)
Grazing factor	1
Body condition score factor	1
Acclimatization factor	0
DM in diet	90%

OUTPUTS

ME requirement for maintenance	11.48 MJ
Dietary ME used for maintenance	10.81 MJ
ME requirement for gain	0.00 MJ
Dietary ME requirement for lactation	17.95 MJ
Total dietary ME requirement	28.76 MJ
Dry matter intake for dietary ME requirement	2.58 kg (5.68 lbs)
Dry matter intake for dietary ME requirement (% body weight)	3.96 %
As fed intake for dietary ME requirement	2.86 kg (6.31 lbs)
As fed intake for dietary ME requirement (% body weight)	4.41 %

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Feed Intake by Lactating Goats in Confinement

INPUTS

Biotype	dairy
Body weight	65 kg (143 lbs)
Average daily gain	-20 g/day (-0.04 lbs/day)
Milk production	3.5 kg (7.7 lbs)
Milk concentration of fat	3%
Dietary ME concentration (Dietary TDN concentration)	11.16 MJ/kg dry matter (74.2% dry matter)
DM in diet	90%

OUTPUTS

Predicted ME intake	26.12 MJ
Predicted DM intake	2.28 kg (5.03 lbs)
Predicted DM intake (% BW)	3.51 %
Predicted as fed intake (kg)	2.53 kg (5.58 lbs)
Predicted as fed intake (% body weight)	3.90 %

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Metabolizable Protein (MP) and Crude Protein (CP) Requirements for Maintenance and Growth of Growing Goats

(Meat, Dairy, and Indigenous)

INPUTS

Biotype	indigenous or local
Body weight	25 kg (55 lbs)
Average daily gain	100 g/day (0.22 lbs/day)
DM intake (% of body weight)	3.50%

OUTPUTS

DM intake	0.88 kg
MP requirement for maintenance	34.32 g
Dietary MP used for maintenance	34.32 g
MP requirement for growth or gain	29.00 g
Total dietary MP requirement	63.32 g
Total dietry MP requirement (% of DM intake)	7.24 %
Total dietary CP requirement, diet with 20% UIP and 80% DIP (g)	94.23 g (0.21 lbs)
Total dietary CP requirement, diet with 40% UIP and 60% DIP (g)	89.95 g (0.20 lbs)
Total dietary CP requirement, diet with 60% UIP and 40% DIP (g)	86.04 g (0.19 lbs)
Total dietary CP requirement, diet with 20% UIP and 80% DIP (% DM)	10.77 %
Total dietary CP requirement, diet with 40% UIP and 60% DIP (% DM)	10.28 %
Total dietary CP requirement, diet with 60% UIP and 40% DIP (% DM)	9.83 %

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Metabolizable Protein (MP) And Crude Protein (CP) Requirements For Maintenance Of Mature Goats

(Meat, Dairy, and Indigenous; Non-lactating and Lactating)

INPUTS

Body weight	65 kg (143 lbs)
Average daily gain	-10 g/day (-0.02 lbs/day)
DM intake (% body weight)	1.79%
Gestation Protein Requirement	0 g based on: 0 kg birth weight (0.0 lbs), day of gestation = 0, litter size = 0

OUTPUTS

DM intake	1.16 kg
Metabolic fecal MP	31.07 g
Endogenous urinary MP	23.61 g
Scurf MP	2.45 g
MP requirement for maintenance	57.12 g
Dietary MP used for maintenance	55.69 g
MP requirement for gain	0.00 g
MP requirement for gestation	0.00 g
Total dietary MP requirement	55.69 g
Total dietary MP requirement (% DM intake)	4.79 %
Total dietary CP requirement, diet with 20% UIP and 80% DIP (g)	82.87 g (0.19 lbs)
Total dietary CP requirement, diet with 40% UIP and 60% DIP (g)	79.11 g (0.18 lbs)
Total dietary CP requirement, diet with 60% UIP and 40% DIP (g)	75.67 g (0.17 lbs)

Total dietary CP requirement, diet with 20% UIP and 80% DIP (% DM)	7.12 %
Total dietary CP requirement, diet with 40% UIP and 60% DIP (% DM)	6.80 %
Total dietary CP requirement, diet with 60% UIP and 40% DIP (% DM)	6.50 %

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Metabolizable Protein (MP) and Crude Protein (CP) Requirements for Lactation

INPUTS

Body weight	60 kg (132 lbs)
Average Daily Gain	0 g/day (0.00 lbs/day)
Milk production	2.3 kg (5.1 lbs)
Milk concentration of protein	3.2%
DM intake (% of body weight)	3.41%

OUTPUTS

DM intake	2.05 kg
Metabolic fecal MP	54.63 g
Endogenous urinary MP	22.23 g
Scurf MP	2.33 g
Total maintenance MP requirement	79.19 g
Dietary MP used for maintenance	79.19 g
Dietary MP used in milk protein synthesis	106.72 g
MP requirement for BW gain	0.00 g
Total dietary MP requirement, the sum of dietary MP used for maintenance, lactation, and BW change	185.91 g
Total dietary MP requirement (% of DM intake)	9.09 %
Total dietary CP requirement, diet with 20% UIP and 80% DIP (g):	276.66 g (0.61 lbs)
Total dietary CP requirement, diet with 40% UIP and 60% DIP (g):	264.08 g (0.58 lbs)
Total dietary CP requirement, diet with 60% UIP and 40% DIP (g):	252.60 g (0.56 lbs)
Total dietary CP requirement, diet with 20% UIP and 80% DIP (% DM):	13.52 %
Total dietary CP requirement, diet with 40% UIP and 60% DIP (% DM):	12.91 %

Total dietary CP requirement, diet with 60% UIP and 40% DIP (% DM):	12.35 %

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Metabolizable Energy (ME) and Metabolizable Protein (MP) Requirements for Angora Goats

INPUTS

Gender	female or wether
Maturity of the goat	mature (> 1 year)
Body weight	45 kg (99 lbs)
Tissue (non-fiber) gain	0 g/day (0.00 lbs/day)
Clean mohair fiber gain	12 g/day (0.03 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	9.67 MJ/kg dry matter (64.3% dry matter)
Grazing factor	1.21
Body condition score factor	1
Acclimatization factor	0
Gestation Energy and Protein Requirements	ME: 0 MJ, MP: 0 g based on: 0 kg birth weight (0.0 lbs), day of gestation = 0, litter size = 0
Lactation Requirement	milk yield: 0 kg (0.00 lbs), milk fat: 0%, milk protein: 0%
DM in diet	90%

OUTPUTS

MP requirement for maintenance	58.20 g
MP requirement for tissue gain	0.00 g
Dietary MP used for fiber gain	19.80 g
Dietary MP used for maintenance	58.20 g
Sum of dietary MP used for maintenance, tissue, and fiber	78.00 g
MP requirement for gestation	0.00 g
MP requirement for lactation	0.00 g
Sum of dietary MP used for maintenance, tissue, fiber, gestation, and lactation	78.00 g

ME requirement for maintenance	8.22 MJ
ME requirement for tissue gain	0.00 MJ
Dietary ME used for fiber gain	1.88 MJ
Dietary ME used for maintenance	9.94 MJ
Sum of dietary ME used for maintenance, tissue, and fiber	11.83 MJ
ME requirement for gestation	0.00 MJ
ME requirement for lactation	0.00 MJ
Sum of dietary ME used for maintenance, tissue, fiber, gestation, and lactation	11.83 MJ
DM intake for dietary ME requirement (kg)	1.22 kg
Adjusted DM intake for dietary ME requirement (kg)	1.24 kg (2.73 lbs)
Adjusted DM intake for dietary ME requirement (% BW)	2.76 %
Adjusted as fed intake for dietary ME requirement	1.38 kg (3.04 lbs)
Adjusted as fed intake for dietary ME requirement (% body weight)	3.06 %
Total dietary CP requirement, diet with 20% UIP and 80% DIP (g)	116.08 g (0.26 lbs
Total dietary CP requirement, diet with 40% UIP and 60% DIP (g)	111.12 g (0.24 lbs
Total dietary CP requirement, diet with 60% UIP and 40% DIP (g)	105.98 g (0.23 lbs
Total dietary CP requirement, diet with 20% UIP and 80% DIP (% DM)	9.35 %
Total dietary CP requirement, diet with 40% UIP and 60% DIP (% DM)	8.95 %
Total dietary CP requirement, diet with 60% UIP and 40% DIP (% DM)	8.54 %

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Feed Intake by Angora Goats

(Non-lactating, Not in Late Pregnancy)

INPUTS

Maturity of the goat	mature (> 1 year)
Gender	female or wether
Body weight	45 kg (99 lbs)
Tissue (non-fiber) gain	0 g/day (0.00 lbs/day)
Clean mohair fiber gain	12 g/day (0.03 lbs/day)
Dietary ME concentration (Dietary TDN concentration)	9.67 MJ/kg dry matter (64.3% dry matter)
Dietary CP concentration	12% of DM
Grazing factor	1.21
Body condition score factor	1
Acclimatization factor	0
DM in diet	90%

OUTPUTS

Predicted ME intake	13.55 MJ
Predicted DM intake	1.23 kg (2.71 lbs)
Predicted DM intake (% BW)	2.74 %
Predicted as fed intake (kg)	1.37 kg (3.01 lbs)
Predicted as fed intake (% body weight)	3.04 %

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Estimating Supplemental Concentrate Needs For Mature Goats

INPUTS

Class	mature
Body weight	50 kg (110 lbs)
Average daily gain	0 g/day (0.00 lbs/day)
ME requirement	7.95 MJ
MP requirement	43.38 g
Intake of forage without supplementation	1.64 % of body weight
Forage ME concentration (forage TDN concentration)	8 MJ/kg dry matter (53.2% dry matter)
Forage CP concentration	6 %
Supplemental concentrate ME concentration (supplemental concentrate TDN concentration)	13.02 MJ/kg dry matter (86.6% dry matter)
Supplemental concentrate CP concentration	20 %
UIP concentration in forage	20% total CP
UIP undegraded protein concentration in supplemental concentrate	40% total CP
DM concentration in forage	60%
DM in supplemental concentration	90%

OUTPUTS

Final estimate of total intake, which is that based on ME or MP, dependent upon the greater estimate of supplemental concentrate intake (kg)	0.93 kg (2.04 lbs)
Total intake (% BW)	1.85 %
Final estimate of supplemental concentrate intake, which is that based on ME or MP, whichever is greater (kg)	0.11 kg (0.24 lbs)
Supplemental concentrate intake (% BW)	0.21 %
As fed supplemental concetrate intake	0.12 kg (0.26 lbs)
As fed supplemental concentrate intake (% body weight)	0.24 %
Forage DM intake (kg)	0.82 kg (1.81 lbs)

Forage DM intake (% BW)	1.64 %
As fed forage intake	1.37 kg (3.01 lbs)
As fed forage intake (% body weight)	2.73 %
As fed total intake	1.49 kg (3.27 lbs)
As fed total intake (% body weight)	2.97 %
Supplemental concentrate intake (% total diet)	11.52 %
Forage intake (% total diet)	88.48 %
ME from forage (MJ)	6.56 MJ
ME from concentrate (MJ)	1.39 MJ
Total ME intake (MJ)	7.95 MJ
MP from forage (g)	33.06 g
MP from concentrate (g)	15.03 g
Total MP intake (g)	48.09 g
DIP requirement (g)	44.24 g
DIP from the diet (g)	52.17 g
Optimal supplemental concentrate **ME** concentration when the amount of supplement needed to meet the MP requirement was greater than that for ME (MJ/kg DM)	
Optimal supplemental concentrate **MP** concentration when the amount of supplement needed to meet the ME requirement was greater than that for MP (% DM)	9.66 %
Optimal supplemental concentrate **CP** concentration when the amount of supplement needed to meet the ME requirement was greater than that for MP (% DM)	13.73 %
Optimal supplemental concentrate **TDN** concentration when the amount of supplement needed to meet the ME requirement was greater than that for MP (% DM)	

The proper citation for this article is:

Goetsch, A. and T. A. Gipson. 2004. Web-based Goat Nutrient Requirement Calculation System: Usage Notes and Some Examples. Pages 57-78 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Simulation Goat Production Modeling

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Introduction

Goats are raised under a variety of production systems and environmental conditions, resulting in numerous combinations of biological, economic and managerial factors. Usually, these components and parameters studied separately, ignoring the complex interactions of the components. Such an approach can result in the loss of important linkages for the overall functioning of the system. Also, the lack of uniformity in production processes makes production decisions difficult for goat producers because the goat enterprise is a complex production system in which the goat producers have little control over some of the variables such as physical environment, forage quality, and climatic conditions. In addition, the number of variables controlling goat production is too large to incorporate in any decision making by the producer without the help of some kind of a tool. Therefore, a computer simulation model is needed to help producers in understanding these complex processes as well as a tool for decision making. A computer simulation program can simulate and integrate large amounts of data on a specific problem area and help the user in making the right decisions in operating a complex system. However, A goat system model can only be efficient if it accounts for all inputs as a whole. This means that the biological and productive life cycle of the animal and herd is to be considered, as well as all outputs, and its production level and economic returns determined.

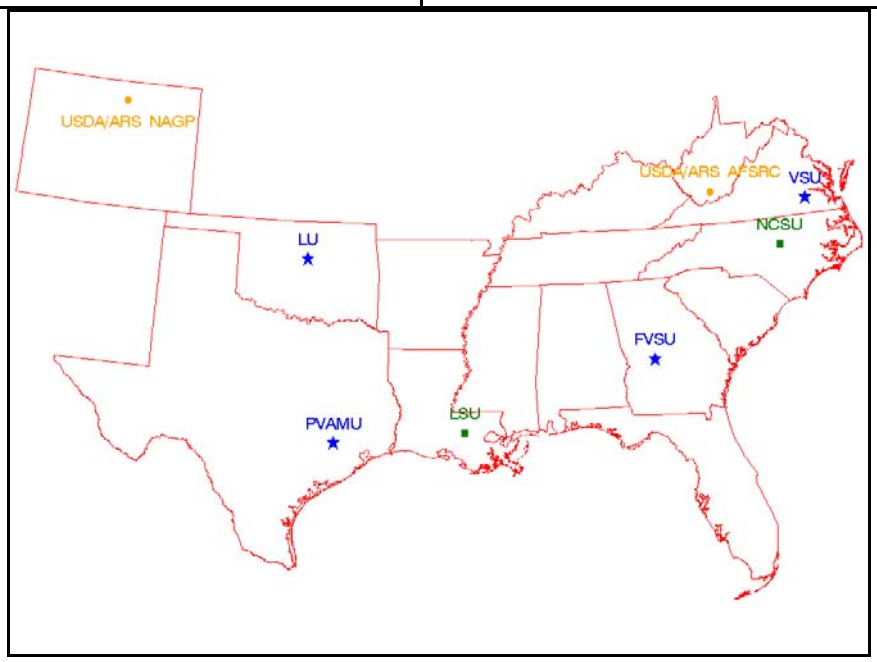
This presentation examines the basic considerations for modeling goat production systems to simulate dairy, meat or mohair goats, suggesting specific mathematical procedures related to cause-effect relationships for a single animal and a herd model.

Regional Goat Simulation Model Project History

Langston University is the lead institution in a multi-state, multi-discipline collaborative research and extension project to enhance goat production systems for the southern United States. Goat research and extension activities have long been the domain and one of the strengths of the 1890 community. In fact, several of the 1890 institutions are recognized as leaders world-wide in goat research and extension activities. Therefore, it is natural that a collaborative effort on goat research and extension should emanate from the 1890 community and with the 1890 community taking the lead. This collaborative project grew out of effort to establish a regional project for 1890 institutions involved in goat research and extension activities. It is broad based geographically and academically. It covers the southern region from East to West and North to South. It encompasses all academic disciplines involved in production agriculture. It was submitted to the USDA Initiative for Future Agriculture and Food Systems and funded by that agency for a four year duration. We are mid-way through year two of the project.

This collaborative project involves 16 scientist at those 8 institutions as lead scientists for their respective institutions as well as numerous other scientists at the collaborating institutions in a supporting role. This collaborative project involves four 1890 institutions, Langston University, Prairie View A&M University, Fort Valley State University, and Virginia State University, two 1862 institutions, Louisiana State University and North Carolina State University, and two USDA Agricultural Research Service programs, the National Animal Germplasm Program and the Appalachian Farming Systems Research Center.

1890 Institutions	
Fort Valley State University	Will Getz
	Tom Terrill
	Mack C. Nelson
Langston University	Terry Gipson
	Arthur Goetsch
	Steven Hart
	Lionel Dawson
	Mario Villaquiran
Prairie View A&M University	Jackson Dzakuma
Virginia State University	Stephan Wildeus
	Joseph Tritschler
1862 Institutions	
Louisiana State University	Marcos Fernandez
North Carolina State University	Jean-Marie Luginbuhl
	Matt Poore
USDA ARS	
Appalachian Farming Systems Research Center	Ken Turner
National Animal Germplasm Program	Harvey Blackburn



Regional Goat Simulation Model Project Goal and Objectives

The goal of the project is to develop a computer simulation model to assess and to improve the compatibility of goat production systems with available resources prevalent in the southern United States.

The reliability of a computer simulation model is dependent upon the accuracy and precision of the parameters hard-coded into the computer program and the input data for the scenario to be simulated. The old adage of garbage in, garbage out is most appropriate. The task of the collaborating scientists is to determine the most appropriate vehicle parameters and inputs. With appropriate parameters and inputs determined, collaborating scientists will be able to assess suitability of present production systems within available resources and production conditions, will be able to determine suitability of alternative production systems for present resources and production conditions, and will be able to evaluate most limiting resources and production conditions to adoption of alternative, preferred production systems. All of this done in a fraction of the cost and time of real time production.

Objectives

- determine most appropriate vehicle inputs
- assess suitability of present production systems with available resources and production conditions at simulation sites
- determine suitability of alternative production systems for present resources and production conditions
- evaluate most limiting resources and production conditions to adoption of alternative, preferred production systems

Simulation Model

Using components, limits and establishing procedures of cause-effect relationships. The simulation process is built and organized in a dynamic and quantitative way, the knowledge embodied in the model, which includes mathematical programming of the various components, processes and their interactions. In most cases the lack of quantitative knowledge of social aspects, makes it difficult to incorporate them in models and they remain implicit within the farm management decisions and management effects considered in the model.

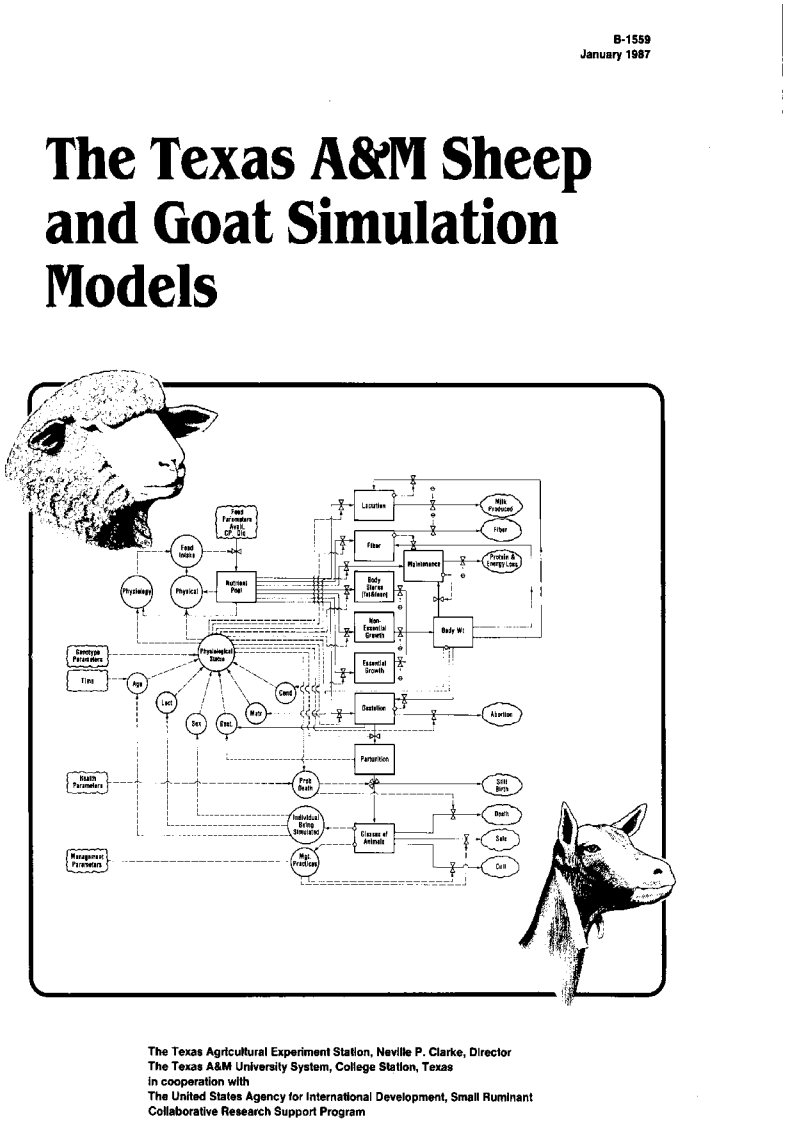
Modeling and simulation are techniques, which enable users to visualize various scenarios of a system with a range of precision as close to the real values as available data permits it. A model can be deterministic or stochastic. In either case, it must allow analysis for decision making on the present and future functioning, based on actual or existing information.

Definition of the basic parameters on a goat system are necessary to build a complex model, starting with the most simple element to define the links between components and their importance in the whole system. This, in turn, determines the equations used in programming and simulation. Programming can be done through a set of integrated equations

With appropriate parameters and inputs determined, collaborating scientists will be able to assess suitability of present production systems within available resources and production conditions, will be able to determine suitability of alternative production systems for present resources and production conditions, and will be able to evaluate most limiting resources and production conditions to adoption of alternative, preferred production systems. All of this done in a fraction of the cost and time of real time production.

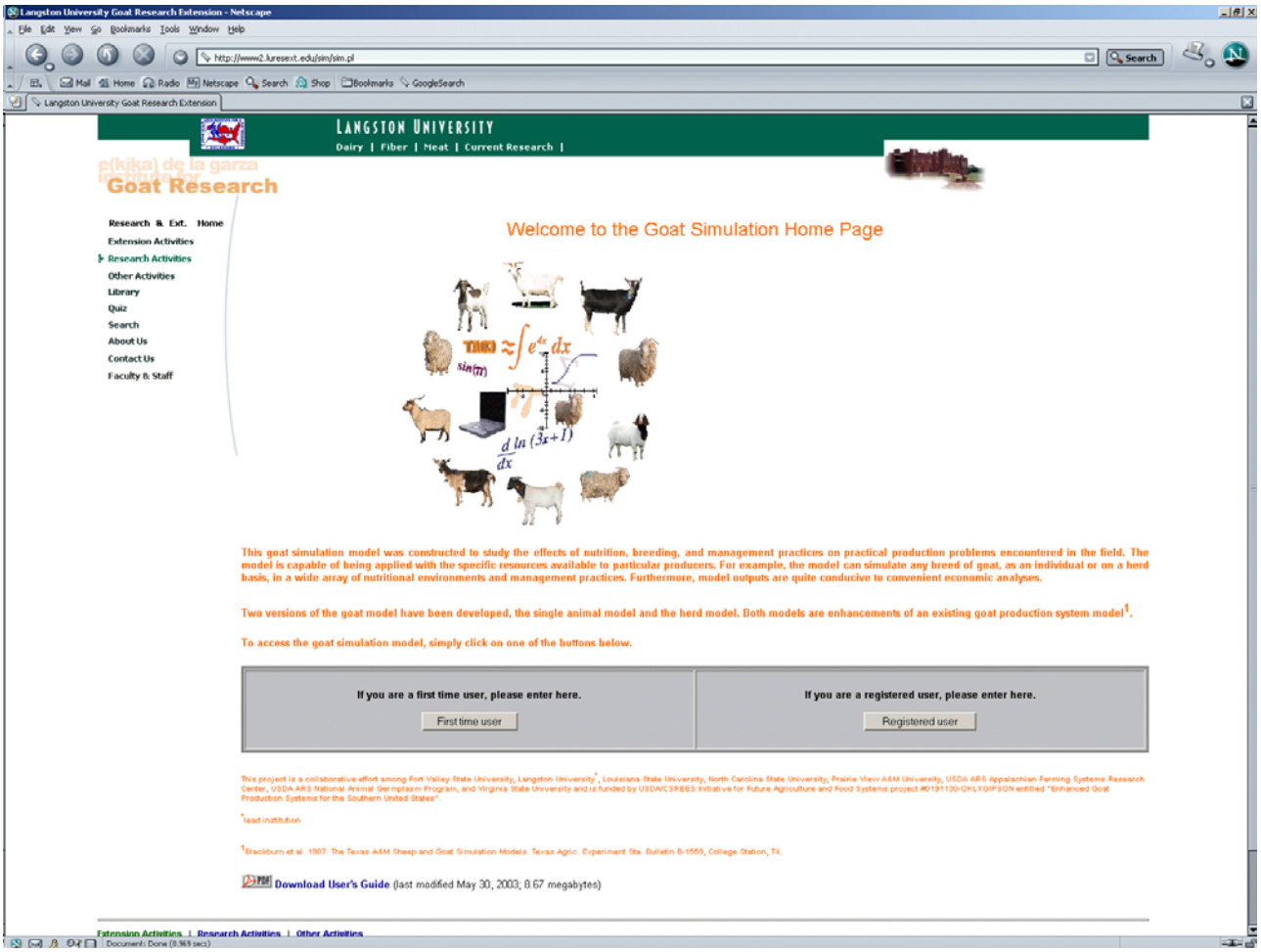
Once the computer simulation model has been tested for reliability or validated in computer jargon, the end product of this project is to provide training to participants at goat production sites in the southern United States. The target audience for this training will be research, teaching, and extension specialists at various universities, local extension agents, and livestock producers, especially goat producers.

The development of a computer simulation model is a slow and arduous process. Fortunately, this project builds upon an older existing computer simulation model developed by one of the collaborators, Dr. Harvey Blackburn of USDA-ARS National Animal Germplasm Program, and we thank Dr. Blackburn for this major contribution to the project. Enhancements to the existing goat simulation model are being constructed, which will allow greater flexibility in the decision-support vehicle for consideration of profitability, sustainability, and integration with other farm enterprises.



This expert contributions will be integrated at two levels. One level is a core team of scientists versed in the development of computer simulation models, and computer languages such as FORTRAN, which is the development source language of the simulation program and PERL, which is the distribution language of the simulation model via the Internet, as well as the biological processes. Scientists from Langston University, Prairie View A&M University and the National Animal Germplasm Program constitute this core team.

The other level consists of scientists at all eight collaborating institutions. This team are the experts in the biological processes that affect production. Their role is to fine tune parameters that are hard coded into the simulation model and to assist in the validation of the simulation model with field data that they have collected during the normal conduct of their respective research programs.


Langston University Goat Research Extension - Netscape
LANGSTON UNIVERSITY
Dairy | Fiber | Meat | Current Research |
Goat Research
Research & Ext. Home
Extension Activities
Research Activities
Other Activities
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Welcome to the Goat Simulation Home Page
This goat simulation model was constructed to study the effects of nutrition, breeding, and management practices on practical production problems encountered in the field. The model is capable of being applied with the specific resources available to particular producers. For example, the model can simulate any breed of goat, as an individual or on a herd basis, in a wide array of nutritional environments and management practices. Furthermore, model outputs are quite conducive to convenient economic analyses.
Two versions of the goat model have been developed, the single animal model and the herd model. Both models are enhancements of an existing goat production system model[1].
To access the goat simulation model, simply click on one of the buttons below.
If you are a first time user, please enter here.
First time user
If you are a registered user, please enter here.
Registered user
This project is a collaborative effort among Fort Valley State University, Langston University*, Louisiana State University, North Carolina State University, Prairie View A&M University, USDA ARS Appalachian Farming Systems Research Center, USDA ARS National Animal Germplasm Program, and Virginia State University and is funded by USDA/CSREES Initiative for Future Agriculture and Food Systems project #0191130-OKLXGIPSON entitled "Enhanced Goat Production Systems for the Southern United States".
*lead institution
[1]Blackburn et al. 1987. The Texas A&M Sheep and Goat Simulation Models. Texas Agric. Experiment Sta. Bulletin B-1559, College Station, TX.
Download User's Guide (last modified May 30, 2003; 8.67 megabytes)
Extension Activities | Research Activities | Other Activities

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DHI Training

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Langston University
Langston, Oklahoma 73050

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.	SA	Type of Test
			NONE	NONE
73425024				

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					Date of Birth			Sire Identity		Dam Identity		Kid		
Index No.	Registration or Eartag No. / Barn Name	Br	LACT #	BODY WT	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 / Ind	Old Status: Date / Reg/Tag Number	Old Status: Milk Wt	New Status: C O D E	New Status: Date Changed Mo	New Status: Date Changed Day	Index / Barn Name	Milk Weights: 1st Milking Lbs	1st Milking 10 TH	2nd Milking Lbs	2nd Milking 10 TH	3rd Milking Lbs	3rd Milking 10 TH	CAR	Body WT.	New Repro Status: C O D E	New Repro Status: No. Br.	New Repro Status: Breed Date or Heat Date Mo	New Repro Status: Breed Date or Heat Date Day	BIRTH	Kid Identity or Sire: Kid: Tattoo, Tag, or Other / Sire:Reg. No., or Sire Name	Kid Identity or Sire: ID Code	Kid Identity or Sire: ID Number	Old Repro Status: Str. Num 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 Dooling Herd
F: Freshend

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

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

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

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

Repro Codes
A: ABORT; B: BRED; H: IN HEAT; O: OPEN; P: PREGNANT; R: REPRO. CULL; P: 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

BRED	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	9/17	3/18	4/21	5/26	6/30	7/24	8/24	9/29	TEST DAY 11/5/98		LACTATION TO DATE: MILK POUNDS / %FAT	%PROT	PROTEIN / Fat	ME: Fat / Milk	Breeding Information: REPRO / # Serv	SERVICE SIRE IDENTIFICATION / BREEDING DATE	HEAT OR DUE DATE	NO DAYS DRY / NO DAYS OPEN	BODY WT / SCORE
								TEST DAY	8/13	9/17	3/18	4/21	5/26	6/30	7/24	8/24	9/29	11/5/98										
								SCCS / MILK	SCCS	MILK	SCCS	MILK	SCCS	MILK	SCCS	MILK	SCCS	MILK	SCCS	MILK	SCCS	%PROT %FAT								
	180760205		362	5					0	5.65													0		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	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												0	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												0	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												0	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	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												0	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
E: Estimated
F: Sup. Est. Fat
H: In Heat
I: Injected
L: Lab Est. Fat
M: Milked 3X
X: No 305D Rec.
U: Unofficial

SCC Score to Actual 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

E (KIKA) DE LA GARZA
LANGSTON UNIVERSITY
PO BOX 730
RESEARCH FARM/DHI LAB
LANGSTON

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

73425024
LANGSTON UNIVERSITY
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Dam Information

Index:
Dam ID: 180774012
Name: 1
Breed: A
PTA Milk:
PTA BFat:
PTA Protein:

Sire Information

Sire ID: 180760205
Name: -
Breed: A

Index No.: 362
Name: 362
Registration: 180884425
Breed: A
Date of Birth: 3/14/92
PTA Milk: 0
PTA BFat: 0
PTA Protein: 0

Kidding Date	Lactation Num.
3/16/97	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
Dry	Fresh	140	9/17/97	7.2	3.1	186									

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
3/16/97	61	1/7/99	5	0		0	0	0	663	0	0	0	0.0	1339	0	0
1/18/96	47	8/11/96	4	917	4.3	39	3.4	31	206	917	39	31	4.3	1089	46	36
2/16/95	36	1/18/96	3	1882	3.3	62	3.2	61	336	1975	65	65	5.7	1882	62	61
1/16/94	22	9/20/94	2	1900	4.2	80	3.2	60	247	1900	80	60	6.4	2569	109	81
4/30/93	14	10/25/93	1	970	4.6	45	3.0	29	178	970	45	29	6.1	2149	101	64
				1417	4.1	57	3.2	45	326	1441	57	46	5.6	1806	80	61

Lifetime Milk
5762

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	3/16/97	217									
4	1/18/96	0	0		Unknown						
3	2/16/95	149	0		Unknown	GIGR-H552					
2	1/16/94	83	0		Unknown						
1	4/30/93	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
	5.7	3.7	5.8	3.2	3.8	3.2	0.0	2.8	5.7	2.9														
5	10.7	2.5	8.9	3.6	9.2	2.4	6.7	3.6	7.2	3.1														
	4.8	3.5	4.1	3.6	3.5	3.4	3.3	3.2	5.0	3.0	4.8	3.0												
4	3.2	4.6	4.0	4.3	5.9	4.4	6.8	3.8	4.5	3.8	2.8	3.6												
	5.1	3.3	1.9	3.2	5.5	3.1	4.7	3.1	4.6	3.0	5.2	2.8	7.9	3.8	8.7	4.3	6.8	3.9	5.3	3.7	7.1	3.8		
3	9.1	3.6	10.6	2.5	8.8	2.8	8.9	3.4	7.9	3.4	4.9	2.8	2.2	3.6	1.2	4.7	2.4	4.9	3.1	4.0	2.8	4.2		
	6.4	3.3	6.9	2.8	7.1	2.8	5.0	3.2	5.5	3.5														
1	6.0	6.7	7.0	4.2	4.0	3.3	5.0	3.7	5.0	5.5														

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.	
2163	B	2163	181067898	A	180760205	A		180918220	A			2/18/97	0	0	0	
2165	B	2165	181067895	A	180900735	A		180884412	A			2/18/97	0	0	0	
2167	B	2167	181067893	A	180760205	A		180948627	A			2/19/97	0	0	0	
2463	B	2463	180989176	A	180710539	A		180848913	A			2/8/95	0	0	0	
2465	B	2465	180989178	A	180643086	A		180884426	A			2/9/95	0	0	0	
2466	B	2466	180989184	A	180900735	A		180884425	A			2/16/95	0	0	0	
802	K	802	PENDING	A	1029965	W		181062415	A			3/8/98	0	0	0	
803	K	803	PENDING	A	1029965	W		181062424	A			3/13/98	0	0	0	
805	K	805	PENDING	A	1029965	W		181062431	A			3/15/98	0	0	0	
806	K	806	PENDING	A	1029965	W		181062438	A			3/15/98	0	0	0	
807	K	807	PENDING	A	0989178	W		180948636	A			3/15/98	0	0	0	
808	K	808	PENDING	A	0989178	W		180948636	A			3/15/98	0	0	0	
813	K	813	PENDING	A	0989184	W		180884415	A			3/17/98	0	0	0	
815	K	815	PENDING	A	0989176	W		180989189	A			3/18/98	0	0	0	
816	K	816	PENDING	A	0989184	W		180918225	A			3/19/98	0	0	0	
817	K	817	PENDING	A	0989178	W		181028016	A			3/20/98	0	0	0	
818	K	818	PENDING	A	0989184	W		AA0884410	A			3/20/98	0	0	0	
819	K	819	PENDING	A	0989184	W		181062437	A			3/20/98	0	0	0	
820	K	820	PENDING	A	0989184	W		181062463	A			3/20/98	0	0	0	
822	K	822	PENDING	A	0989178	W		181027992	A			3/20/98	0	0	0	
824	K	824	PENDING	A	0989184	W		180884408	A			3/21/98	0	0	0	
826	K	826	PENDING	A	0989184	W		181062451	A			3/22/98	0	0	0	
827	K	827	PENDING	A	0989184	W		181062451	A			3/22/98	0	0	0	
828	K	828	PENDING	A	0989184	W		180989167	A			3/23/98	0	0	0	
829	K	829	PENDING	A	0989184	W		180989167	A			3/23/98	0	0	0	
830	K	830	PENDING	A	0989184	W		181062445	A			3/25/98	0	0	0	
831	K	831	PENDING	A	0989178	W		180884414	A			3/25/98	0	0	0	
833	K	833	PENDING	A	0989176	W		180989191	A			3/25/98	0	0	0	
834	K	834	None	A	180989184	A		180918216	A			3/25/98	0	0	0	
835	K	835	None	A	180989176	A		180918218	A			3/25/98	0	0	0	
836	K	836	None	A	180989178	A		181027993	A			3/25/98	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.

6. Special ADGA Considerations

6.1 ADGA approves Owner Sampler plan for use in the DHIR program!

ADGA members, with the approval of their local associations, can now participate in DHIR using Owner Sampler Plan '40' beginning in 2004. Features of the plan are:

* All DHI management information
* Herd/Individual Records
* STAR (ST) Volume eligibility*
* Affordability
* Flexibility
* Availability

As with all plans recognized for use in ADGA, there are requirements for acceptance of records into the STAR Volume. These are:

* Application/fees to ADGA DHIR
* Herd verification test between 60 and 150 days in milk
* Minimum data collection rating of '75'
* Owner responsibility to send in completed lactation record

All requirements of the ADGA DHIR program will apply to the Owner Sampler Test Plan, including those set for verification testing.

*The *M will be equivalent to those earned in a One-Day Milking Competition but with increased opportunity to earn Star recognition based on the yield minimums set forward in the ADGA guidebook. As part of the STAR (ST) volume, Owner Sampler records are not eligible for Breed Leader (Top Ten) recognition nor will appear on Performance Pedigrees, features that are part of the ADVANCED

REGISTRY (AR) Volume. Records will be included in the Performance Volumes.

6.2 Quality Assurance Program

A 2-year plan has been implemented to resolve any remaining issues with organizations that have indicated they are unable to provide the materials necessary to comply with a quality assurance review for dairy goat records as required by the understanding between ADGA and USDA.

During the first year (2004), ADGA will be working to find solutions with these organizations. The second year (2005) will be spent assisting those herds still needing transitioning to organizations willing to work with dairy goat production testing.

All DHIR records will be accepted by ADGA through December 31, 2005 from your current organization. Lactations starting on or after January 1, 2006 must have records from organizations participating in the quality assurance program for dairy goats.

ADGA will be providing herdowners information at the time of renewal as well as throughout 2004-2005 regarding status of each organization, so that producers will be fully informed during this time period.

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McKinney, T. 2004. DHI Training. Pages 84-102 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Managing Goats

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Introduction

Goats are an effective tool for managing a variety of plants. However, some would think that because of their independent nature, goats would defy any type of management! They are a proven tool. Some plants that goats have been documented to manage include sand shinnery, sumac, oaks, buckbrush, young cedar, and many other species. Goats can be used as an alternative to chemicals, fire, mowing and mechanical control methods. In some cases, these methods are not a viable choice because of location, proximity to adjoining landowners, and other reasons. The use of goats integrated with other methods can be an effective approach.

Goats are not for everybody. Unless one is willing to learn from others and learn from their mistakes, then goats may not be the right choice.

Goats have been misunderstood by many. Some perceive goats as animals that can munch incessantly on tin cans, newspapers, and seat covers, and that they will clear out brush or unwanted plants while leaving the desirable plants. Experience reveals that goats are no different than many other animals, including humans, in that they must have positive nutritional experiences with the forages that they eat. They do not automatically know which forages they will eventually come to like. So, they experiment and have a complex feedback mechanism to help them settle on the plants they will eventually put on their menu. They will also develop an aversion to forages that "do not agree" with their system.

Goats have several things going for them nutritionally speaking. They pass forage through their system much faster than cattle. They also can de-toxify certain plant compounds which might include tannins, allelochemicals, essential oils, alkaloids, and others. They do best with a diversity of forages which enables the detoxification process. It may take several days or several months to adjust to a novel forage. The best goats to use are those that come from a location with similar plants. It is even better to raise kids that learned from their mothers and peers about which plants to eat.

Vegetation Management with Goats

To explore the possibilities of using goats on sand shinnery, a shrub of sandy western Oklahoma, the Great Plains RC&D Council provided initial funding for the Natural Resources Conservation Service, Langston University, Forest Service, private ranchers, Upper Washita CD and Atwoods Country Store at Cheyenne, to do a demonstration project.

The project goals were to change the plant composition from a 95% shinnery – 5% grass to an 80% grass – 20% oak ratio within a 3-year time frame. In 1992, 80 acres of National Grasslands was divided into 8 pastures. Both Spanish goats and Angora goats were introduced at two different stocking rates and grazing strategies. Adjustments were made each year based on what was learned from previous experience. In 1993, only Angora goats were used in the project. The goals were also amended to hold the death loss to 3 percent and achieve 7 lb per head mohair growth.

The operating principle is very simple. Grasses grow from their bases while shrubs grow from their tips. Anytime more than half a growing leaf is removed, a plant has to call upon reserves to maintain itself. Because of this difference in growth physiology, grasses can withstand grazing pressure better than shrubs. The shrubs will deplete their food reserves first. The key is to find an animal that has learned to appreciate the shrubs over the grass - the goat.

Here are some items that summarize some of what we learned:

- Ask those with experience before starting.
- Goats select what they eat based on quality and what they are familiar with. Goats that came from a background of grass ate a higher proportion of grass and forbs that did the goats with a background of brush. The goats were selective, even between shinnery ecotypes.
- Use guard dogs that are well trained.
- Have net wire or permanent power fences with at least 4 strands.
- Have a good health program, particularly internal parasites.
- Have a good nutritional program.
- Have a marketing plan.
- Be committed to making it work.
- Introduce the goats to the shinnery as soon after bud break as possible. There is a small chance that some goats may get bud poisoning, but the toxicity is reduced after about two weeks.
- If the oak leaf gets too mature the goats will shift to better forage.
- Designate one pasture as a "target pasture". Start the goats here, leaving them in until they have defoliated 80 percent of the shinnery, then move them into a rotation. Try to accomplish the defoliation within 7 days. When the leaves in the target pasture have re-grown to about one-half mature size, pull the goats out of the rotation and put them back into the target pasture. Again, strive for 80 percent defoliation, and then back into the rotation. Continue this cycle for the growing season.
- We used 6 goats per acre stocking rate. For the 5 pasture rotation, as many as 124 goats were in the herd. This means each pasture was stocked with a *density* of 21 goats per acre.
- Records kept during the trial reveal the following grazing pressures on the target pasture:

  1992 - 990 goat days per acre
  1993 - 681 goat days per acre
  1994 - 533 goat days per acre
  2,204 total goat days per acre

- This suggests that the shinnery was decreasing in the pastures.
- The goats in the non-rotation system gained weight initially but lost weight rapidly after mid-July. This was attributed to the fact that once the goats had grazed all the quality forbs and grasses from their pasture, they were left with low quality shinnery. The rotation goats gained weight throughout the summer. The rotation pastures had a greater variety of forages, allowing the goats to select higher quality diets.
- Continuous grazing is an option, but should have diet quality and the resulting plant composition as a consideration.
- Forage quality testing of shinnery revealed the following digestible protein figures:

Date	Current Growth	Regrowth
July 28	6.2%	9.5%
August 25	4.3%	3.6%

- Amounts can be misleading because the tannins in the oak leaf can tie up the protein.
- Fecal protein testing revealed:

Date	Fecal Protein	Dig. Organic Matter
7-20	15%	54%
7/29	17%	63%
8/11	14%	55%
8/26	12%	50%

- The goats recycled the nutrients in the vegetation and the nutrients eaten in the supplemental feed. Soil testing revealed a measurable difference in pounds per acre of the various nutrients as tested by Oklahoma State University.

	N	P	K	pH
Control	1	5	120	6.7
Target Pasture	21	23	314	6.4

- Frequency counts reveal:

	Control	Target
Oak	100%	55%
Sand Lovegrass	20%	59%

- The production was near 3100 lb per acre in both the control plot and in the target plot. However the percent production by weight by kinds of plants are:

	Control	Target
Oak	95%	50%
Grasses & Forbs	5%	50%

- Death loss and hair weight by year:

Year	% Death Loss	Hair weight
1992	12 on meat goats 28 on Angoras	NA
1993	3.6	5.5
1994	4	NA

- The target pasture had 11 different species of plants while the control only had 7 different species.
- Wildlife species such as white-tailed deer, quail and lesser prairie chicken can be benefited by the increased diversity of plants and the change in cover structure. However, goats may remove other valuable woody plants such as plum, hackberry, and others that would detract from their habitat requirements.
- The grazing by the goats reduced the competition from the shinnery, allowing the native grasses to recover. This improves the carrying capacity for cattle. The stocking rate can be estimated from the forage production figures.

There is much to be learned when managing plants with goats. These points are cursory highlights and do not in any way provide all the discussion needed for a successful endeavor. The measurements of fecal protein and forage quality need further study for greater accuracy. Even though there was a different set of goats each year the trend points to the same end result.

This experience does suggest that goats are an effective tool to manipulate unwanted plants to accomplish a management objective.

One final thought: A decision needs to be made early on as to the management objective. Many ranchers report that what originally were considered problem plants for cattle, are desirable plants for goats. Moreover, if goats make more money than cattle, then it might make sense to manage the land for the brush on a sustainable basis rather than an extermination basis.

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CURRENT PROGRAM SUMMARY

E (Kika) de la Garza American Institute for Goat Research
Langston University
Langston, Oklahoma 73050

- **EXTENSION OVERVIEW**
- **INTERNATIONAL PROJECTS**
- **RESEARCH OVERVIEW**
- **USDA/CSREES PROJECTS**
- **EXPERIMENTS**
- **ABSTRACTS**
- **ARTICLE SUMMARIES**
- **VISITING SCHOLARS, GRADUATE STUDENTS, AND INTERNS**

Extension Overview

Dr. Terry A. Gipson

Goat Extension Leader

Introduction

The year 2003 was a busy one for the Langston Goat Extension program. The goat extension specialists have answered innumerable producer requests for goat production and product information via the telephone, letters, and e-mail, have given numerous presentations at several state, regional, national, and international goat conferences for potential, novice, and veteran goat producers, and have produced a quarterly newsletter. They have also been busy with several major extension activities. These activities include the annual Goat Field Day, Langston Goat Dairy Herd Improvement (DHI) Program, grazing demonstrations, the seventh annual meat buck performance test, and various goat workshops on artificial insemination and on internal parasite control.

Goat Field Day

Our 18th annual Goat Field Day was held on Saturday, April 26, 2003 at the Langston University Goat Farm. The theme was Export Potential, Market Outlook, and Value-Added Processing. Ms. Linda Campbell, owner and operator of Khimaira Farm, was the featured speaker for export potential, market outlook, and value-added processing of dairy goats and dairy goat products. Khimaira Farm, located in Luray, Virginia, is a family dairy and meat goat operation. Nubians are the primary breed, with smaller numbers of Saanens, Alpines, and black Boers. The Khimaira herd was on official DHIR standard testing for nearly 15 years. Khimaira dairy goats have placed Top Ten in the nation for milk and butterfat. Khimaira herdsires have placed in the USDA Sire Summary Top 15%, with does appearing on the Elite Doe lists. Thousands of Khimaira dairy goats have found homes in every state of the U.S. and more than thirty countries worldwide. Dr. Joe David Ross, manager of the Cashmere America Co-Operative, was the featured speaker for export potential, market outlook, and value-added processing of fiber goat products. Cashmere America Cooperative was started in 1991 by a small group of dedicated cashmere producers. Cashmere America Cooperative recognizes that consistence in quality makes for a premium finished product. That is just one of the reasons dedicated growers all across America joined together in the Co-op to establish high and consistent grading standards for their fiber. Dr. Ross is the owner of Ross Builta Farm in Sonora, Texas. Recently, Ross Builta Farm received the 2002 Outstanding Forage Producer award from the Texas Forage and Grassland Council. Dr. tatiana Stanton, Extension Associate in the Department of Animal Science at Cornell, was the featured speaker for export potential, market outlook, and value-added processing of meat goats and meat goat products. Dr. Stanton is a staff member of the Northeast Sheep and Goat Marketing Program, which was developed from a grant received by Cornell University from the USDA to improve sheep and goat marketing infrastructure in the Northeast. The Northeast Sheep and Goat Marketing Program seeks to reinvigorate the lamb and goat meat industry in the Northeastern United States by improving producer access to equitable markets while building regional capacity to supply the growing consumer demand for high quality lamb and goat meat. Dr. Stanton also has written several goat factsheets for use in NY State 4-H meat goat projects and has published these factsheets on the Internet so that they are available to 4-H'ers nationwide. Dr. Stanton also operates a goat farm in upstate New York and is very active in the Empire State Meat Goat Producers Association. In the afternoon session, participants broke into small-group workshops. Afternoon workshops included: Export Potential, Market Outlook, and Value-Added Processing of Meat Goats, Export Potential, Market Outlook, and Value-Added Processing of Goat Fiber, Export Potential, Market Outlook, and Value-Added Processing of Dairy Goats/Products, Basic Goat Husbandry I, Basic Goat Husbandry II, Cheesemaking Overview, Dewormer Resistance, Goat Production Budgets, Goat Production Record Keeping, International Activities, Goat Production & Quality Assurance, Pasture-Based Dairying, and Goat Nutrition. There

was a youth program in the morning and afternoon. For the younger youth, there was a craft project and games to play during the morning and afternoon. Therefore, the parents of young children were able to enjoy the morning and afternoon session while their children are entertained. Youth will enjoy a day of fun-filled activities. Ms. Shelia Stevenson interspersed 4-H goat activities with activities from the Risk Watch Safety Training program of the National Fire Prevention Association. Youth participants learned about goat anatomy/physiology and production as well as bicycle safety and fire/burn prevention. Youth also had the opportunity to participate in a craft project and a fishing derby. Again, this year we had a cheesemaking workshop conducted by Pure Luck Texas of Dripping Springs, TX. This workshop provided participants with a unique, hands-on experience of making cheese with award-winning artisans. In 1998, Pure Luck entered the American Cheese Society competition and won a Blue Ribbon with their Del Cielo in the "Farmstead Goat Cheese" category. In 1999, Pure Luck won another Blue Ribbon, this one for Basil Pesto Spread, made with fresh organic basil grown on the farm. In 2000, Pure Luck won a Blue Ribbon for the Restaurant Pack in the Fresh Goat's Milk Cheese Category. In 2001, Pure Luck won a Blue Ribbon for their Basked Molded Chevre in the category of Farmstead Goat Cheese, a Red Ribbon for Feta in the category of Goat Milk Feta, and a Red Ribbon for Ste. Maure, a soft ripened log in the Soft Ripened Goat Cheese category. In 2003, 265 participants attended the field day. Thirty-two of the 265 participants were youth and were enrolled in a 4-H fun-activity event. The majority of the participants were from Oklahoma.. 500 copies of the proceedings of the 18th annual Goat Field Day were printed and over 475 copies have been disseminated either via the 18th Goat Field Day or later via telephone or email request. Producers are educated on aspects of goat production and are better informed to make management and marketing decisions. Producers are able to network with other goat producers within their locale, state and region. The E (Kika) de la Garza American Institute for Goat Research is able to disseminate research findings that enhance the producers' knowledge base and to expose producers to new technologies that improve production or makes it more efficient. Potential producers are better able to make decisions about goat enterprises.

Goat DHI Laboratory

The Langston Goat Dairy Herd Improvement (DHI) Program is housed at the dairy farm, west of campus, operates under the umbrella of the Texas DHIA. In February 1998, the Langston DHI program became the first DHI program to introduce forms and reports in goat terminology to dairy goat producers in the United States. A national Dairy Herd Improvement Association (DHIA) has been in existence for a number of years. However, until 1996 DHIA catered only to cow dairies. Dairy goat clientele had to deal with records written in cow language. This meant that they could not get accurate information on delivery dates, and that all the pages reflected cows, bulls, and calves rather than does, bucks, and kids. Additionally research has shown that when the laboratory instruments are calibrated with a cow milk standard and then goat milk is tested, there is a 29% increase in somatic cells, a 0.27% decrease in protein and a 0.04% decrease in butterfat from the actual values. The records produced by the DHI labs across the country are used to identify high producing does. These records are also useful for the exportation of these does to foreign countries. These incorrect records were costing goat producers on the resale value of their does and offspring. Langston University established a certified DHI laboratory that calibrates the instruments using a goat milk standard. We have also worked in cooperation with Texas A&M University to write a program that utilizes goat language. This program produces records with the any of the dairy goat breeds along with correct sex identification and expected delivery dates for pregnant does. The Langston DHI program has been very popular with dairy goat producers and has grown significantly since its establishment in 1996. Figures 1and 2 shows the growth of the Langston DHI lab in terms of number of herds and doe records processed and compared to other record processing centers. Generally, there is a decrease nationwide in number of herds and does enrolled in the national DHIA program, except for the Langston DHI program. Goat producers are now able to get records for there animals that reflect accurate information with the correct language. These records not only reflect higher fat and protein values for a doe, but also are easier to understand when dealing with importers from foreign countries. Currently we are serving a 27 state area that includes a majority of the eastern states. We have over 100 herds in these 27 states enrolled

in the Langston Goat Dairy DHI Program. This is an increase of 28% in herds and 32% in animals from 2001. Even though Langston University is one of the smallest certified DHIA laboratories, it recorded the largest increase in herds and numbers of the six certified DHIA processing centers that process goat records. In fact only two processing centers showed an increase in these two categories; all the other four recorded a decrease in the number of herds and the number of animals processed. Langston University continues to serve the very small-scale dairy goat producer. The average herds size on test with Langston University is 10 animals (Figure 3). This is significantly smaller than the herd size average for the five other processing centers.

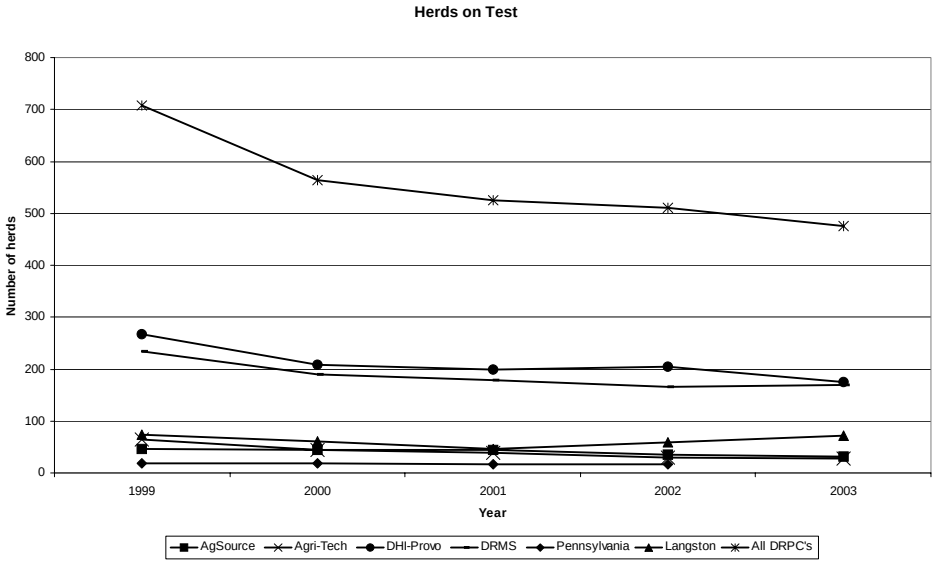


Figure 35. Number of goat herds on DHIA test by processing centers.

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

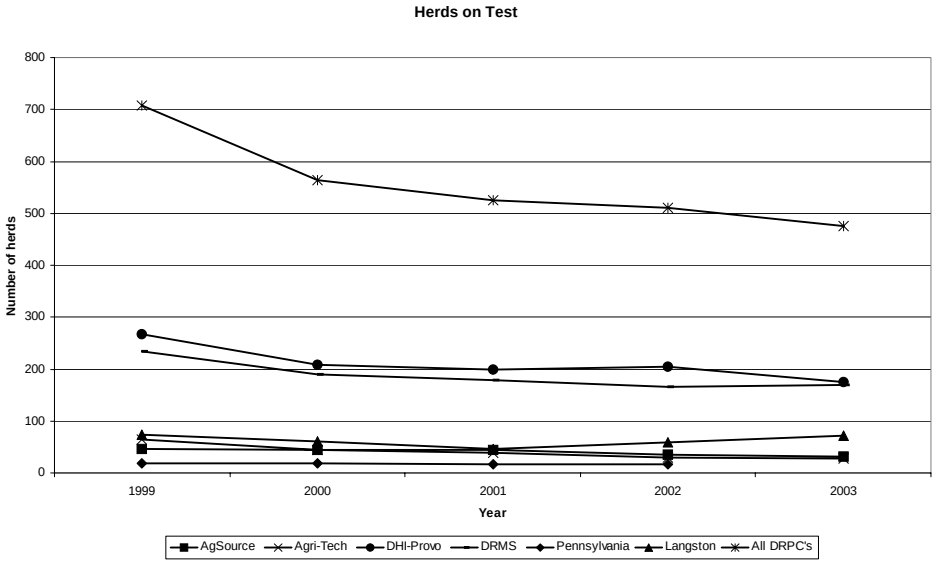


Figure 36. Number of does on DHIA test by processing center.

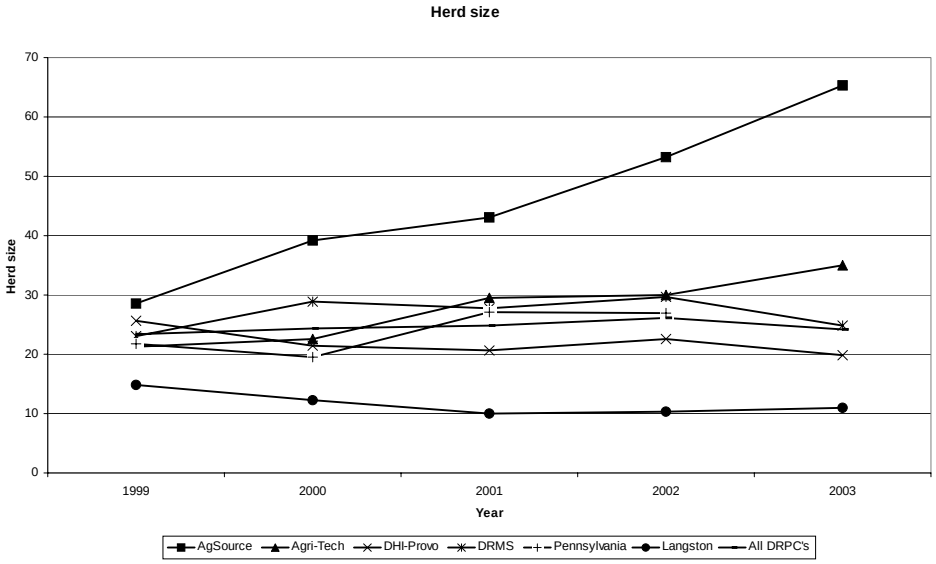


Figure 37. Average herd size by processing center.

Goat Newsletter

The Goat Extension program published four issues of the 8-page Goat Newsletter in 2003. Interest in the newsletter has grown and we currently have over 3,400 subscribers to our free quarterly Goat Newsletter and the subscription list continues to increase every year. The Goat Newsletter is mailed to every state in the nation and to 10 countries overseas. Ninety-seven percent of the mailings go to American households. At least one newsletter is mailed to a household in every state in the nation. Fifty percent of the newsletters are mailed to Oklahoma households. An additional thirty percent of the newsletters are mailed to households to states adjacent to Oklahoma.

Grazing Demonstration

In 2001, Langston University was awarded an USDA Sustainable Agriculture Research and Education grant to study the efficacy of using goats to eliminate invasive vegetation on tribal lands. The Caddo, Cherokee, Choctaw, Osage, Sac & Fox, and Greater Seminole Nations are collaborators on this project and demonstration sites were established on lands affiliated with the tribes. First year (2002) and second year (2003) grazing treatment differed from site to site. At the Caddo demonstration site, we examined the effects of goats and sheep. At the Cherokee site, we examined the effect of goats, mechanical, and chemical control. At the Chotaw site, we examined goats and beef cattle. At the Osage site, we examined different stocking rates of goats. At the Sac & Fox site, we examined varying stocking rates in addition to a rotational grazing treatment. And, at the Seminole site, we also examined varying stocking rates. Workshops were held at each site detailing the progress of the project including basic goat husbandry.

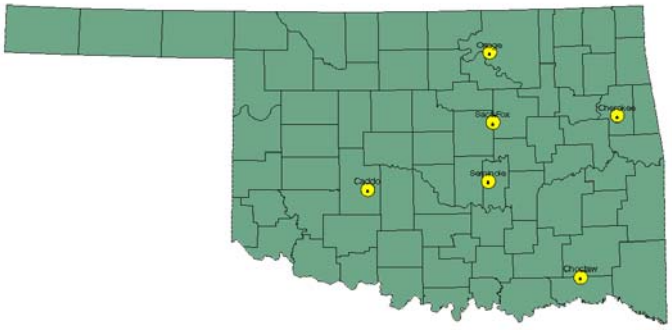
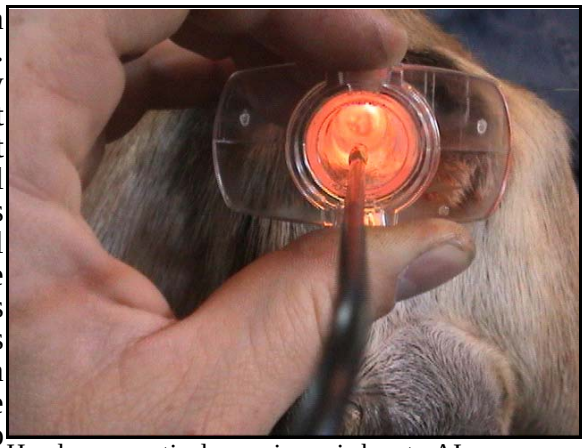


Figure 38. Location of the SARE demonstrations grazing sites.

Artificial Insemination Workshop


Hands-on practical experience is key to AI workshops

The use of superior sires is imperative in improving the genetic composition of breeding stock. Artificial insemination has long been used in the dairy cattle industry and is a simple technology that goat producers can acquire. However, opportunities for goat producers to the necessary skills via formal and practical instruction are not widespread. Langston University has instituted a practical workshop for instruction in artificial insemination in goats. Producers are instructed in the anatomy and physiology of the female goat, estrus detection and handling, and storage of semen. Producers participate in a hands-on insemination exercise. An understanding of the anatomy and physiology enable the producer to devise seasonal breeding plans and to troubleshoot problem breeders. An understanding of estrus detection enables the producer to effective time inseminations for favorable conditions for conception and to effectively utilize semen. An understanding of semen handling and storage enables the producer to safeguard semen supplies, which can be scarce and costly. The experience of actually inseminating a female goat enables the producer to practice the knowledge that they have gained. The acquisition of these inseminating skills will allow producers the use of genetically superior sires in their herds that they normally would not have access to. It also allows producers to save money by conducting the inseminating themselves instead of hiring and inseminator. In 2003, AI workshops were held on 9/06/03 at the Langston University campus and on 10/12/02 at the county fairgrounds in Tahlequah. There were 33 participants enrolled in the two workshops, 21 at Langston University and 15 in Tahlequah.

Controlling Internal Parasites Workshop

At a recent workshop at Langston, the representatives of three major goat organizations in the US identified internal parasites as the number one industry problem. Internal parasites are becoming a much greater industry problem because they have developed resistance to many of the anthelmintics that are commonly used for their control. A recent field study at Langston showed that most producers have internal parasites that are resistant to all available dewormers but two, Tramisole and Cydectin. More recently, there are two apparent cases of resistance to Cydectin. These findings mean that producers are going to have to rely more on management to control parasites rather than dewormers.

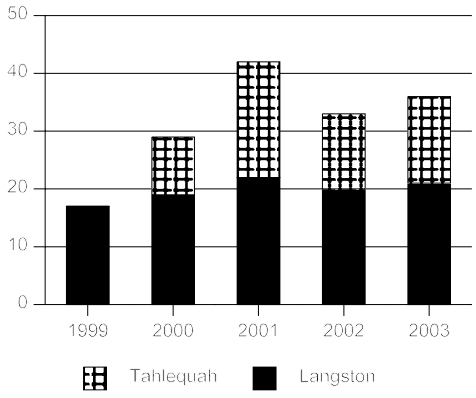


Figure 40. Number of participants enrolled in AI workshops.

An understanding of life cycles of the parasite and monitoring of parasite infection by fecal egg counts equips farmers to modify their management practices to reduce the use of anthelmintics. It also enables them to identify animals that have poor resistance to internal parasites and as such increase pasture contamination and the consequent levels of parasitism in the herd. These animals with high fecal egg counts can be culled, reducing pasture contamination. Equipping producers with an objective took to determine the need for deworming will save money on the use of dewormers, but more importantly will reduce the development of dewormer resistance enabling the use of dewormers longer and ensuring the future of goat production. Without effective dewormers, the newly expanded goat industry will not be able to survive. While a cost saving of $1.00-2.00/hd can be documented through reduced use of

dewormer, the reduced development of dewormer resistance is worth far more due to saving the industry.

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. 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 and staff via e-mail.

Tulsa State Fair

At the 2003 Tulsa State Fair, Langston University participated in the Birthing Center program with twelve 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 twelve does gave birth to eight sets of twins and four sets of singles. This was a huge success and plans are underway to provide pregnant does for 2004.

Oklahoma State Fair

Langston University provided five goats to Agropolis Advantage, an educational exhibit designed to help children understand where food comes from and the role of the farmer and animals in providing food to the store and ultimately to their home.

Oklahoma Black Historical Association

In 2001, Langston University signed a memorandum of understanding with the Oklahoma Black Historical Association to conduct a goat grazing demonstration. The objective of the memorandum was

to conduct a vegetation management demonstration and appropriate goat management workshops to complement the demonstration project. In 2003, collabrative work continued at the Oklahoma Black Historical Association site near Nobletown, OK.

Meat Buck Performance Test

Meat goat production represents the most rapidly growing animal industry in the US today, and is becoming a mainstream livestock enterprise. To further genetic progress through the identification of superior sires in the industry, Langston University and the Oklahoma Meat Goat Association established a meat goat performance test in 1997.

Entry

The seventh annual meat buck performance test started May 3, 2003 with 52 bucks enrolled from 16 different breeders. Fifty-one of the bucks were fullblood Boers, and one Boer-cross buck. Twenty-nine bucks were from Texas, 19 from Oklahoma, 2 from Mississippi, and 2 from Nebraska. The test was open to purebred and crossbred bucks born between December 1, 2002 and March 31, 2003.

Bucks were given a thorough physical examination by Dr. Lionel Dawson, dewormed with Valbazen (albendazole), foot bathed with Nolvasan, deloused with Atroban De-Lice, given a preemptive injection of Nuflor for upper respiratory infections, and for those bucks that needed a booster or initial vaccinations for enterotoxemia and caseous lymphandinitis, the vaccination was given. 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.

Entrance weight for the 52 bucks averaged 58.6 lb with a range of 35.2 to 110.1 lb.

Adjustment Period

All bucks underwent an adjustment period of 18 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' x 20' inside pen equipped with nine Calan feeders. Each pen also had a 20' x 20' outside run. The inside and outside pen space was 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, the feed remaining in the Calan feeder from the day before 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.

On 7/4/03, Buck #1010 became ill and was taken to the emergency room at the Oklahoma State University, College of Veterinary Medicine. Unfortunately, the buck died that same day while still at the College of Veterinary Medicine. The body was transported to Oklahoma State University's Diagnostic Laboratory. The post mortem report indicated that the animal had died of polioencephalomalacia. No other animal has shown any sign of major illness and the health problems of the bucks on-test have been minimal.

Ration

Nutritionists at Langston University formulated the following ration. In 1999, the amount of salt and ammonium chloride was doubled due to problems with urinary calculi the previous year. Except for the increase in salt and ammonium chloride, the ration was unchanged from that which was used in the first two meat buck performance tests. The ration was fed free-choice during the adjustment period and during the 12-week test.

Ingredient	**Percentage (as fed)**
Cottonseed hulls	29.07
Alfalfa meal	19.98
Cottonseed meal	15.99
Ground corn	15.99
Wheat midds	9.99
Pellet Partner (binder)	5.00
Ammonium chloride	1.00
Yeast	1.00
Calcium Carbonate	0.95
Salt	0.50
Trace mineralized salt	0.50
Vitamin A	0.02
Rumensin	0.01
TOTAL	**100.00**

The crude protein content of the ration is 16% with 2.5% fat, 20.4% fiber, and 60.6% TDN (dry matter basis). Calcium phosphorus and sodium levels are 0.74%, 0.37%, and 1.07%, respectively. Zinc concentration is 33.04 ppm, copper is 17.15 ppm, and selenium is .21 ppm. In 2003, competitive bids were sought for the buck-test feed and Bluebonnet Feeds of Ardmore, OK was awarded the contract to supply feed for the buck performance test.

ABGA Approved Performance Test

In early 2000, the Oklahoma performance test was designated by the American Boer Goat Association Board of Directors as an ABGA Approved Performance Test. Qualified fullblood or purebred Boer bucks will be eligible to earn points towards entry into the "Ennobled Herd Book". Candidate bucks must pass a pre-performance test inspection conducted by one (1) or more ABGA

approved breeders. Ten (10) points will be awarded a Boer buck who shows an average daily weight gain (ADG) in the top five percent (5%) of the animals on test. Five (5) points will be awarded a Boer buck who shows an average daily weight gain (ADG) in the next fifteen percent (15%) of the animals on test. All bucks must gain at least three-tenths (0.3) pounds per day to be awarded any points.

International Boer Goat Association, Inc. Sanctioned Test

In 2003, the Oklahoma buck performance test was sanctioned by the International Boer Goat Association, Inc. The Oklahoma performance test continues to grow and to serve the meat goat industry.

Gain

The official performance test started on May 21 after the adjustment period was finished. Weight at the beginning of the test averaged 66.3 lbs with a range of 40.7 to 124.4 lb. Weight at the mid-point averaged 94.5 lb with a range of 57.3 to 159.7 lb. Weight at the end of the test averaged 119.5 lb with a range of 70.5 to 175.1 lb. Weight gain for the test averaged 52.9 lb with a range of 11.0 to 77.1 lb.

Average Daily Gain (ADG)

For the test, the bucks gained on averaged 0.63 lb/day with a range from 0.13 lb/day to 0.92 lb/day.

Feed Efficiency

For the test, the bucks consumed an average of 363.3 lb of feed with a range of 137.3 lb to 559.7 lb. For the test, the bucks averaged a feed efficiency of 7.1 (feed efficiency is defined as the number of lb of feed needed for one lb of gain), with a range of 5.1 to 12.5.

Muscling

The average loin eye area as determined by ultrasonography was 1.76 square inches with a range of 0.96 to 2.66 square inches and the average right rear leg circumference was 16.6 inches with a range of 13.75 to 20.5 inches.

Index

For 2003, 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 right 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 indices above 100% and those below average have index scores below 100%.

Congratulations

The Oklahoma Meat Goat Association and the Agricultural Research and Extension Program at Langston University congratulate:

- Mr. Marvin Shurley of Sonora, TX
  for having the Top-Indexing buck
  in the 2003 Oklahoma Meat Buck Performance Test

Also, deserving congratulations are:

- Mr. Marvin Shurley of Sonora, TX
  for having the #1 Fastest-Gaining buck

- Mr./Mrs. James and Luann Hansen of Cushing, OK
  for having the #2 Fastest-Gaining buck

- Mr./Mrs. James and Luann Hansen of Cushing, OK
  for having the #3 (tie) Fastest-Gaining buck

- Ms. Lynn Farmer of Mullin, TX
  for having the #3 (tie) Fastest-Gaining buck

- Ms. Lynn Farmer of Mullin, TX
  for having the #5 (tie) Fastest-Gaining buck

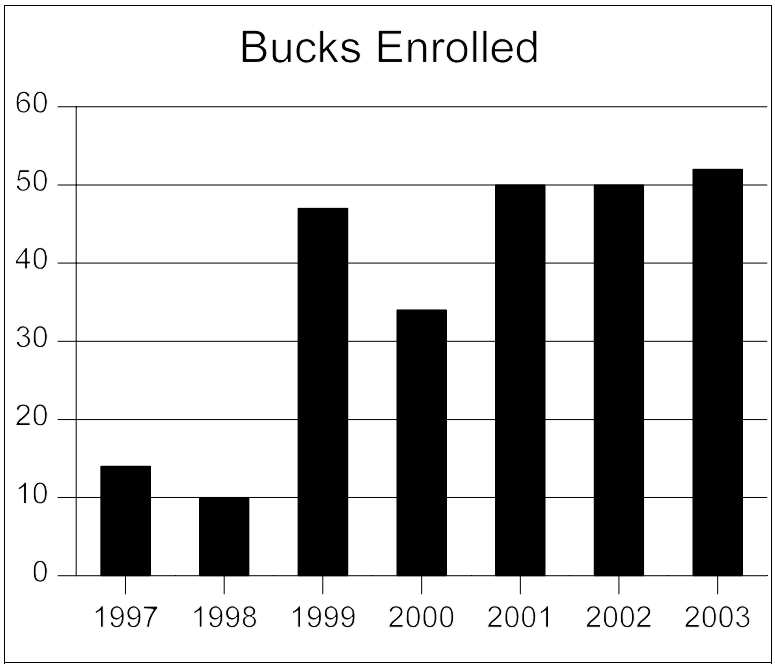
- Mr. Johnnie Holliday of Edmond, OK
  for having the #5 (tie) Fastest-Gaining buck

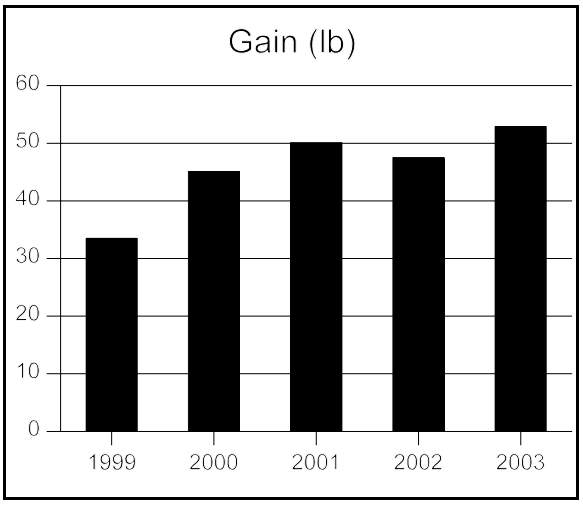
- Mr./Mrs. James and Luann Hansen of Cushing, OK
  for having the Most-Feed-Efficient buck

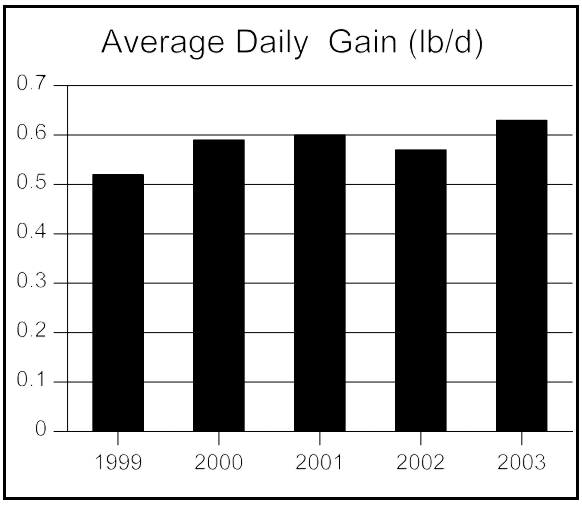
- Mr./Mrs. Jim and Mary Daniel of Earlsboro, OK
  for having the Most-Heavily-Muscled buck

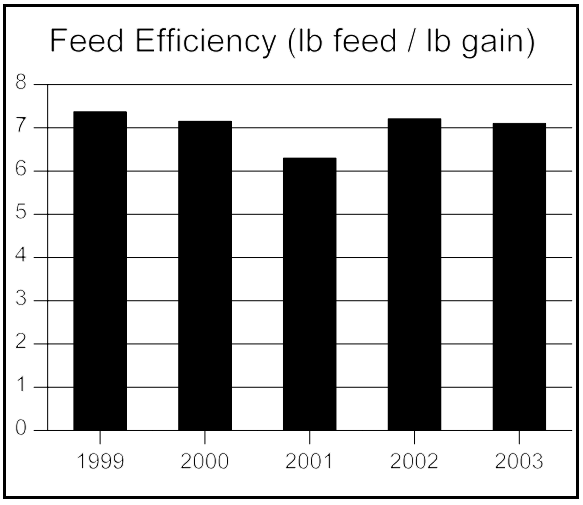
Acknowledgments

The Buck Test supervisor wishes to acknowledge Dr. Lionel Dawson of Oklahoma State University for his contributions as the admitting and on-call veterinarian, Mr. Filemon Vasquez for his management and oversight of the day-to-day activities, Mr. Jerry Hayes of Langston University for aid and supervision, Mr. Les Hutchens and his associates at Reproductive Enterprises, Inc. for conducting the ultrasound measurements for the loin eye area and the breeding soundness exams, and Bluebonnet Feeds of Ardmore, OK for custom mixing the feed.


Bucks Enrolled
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2003


Gain (lb)
60
50
40
30
20
10
0
1999
2000
2001
2002
2003


Average Daily Gain (lb/d)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1999
2000
2001
2002
2003


Feed Efficiency (lb feed / lb gain)
8
7
6
5
4
3
2
1
0
1999
2000
2001
2002
2003

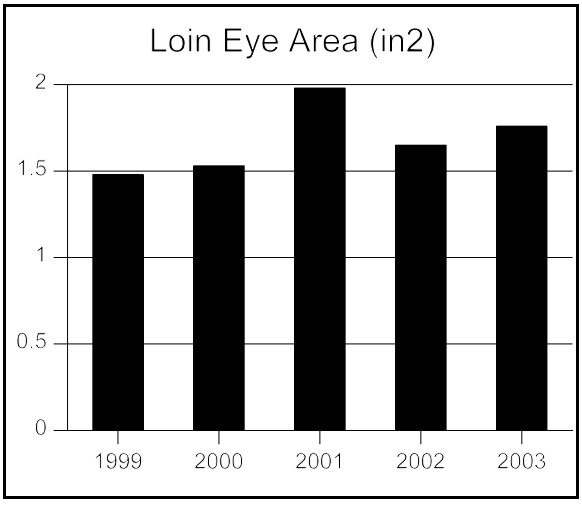

Loin Eye Area (in2)
2
1.5
1
0.5
0
1999
2000
2001
2002
2003

Table 1. Bucks sorted by Index score.

LU ID	Breed	Beg wt (lb)	End wt (lb)	Gain (lb)	ADG (lb/day)	Intake (lb)	FE*	LEA (in^2)	Rear leg (in)	Index
91021	Boer	67.2	144.3	77.1	0.92	443.0	5.75	1.48	15.00	101.47
91040	Boer	47.4	118.9	71.6	0.85	366.8	5.12	1.56	16.50	101.44
91002	Boer	55.1	122.2	67.2	0.80	395.2	5.88	1.48	15.00	101.00
91041	Boer	78.2	146.5	68.3	0.81	443.7	6.50	2.24	17.75	100.84
91038	Boer	73.8	142.1	68.3	0.81	460.4	6.74	1.72	17.50	100.76
91042	Boer	50.7	107.9	57.3	0.68	307.5	5.37	1.53	16.50	100.76
91037	Boer	63.9	131.1	67.2	0.80	445.2	6.63	2.12	18.00	100.75
91076	Boer	56.2	113.4	57.3	0.68	314.3	5.49	1.65	15.50	100.72
91028	Boer	59.5	116.7	57.3	0.68	333.2	5.82	1.37	15.00	100.61
91033	Boer	58.4	118.9	60.6	0.72	386.2	6.38	1.70	17.00	100.56
91005	Boer	40.7	93.6	52.9	0.63	293.9	5.56	1.44	16.00	100.51
91049	Boer	56.2	106.8	50.7	0.60	276.0	5.45	1.51	14.50	100.45
91044	Boer	63.9	124.4	60.6	0.72	405.9	6.70	2.03	18.00	100.45
91050	Boer	41.9	93.6	51.8	0.62	291.5	5.63	1.39	15.00	100.44
91036	Boer	71.6	130.0	58.4	0.69	379.9	6.51	2.26	18.00	100.42
91020	Boer	55.1	112.3	57.3	0.68	365.7	6.39	2.01	17.50	100.42
91017	Boer	70.5	133.3	62.8	0.75	447.0	7.12	2.04	18.00	100.40
91018	Boer	59.5	115.6	56.2	0.67	355.5	6.33	1.50	14.50	100.39
91030	Boer	100.2	166.3	66.1	0.79	501.9	7.60	2.40	17.50	100.38
91015	Boer	54.0	109.0	55.1	0.66	343.1	6.23	1.62	15.50	100.38
91026	Boer	60.6	120.0	59.5	0.71	404.8	6.81	1.67	16.00	100.37
91019	Boer	61.7	120.0	58.4	0.69	402.6	6.90	1.81	17.25	100.29
91046	Boer	70.5	131.1	60.6	0.72	435.6	7.19	1.65	17.50	100.29
91043	Boer	72.7	128.9	56.2	0.67	378.1	6.73	1.86	17.50	100.25
91022	Boer	56.2	111.2	55.1	0.66	365.2	6.63	1.65	15.00	100.24
91031	Boer	71.6	131.1	59.5	0.71	428.5	7.21	1.56	15.25	100.23
91032	Boer	51.8	102.4	50.7	0.60	309.4	6.11	1.61	15.00	100.23
91048	Boer	49.6	100.2	50.7	0.60	312.6	6.17	1.70	16.00	100.21
91011	Boer	49.6	99.1	49.6	0.59	300.9	6.07	1.31	14.50	100.20
91047	Boer	50.7	95.8	45.2	0.54	253.7	5.62	1.39	15.50	100.17
91013	Boer	51.8	103.5	51.8	0.62	338.9	6.55	1.64	15.00	100.13
91045	Boer	78.2	133.3	55.1	0.66	383.9	6.97	2.52	19.50	100.13
91035	Boer	69.4	121.1	51.8	0.62	348.1	6.73	1.82	17.00	100.07
91023	Boer	65.0	120.0	55.1	0.66	408.1	7.41	1.92	16.50	99.98
91014	Boer	63.9	110.1	46.3	0.55	295.0	6.38	1.86	17.00	99.96
91009	Boer	48.5	96.9	48.5	0.58	327.4	6.76	1.45	15.00	99.92
91016	Boer	61.7	111.2	49.6	0.59	343.5	6.93	1.79	16.50	99.91
91004	Boer	82.6	135.5	52.9	0.63	398.4	7.54	1.77	18.00	99.85
91029	Boer	113.4	175.1	61.7	0.73	559.7	9.08	2.44	19.75	99.70
91003	Boer	88.1	145.4	57.3	0.68	497.0	8.68	2.52	20.00	99.65
91025	Boer	74.9	124.4	49.6	0.59	384.1	7.75	1.67	17.75	99.63
91034	Boer	73.8	120.0	46.3	0.55	340.5	7.36	1.96	18.25	99.63
91027	Boer	78.2	117.8	39.6	0.47	322.9	8.14	1.65	16.50	99.09
91006	Boer	115.6	159.7	44.1	0.52	383.4	8.70	1.93	17.50	99.08
91077	Boer	69.4	107.9	38.5	0.46	310.0	8.04	1.84	17.00	99.07
91012	Boer-X	54.0	89.2	35.2	0.42	282.8	8.03	1.45	15.00	98.94
91024	Boer	49.6	77.1	27.5	0.33	194.4	7.06	1.08	14.00	98.94
91008	Boer	124.4	168.5	44.1	0.52	469.8	10.66	2.66	20.50	98.42
91001	Boer	60.6	89.2	28.6	0.34	284.0	9.92	1.51	15.00	98.03
91007	Boer	98.0	131.1	33.0	0.39	368.6	11.16	2.13	17.25	97.80
91039	Boer	59.5	70.5	11.0	0.13	137.3	12.47	0.96	13.75	96.43

* lbs of feed for one lb. of gain.

Table 2. Bucks sorted by Gain (ADG).

LU ID	Breed	Beg wt (lb)	End wt (lb)	Gain (lb)	ADG (lb/day)	Intake (lb)	FE*	LEA (in^2)	Rear leg (in)	Index
91021	Boer	67.2	144.3	77.1	0.92	443.0	5.75	1.48	15.00	101.47
91040	Boer	47.4	118.9	71.6	0.85	366.8	5.12	1.56	16.50	101.44
91041	Boer	78.2	146.5	68.3	0.81	443.7	6.50	2.24	17.75	100.84
91038	Boer	73.8	142.1	68.3	0.81	460.4	6.74	1.72	17.50	100.76
91002	Boer	55.1	122.2	67.2	0.80	395.2	5.88	1.48	15.00	101.00
91037	Boer	63.9	131.1	67.2	0.80	445.2	6.63	2.12	18.00	100.75
91030	Boer	100.2	166.3	66.1	0.79	501.9	7.60	2.40	17.50	100.38
91017	Boer	70.5	133.3	62.8	0.75	447.0	7.12	2.04	18.00	100.40
91029	Boer	113.4	175.1	61.7	0.73	559.7	9.08	2.44	19.75	99.70
91033	Boer	58.4	118.9	60.6	0.72	386.2	6.38	1.70	17.00	100.56
91044	Boer	63.9	124.4	60.6	0.72	405.9	6.70	2.03	18.00	100.45
91046	Boer	70.5	131.1	60.6	0.72	435.6	7.19	1.65	17.50	100.29
91026	Boer	60.6	120.0	59.5	0.71	404.8	6.81	1.67	16.00	100.37
91031	Boer	71.6	131.1	59.5	0.71	428.5	7.21	1.56	15.25	100.23
91036	Boer	71.6	130.0	58.4	0.69	379.9	6.51	2.26	18.00	100.42
91019	Boer	61.7	120.0	58.4	0.69	402.6	6.90	1.81	17.25	100.29
91042	Boer	50.7	107.9	57.3	0.68	307.5	5.37	1.53	16.50	100.76
91076	Boer	56.2	113.4	57.3	0.68	314.3	5.49	1.65	15.50	100.72
91028	Boer	59.5	116.7	57.3	0.68	333.2	5.82	1.37	15.00	100.61
91020	Boer	55.1	112.3	57.3	0.68	365.7	6.39	2.01	17.50	100.42
91003	Boer	88.1	145.4	57.3	0.68	497.0	8.68	2.52	20.00	99.65
91018	Boer	59.5	115.6	56.2	0.67	355.5	6.33	1.50	14.50	100.39
91043	Boer	72.7	128.9	56.2	0.67	378.1	6.73	1.86	17.50	100.25
91015	Boer	54.0	109.0	55.1	0.66	343.1	6.23	1.62	15.50	100.38
91022	Boer	56.2	111.2	55.1	0.66	365.2	6.63	1.65	15.00	100.24
91045	Boer	78.2	133.3	55.1	0.66	383.9	6.97	2.52	19.50	100.13
91023	Boer	65.0	120.0	55.1	0.66	408.1	7.41	1.92	16.50	99.98
91005	Boer	40.7	93.6	52.9	0.63	293.9	5.56	1.44	16.00	100.51
91004	Boer	82.6	135.5	52.9	0.63	398.4	7.54	1.77	18.00	99.85
91050	Boer	41.9	93.6	51.8	0.62	291.5	5.63	1.39	15.00	100.44
91013	Boer	51.8	103.5	51.8	0.62	338.9	6.55	1.64	15.00	100.13
91035	Boer	69.4	121.1	51.8	0.62	348.1	6.73	1.82	17.00	100.07
91049	Boer	56.2	106.8	50.7	0.60	276.0	5.45	1.51	14.50	100.45
91032	Boer	51.8	102.4	50.7	0.60	309.4	6.11	1.61	15.00	100.23
91048	Boer	49.6	100.2	50.7	0.60	312.6	6.17	1.70	16.00	100.21
91011	Boer	49.6	99.1	49.6	0.59	300.9	6.07	1.31	14.50	100.20
91016	Boer	61.7	111.2	49.6	0.59	343.5	6.93	1.79	16.50	99.91
91025	Boer	74.9	124.4	49.6	0.59	384.1	7.75	1.67	17.75	99.63
91009	Boer	48.5	96.9	48.5	0.58	327.4	6.76	1.45	15.00	99.92
91014	Boer	63.9	110.1	46.3	0.55	295.0	6.38	1.86	17.00	99.96
91034	Boer	73.8	120.0	46.3	0.55	340.5	7.36	1.96	18.25	99.63
91047	Boer	50.7	95.8	45.2	0.54	253.7	5.62	1.39	15.50	100.17
91006	Boer	115.6	159.7	44.1	0.52	383.4	8.70	1.93	17.50	99.08
91008	Boer	124.4	168.5	44.1	0.52	469.8	10.66	2.66	20.50	98.42
91027	Boer	78.2	117.8	39.6	0.47	322.9	8.14	1.65	16.50	99.09
91077	Boer	69.4	107.9	38.5	0.46	310.0	8.04	1.84	17.00	99.07
91012	Boer-X	54.0	89.2	35.2	0.42	282.8	8.03	1.45	15.00	98.94
91007	Boer	98.0	131.1	33.0	0.39	368.6	11.16	2.13	17.25	97.80
91001	Boer	60.6	89.2	28.6	0.34	284.0	9.92	1.51	15.00	98.03
91024	Boer	49.6	77.1	27.5	0.33	194.4	7.06	1.08	14.00	98.94
91039	Boer	59.5	70.5	11.0	0.13	137.3	12.47	0.96	13.75	96.43

* lbs of feed for one lb. of gain.

Table 3. Bucks sorted by Feed Efficiency.

LU ID	Breed	Beg wt (lb)	End wt (lb)	Gain (lb)	ADG (lb/day)	Intake (lb)	FE*	LEA (in^2)	Rear leg (in)	Index
91040	Boer	47.4	118.9	71.6	0.85	366.8	5.12	1.56	16.50	101.44
91042	Boer	50.7	107.9	57.3	0.68	307.5	5.37	1.53	16.50	100.76
91049	Boer	56.2	106.8	50.7	0.60	276.0	5.45	1.51	14.50	100.45
91076	Boer	56.2	113.4	57.3	0.68	314.3	5.49	1.65	15.50	100.72
91005	Boer	40.7	93.6	52.9	0.63	293.9	5.56	1.44	16.00	100.51
91047	Boer	50.7	95.8	45.2	0.54	253.7	5.62	1.39	15.50	100.17
91050	Boer	41.9	93.6	51.8	0.62	291.5	5.63	1.39	15.00	100.44
91021	Boer	67.2	144.3	77.1	0.92	443.0	5.75	1.48	15.00	101.47
91028	Boer	59.5	116.7	57.3	0.68	333.2	5.82	1.37	15.00	100.61
91002	Boer	55.1	122.2	67.2	0.80	395.2	5.88	1.48	15.00	101.00
91011	Boer	49.6	99.1	49.6	0.59	300.9	6.07	1.31	14.50	100.20
91032	Boer	51.8	102.4	50.7	0.60	309.4	6.11	1.61	15.00	100.23
91048	Boer	49.6	100.2	50.7	0.60	312.6	6.17	1.70	16.00	100.21
91015	Boer	54.0	109.0	55.1	0.66	343.1	6.23	1.62	15.50	100.38
91018	Boer	59.5	115.6	56.2	0.67	355.5	6.33	1.50	14.50	100.39
91033	Boer	58.4	118.9	60.6	0.72	386.2	6.38	1.70	17.00	100.56
91014	Boer	63.9	110.1	46.3	0.55	295.0	6.38	1.86	17.00	99.96
91020	Boer	55.1	112.3	57.3	0.68	365.7	6.39	2.01	17.50	100.42
91041	Boer	78.2	146.5	68.3	0.81	443.7	6.50	2.24	17.75	100.84
91036	Boer	71.6	130.0	58.4	0.69	379.9	6.51	2.26	18.00	100.42
91013	Boer	51.8	103.5	51.8	0.62	338.9	6.55	1.64	15.00	100.13
91037	Boer	63.9	131.1	67.2	0.80	445.2	6.63	2.12	18.00	100.75
91022	Boer	56.2	111.2	55.1	0.66	365.2	6.63	1.65	15.00	100.24
91044	Boer	63.9	124.4	60.6	0.72	405.9	6.70	2.03	18.00	100.45
91035	Boer	69.4	121.1	51.8	0.62	348.1	6.73	1.82	17.00	100.07
91043	Boer	72.7	128.9	56.2	0.67	378.1	6.73	1.86	17.50	100.25
91038	Boer	73.8	142.1	68.3	0.81	460.4	6.74	1.72	17.50	100.76
91009	Boer	48.5	96.9	48.5	0.58	327.4	6.76	1.45	15.00	99.92
91026	Boer	60.6	120.0	59.5	0.71	404.8	6.81	1.67	16.00	100.37
91019	Boer	61.7	120.0	58.4	0.69	402.6	6.90	1.81	17.25	100.29
91016	Boer	61.7	111.2	49.6	0.59	343.5	6.93	1.79	16.50	99.91
91045	Boer	78.2	133.3	55.1	0.66	383.9	6.97	2.52	19.50	100.13
91024	Boer	49.6	77.1	27.5	0.33	194.4	7.06	1.08	14.00	98.94
91017	Boer	70.5	133.3	62.8	0.75	447.0	7.12	2.04	18.00	100.40
91046	Boer	70.5	131.1	60.6	0.72	435.6	7.19	1.65	17.50	100.29
91031	Boer	71.6	131.1	59.5	0.71	428.5	7.21	1.56	15.25	100.23
91034	Boer	73.8	120.0	46.3	0.55	340.5	7.36	1.96	18.25	99.63
91023	Boer	65.0	120.0	55.1	0.66	408.1	7.41	1.92	16.50	99.98
91004	Boer	82.6	135.5	52.9	0.63	398.4	7.54	1.77	18.00	99.85
91030	Boer	100.2	166.3	66.1	0.79	501.9	7.60	2.40	17.50	100.38
91025	Boer	74.9	124.4	49.6	0.59	384.1	7.75	1.67	17.75	99.63
91012	Boer-X	54.0	89.2	35.2	0.42	282.8	8.03	1.45	15.00	98.94
91077	Boer	69.4	107.9	38.5	0.46	310.0	8.04	1.84	17.00	99.07
91027	Boer	78.2	117.8	39.6	0.47	322.9	8.14	1.65	16.50	99.09
91003	Boer	88.1	145.4	57.3	0.68	497.0	8.68	2.52	20.00	99.65
91006	Boer	115.6	159.7	44.1	0.52	383.4	8.70	1.93	17.50	99.08
91029	Boer	113.4	175.1	61.7	0.73	559.7	9.08	2.44	19.75	99.70
91001	Boer	60.6	89.2	28.6	0.34	284.0	9.92	1.51	15.00	98.03
91008	Boer	124.4	168.5	44.1	0.52	469.8	10.66	2.66	20.50	98.42
91007	Boer	98.0	131.1	33.0	0.39	368.6	11.16	2.13	17.25	97.80
91039	Boer	59.5	70.5	11.0	0.13	137.3	12.47	0.96	13.75	96.43

* lb of feed for one lb of gain.

The proper citation for this article is:

Gipson, T. 2004. Extension Overview. Pages 108-122 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

International Projects

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

Support: USAID Middle East Regional Cooperation Program

Collaborator:

Egypt	Desert Research Center and Animal Production Research Institute, Cairo
Israel	Volcani Center, Bet Dagan
Palestinian National Authority	Al-Quds University, East Jerusalem
Jordan	Jordan University of Science and Technology, Irbid

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: **Improving Ethiopian Household Food Security and Enhancing the Teaching, Research and Extension Ability of Awassa College of Agriculture, Debub University, Ethiopia**

Support: UNCFSP- USAID International Development Partnership Activity

Collaborator: Fort Valley State University, Fort Valley, GA (lead institution)
Awassa College of Agriculture of Debub University, Awassa, Ethiopia

Objectives: Provide training to ACA staff in research methodology, parasitology, animal breeding, semen collection and freezing and artificial insemination

Transport Boer goat semen to ACA for a crossbreeding program

Strengthen ACA's current extension program and expand its impact on village goat production through formation of new women's groups for goat production and providing more training to existing women's groups

Increase Langston University and GIGR's involvement in and impact on international development

Title: **Improving Ethiopian Household Food Security and Enhancing the Teaching, Research and Extension Ability of Alemaya University, Alemaya, Ethiopia**

Support: ALO- USAID Partnering with Higher Education for International Development

Collaborator: Oklahoma State University, Stillwater, OK
Alemaya University, Dire Dawa, Ethiopia

Objectives: Provide training to AU staff in research methodology, parasitology, animal breeding, semen collection and freezing and artificial insemination

Transport Boer goat semen to AU for a crossbreeding program

Strengthen AU's current extension program and expand its impact on village goat production through formation of new women's groups for goat production and providing more training to existing women's groups

Increase Langston University and GIGR's involvement in and impact on international development

Title: **Combating Micronutrient Malnutrition: Assessment of Constraints to Including Animal Source Foods in Children's Diets in Rural Ethiopia and Kenya**

Support: Global Livestock Collaborative Research Support Program

Collaborator: Oklahoma State University, Stillwater, OK (lead institution)
University of California at Los Angeles, Los Angeles, CA
Debub University, Awassa, Ethiopia
University of Nairobi, Nairobi, Kenya

Objectives: Address issues relating to use of ASF in children's diets

Evaluation of past projects

Identify potential solutions and create a proposal to test those solutions

Build an Ethiopian/Kenyan regional team for problem solving by linking food production and use with income generation, food security and family health

Title: **Al-Sharaka, The Partnership**

Support: United States Agency for International Development

Collaborator: U.S.A. University of Oklahoma, Norman, OK (lead institution)
Oklahoma State University, Stillwater, OK
Cameron University, Lawton, OK

Iraq Al Anbar University, Ramadi City
Babylon University, Hilla City
Basrah University, Basrah
Salahaddin University, Arbil
University of Technology, Baghdad

Purpose: Assist in modernizing and revitalizing Iraqi institutions of higher education

Langston University Specific Activities:

Provide training to Iraqi university scientists to enhance and upgrade knowledge and techniques of small ruminant research and production

Provide equipment and expertise to establish a ruminant nutrition feedstuff analytical laboratory

The proper citation for this article is:

Merkel, R. 2004. International Projects. Pages 123-125 in Proc. 19th Ann. Goat Field Day, Langston University, Langston, OK.

Research Overview

There has been and is a wide array of research areas addressed by our program. All major types of goats produced in the US are considered, i.e., ones raised for meat, milk, and(or) fiber, both cashmere and mohair. The increasing demand for goat meat and decline in the mohair industry in recent years have resulted in an expansion of research topics with meat goats, but because the future is unknown, all goat industries will continue to receive attention. The Institute has and will in the future conduct research to increase levels and efficiencies of goat production, enhance utilization of goat products, and improve use of goats for specific purposes such as vegetation management. There is intent to increase economic returns to those raising goats or processing their products, as well as providing other benefits such as enhanced sustainability of livestock production systems.

A large proportion of the Institute's research program is made possible by grants, many of which are through USDA programs. Although dissemination of information generated from all of these projects occurs, some entail strong extension components. Likewise, there are projects listed in our international section that entail significant research components.

To provide an idea about our research program since the last Field Day, listed below are research projects and experiments we have been involved with in 2003 and 2004, abstracts for 2004, and summaries of scientific articles that were published in 2003 or will appear in 2004 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:

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