WELCOME

This year is our silver anniversary of the Goat Field Day. The Institute has come a long way since its establishment in 1984 and we couldn't have done it without your support. The first Goat Field Day was the first year following the establishment of the Institute and we are very proud today to have members of that historic event with us to celebrate. Many of you know Dr Frank Pinkerton and maybe even some of you have been to previous Goat Field Days and heard him speak. For those of you who have not had the opportunity to hear Dr. Pinkerton, you are in for a real treat. I know that you will enjoy the day.

Again, we deeply appreciate your attendance at this historic 25th Annual Goat Field Day of the E (Kika) de la Garza American Institute for Goat Research of Langston University. The Field Day is one of the most important things we do each year. The primary purpose of the Field Day is for education and extension in areas of greatest interest to clientele of the Institute. Thus, please share your thoughts with us on today's activities and suggestions for the Field Day next year. In addition to extension and education, the Field Day provides an excellent opportunity for the staff of the Institute to meet other people that work with goats. Such interaction helps make our program the most appropriate it can be for the people it serves. The proceedings of the Field Day is a very useful tool for the Institute beyond impact realized from the program today. First, there are reports on Field Day presentations. After this information, there are highlights of research, extension, and international activities of the Institute in the past year. This section is an aid to assess our recent progress, display current activities, and contemplate future directions to be followed. This year's general theme is "Bridging the Future and the Past". Here is the exciting program planned for today that has developed from your input.

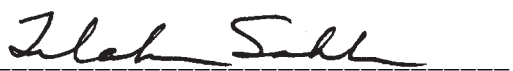
The morning program consists of:

- **From Whence We Have Come, From Whence We Are Going** *Dr. Frank Pinkerton*

The afternoon workshops are:

- **Frankly Speaking** *Dr. Frank Pinkerton*
- **Basic Goat Husbandry** *Mr. Jerry Hayes*
- **Basic Herd Health** *Dr. Lionel Dawson*
- **Nutrition for Health and Production** *Dr. Steve Hart*
- **Internal Parasite Control** *Dr. Steve Hart*
- **Goat Reproduction** *Dr. Dave Sparks*
- **Goat Farm Budgeting** *Mr. Roger Sahs*
- **Cheese-making Overview** *Mr. Neville McNaughton*
- **Pack Goats** *Mr. Dwite Sharp*
- **Mortality Composting** *Dr. Roger Merkel*
- **DHI Training** *Ms. Eva Vasquez*
- **USDA Government Programs** *Mr. Dwight Guy*
- **Fun Tent** *Ms. Sheila Stevenson*

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

Table of Contents

Goat Industry Update: Statistics, Trends, and Commentary

Dr. Frank Pinkerton[1] and Dr. Ken McMillin[2]
[1]Langston University (retired)
[2]Louisiana State University AgCenter

Part One

Preface

Because of the staggered schedule of release of USDA 'goat figures' for 1 January 2009, we necessarily show only census data in the March issue. In the May issue we will report domestic slaughter and import numbers plus certain observations on trends and possible future developments in our industry.

Introduction

This bi-partite Update follows the format of earlier years and, as always, provides the latest USDA statistics and trends; certain portions of the Update are unavoidably repetitious. We can supply you with email copies should you like to reproduce them for distribution to visitors needing goat information for decision-making or to prospective customers for your breeding stock.

Trends in Goat Supply

Figure 1 shows trends in total goat numbers, meat goats, Angora goats, and milk goats in the U.S., 2002/2009. The 2009 figure for *total* goats is 3,070,000 head, a decline of 48,000 (2%) from 2008. Total Angora goat numbers fell to 185,000—a decline of 10%; this trend is likely to continue. However, total dairy goat numbers increased by 4% to 335,000 over 2008. (Much of this increase occurred in Wisconsin and Iowa and, to a lesser extent, in Pennsylvania, New York, North Carolina, Kentucky, Oregon, and California; all have some quantity of commercial-scale or farmstead goat-cheese production)

Table l shows all meat and other goats for 1 January, 2009 and 2008 and documents the 2% decline (40,000) from 2,590,000 to 2,550,000 head in 2009 ('other goats' refers to any animal that is not a classifiable as a meat or dairy or Angora goat). We call special attention to the 5% decline in numbers of replacement kids (21,000) from '08 to '09 and suggest that this figure may reflect reduced owner-confidence regarding positive cost-benefit ratios to be realized in CY '09. Alternatively, it could reflect, in some measure, an unusual year-end 'sell-off' due to unfavorable prospective forage availability or prices.

We feel the 2% decline in national doe numbers (25,000) was due to sell-offs, primarily because of reduced forage availability for grazing and haying in areas of sharply reduced rainfall (Texas, Alabama, Kentucky, Colorado, and elsewhere); contrarily, other states had relatively large increases in numbers (Tennessee, Ohio, Minnesota, Kansas, Indiana, California). The 1% increase in 'market goats and kids' may have been due to limited year-end marketings (for whatever reasons: inclement weather or perhaps expectations of higher winter prices?).

Figure 2, Meat Goat Numbers, shows meat goat inventories by state as of 1 January, 2009. State rankings, 1-15 in declining order, are: Texas, Tennessee, Oklahoma, California, Missouri, North Carolina, Georgia, Kentucky, Alabama, Virginia, Ohio, Florida, Kansas, Arizona, and Pennsylvania.

Figure 3, Percent Change 2008 to 2009, shows the percentage change in inventory numbers. Looking at the 15 states with the most goats (over 40,000 head) on 1 January, 2009, 9 posted gains, 5 posted losses, and 1 remained the same. The Texas decline was not unexpected by industry players/observers…too little

water, too many predators, competing deer leases, etc. The Tennessee increase must have reflected improved numbers from those areas not affected by the mid-state drought that caused substantial reductions toward the end of the year. Oklahoma, Missouri, and Georgia made little or no gain, while Alabama and Kentucky reported substantial losses (more than 7%). Contrarily, California, Virginia, Ohio, Florida, and Kansas had appreciable increases (more than 6%). An overall loss of 1.5% seems not so bad given all the weather problems across the nation.

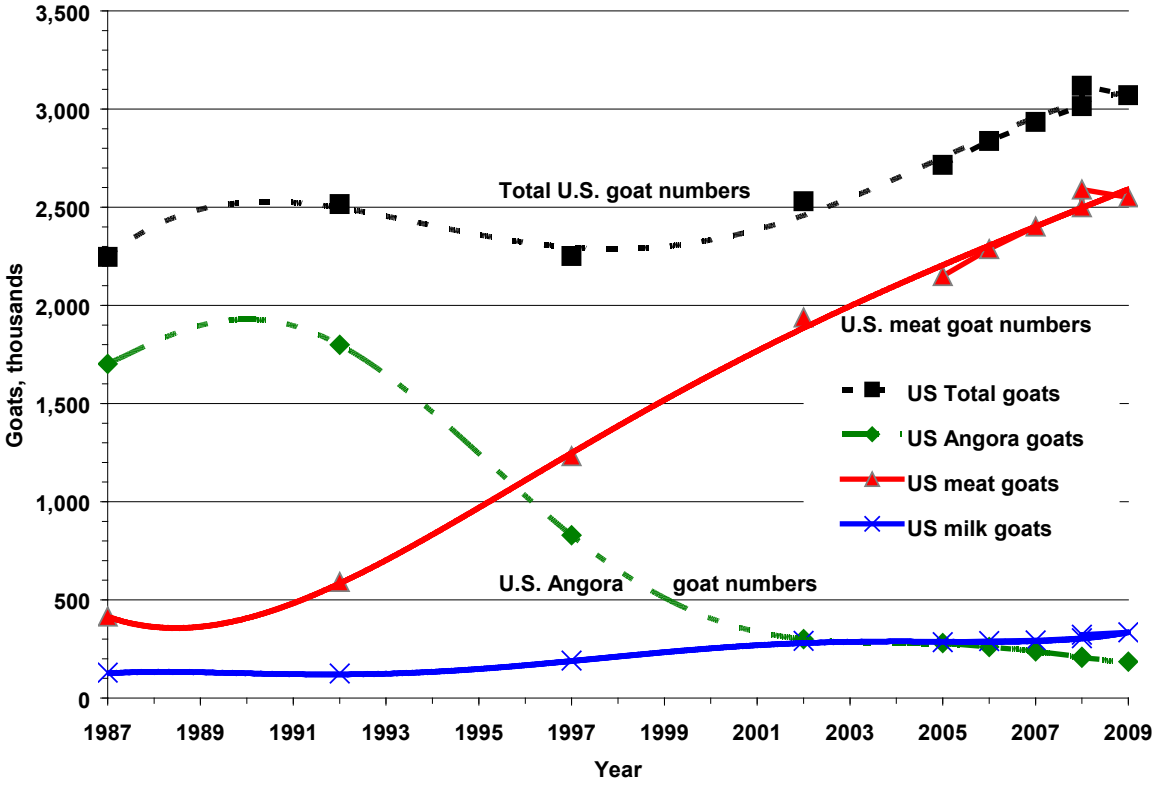


Figure 1. Trends in total goat numbers, meat goats, Angora goats, and milk goats in the U.S.

Table 1. Meat and other goats in the U.S. by class for January 1, 2008 and 2009 (National Agriculture Statistics Service February Sheep and Goat Inventory Report, 2009).

Class	2008	2009	2009 as % of 2008
	head	head	%
All meat and other goats	2,590,000	2,550,000	98
Breeding meat and other goats	2,120,000	2,074,000	98
Replacement kid goats under one year	391,000	370,000	95
Does one year and older	1,575,000	1,550,000	98
Bucks one year and older	154,000	154,000	100
Meat and other market goats and kids	470,000	476,000	101
Kid crop (born the previous year)	1,662,000	1,627,000	98

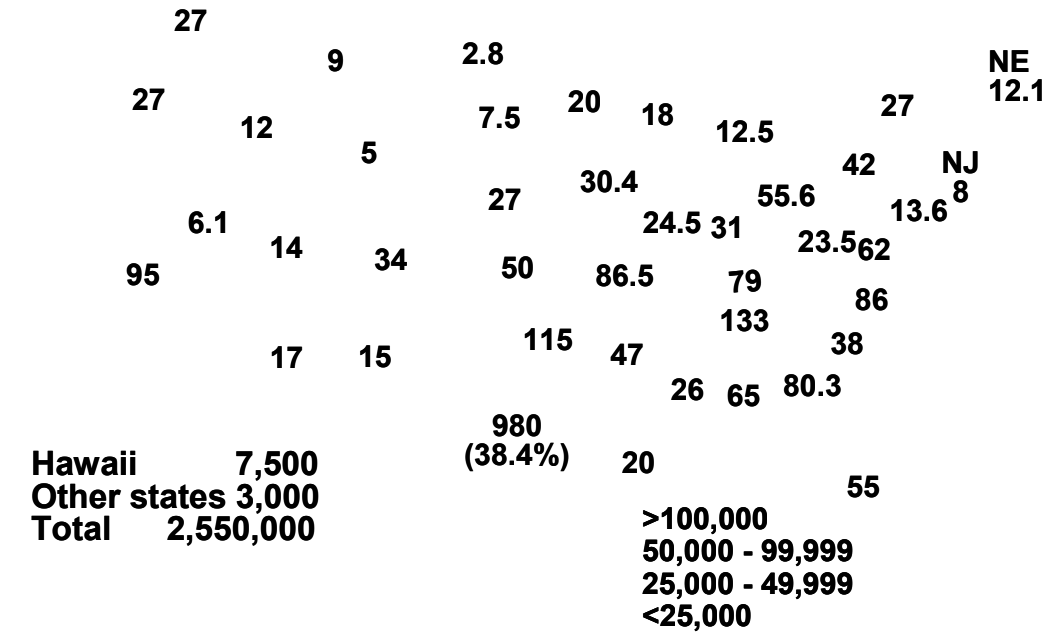


Figure 2. Numbers of meat and other goats by state (NASS, 2009).

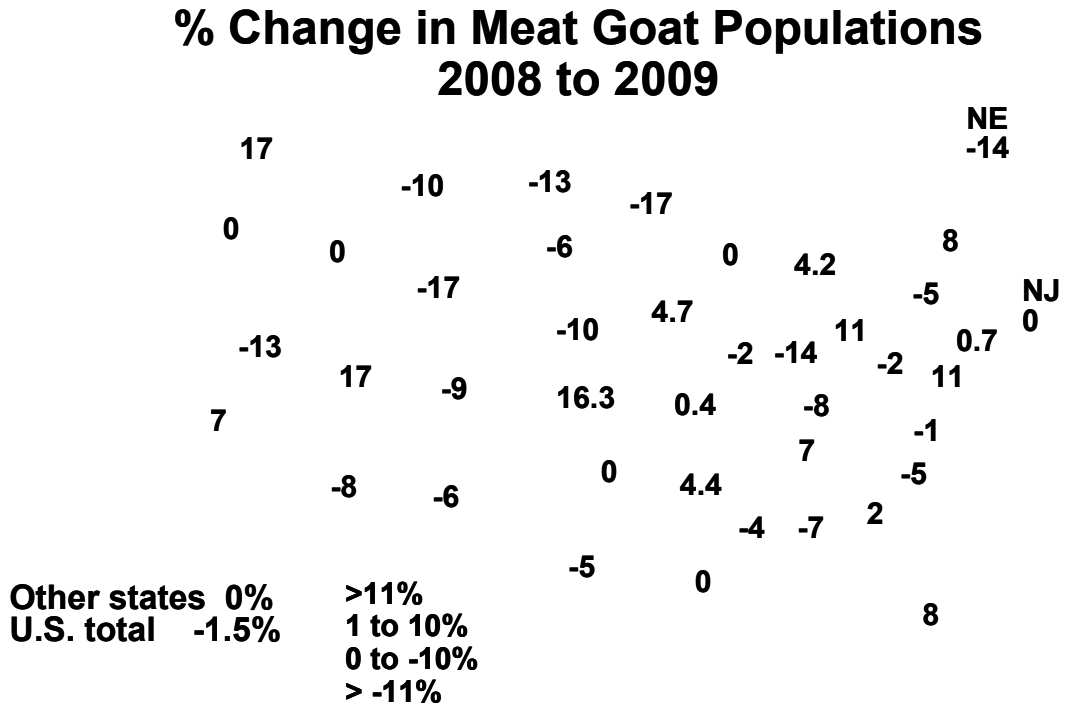


Figure 3. Percentage changes in meat and other goats by state (NASS, 2009).

Part Two

Introduction

Part one of the 2009 Industry Update was published in the March '09 issue of Goat Rancher; it presented certain data on national and state goat inventories and trends. *In part two*, we report additional information concerning domestic slaughter numbers and imported goat meat, as well as supplemental commentary on trends and issues.

Historically, meat goats are produced primarily in Texas and the Southeast with increasing production in the 'lake' states and the Midwest, while major consumption is in the urban northeastern and west coastal areas. Table 1 indicates that major slaughter states (New Jersey, Delaware/Maryland, Pennsylvania, and New York) supply the urban corridor from Washington, DC to Philadelphia to New York City to Boston (about 362,000 head in 2008).

Insofar as we know, slaughter numbers in the other states are consumed 'locally'; however, we are told by industry players that there is some movement of Tennessee-origin carcasses to Illinois and possibly to Ohio and Michigan. Similarly, we understand that a portion of Indiana carcasses go to the Detroit market, and also that some portion of the North Carolina kill goes north, most probably to Washington, DC/Baltimore.

Goat Meat Supply

As shown in Figure 1, the long-term trend in domestic slaughter goat numbers continues upward with rare interruption. Combined federal and state figures totaled about 860,000 head in 2008. But, the informal, unreported kill is thought by industry observers to be quite large—possibly 10-20% of 'available animals' from a January '08 meat goat inventory of 2,500,000, head plus offspring; it is, in any case, simply an unknowable figure, to anyone.

The number of 34 lb carcass equivalents imported from Australia in 2008, about 700,000, reflected a bit of a 'recovery' from 2007 when the '100 year' drought had caused a 'forced sell-off of slaughter and breeding stock in 2006, followed by a drop in slaughter numbers available in 2007. On the other hand, since the drought is said to be continuing, perhaps the 'recovery' seen in 2008 slaughter numbers is evidence of yet another forced sell-off. Thus, prospective import numbers in 2009 are unpredictable.

Figure 2 tracks domestic slaughter of goats across months in 2007 and 2008. While the overall pattern is similar between the two years, there are discernible differences between them. We suggest that the bad droughts in Texas and parts of the Southeast caused increased total sales/slaughter of goats, beginning in July '08 and rising to an early high in September rather the usual October high. The lower sales and slaughter numbers for October and November '08 probably reflect reduced numbers of goats available following the unusual September run.

Note that the federal and state slaughter figures exhibited the same monthly pattern each year. We speculate that the abnormally sharp increase in December '08 numbers over December '07 was due to producers holding kids off the market in November in anticipation of higher-priced sales in December for the Christmas market and for December Muslim holidays (Qurabani).

Figure 3 documents the average weights of goat slaughtered across months of the year at both federal and state packing plants. Note that the average shrunk body weight of goats killed at federal plants is rather similar across the year (add at least 5% to estimate farm weight). The slightly heavier figures, October/January, are thought due to increased numbers of older goats, primarily does that are being culled for whatever reasons. The lower March-to-June weights probably reflect a higher percentage of fall and winter-born slaughter kids coming on-market.

The kill weights at state-inspected packing plants are much more variable and considerably higher than at federal plants, although the January/August patterns are fairly similar across years. Contrarily, the fall '08 figures are grossly different from those of '07. We feel this difference again reflects the drought-induced sell-off of larger does by owners not wanting to buy hay and supplements in the face of uncertainties as to future kid demand, supply, and price/lb. Too, state-inspected plants are disproportionately located in Texas and other such 'inland' plants, and their typical throughput is thought to include a higher percentage of older, heavier goats.

Figure 4 detailing the arrival of imported goat meat in '08 at the 'big four' POE is not appreciably different from '07 although POE-Miami did post a substantial gain, possibly because the nearby POE-Savannah imported somewhat fewer carcasses than previously. On the other hand, southern FL consumes a very high percentage of imported goat meat as compared to domestic goat meat (much of the latter is consumed near the mid- and up-state packers) or shipped to Atlanta or, on occasion, to the NYC metro area…reliable figures are scarce (from this area as in others…dead-goat trails are ever faint).

Do note the 'flattening' of imports into POE at Philadelphia, San Francisco, Los Angeles, Houston and San Juan, PR in '08. We feel this pattern reflects a lack of supply rather than a drop in demand.

Goat Meat Demand

The aggregate demand for domestically produced and/or imported goat meat via commercial channels is *simply unknown*—to us, to the channel players we talk to, and apparently to the USDA units that monitor goat inventory, slaughter, and imports. We have come to feel over the years that both consumption levels and retail prices paid are supply-driven, not demand-driven. Put differently, we have concluded that the combined supply of goat meat is, by some unknown measure, less than the demand for goat meat.

We suggest that the recurring higher retail prices paid by consumers, December to April, are a response to a recurring scarcity of supply. This ethnic consumer 'competition' translates to live-goat markets and accounts for the 25-30% higher prices paid producers for slaughter goats during the winter.

A second *unknown* to us is the probable 'ceiling price' of retail goat meat, that is, the price at which substantial numbers of consumers would opt-out of the market and pursue alternate specie meats—or mac-and-cheese, or its ethnic equivalent. This unknown, but not less real, price ceiling would be dependent on the prevailing 'economic status' of a given family and, as always, cultural-driven priority among choices (religious or patriotic or 'family' concerns). Given the present, and short-term, economic outlook, rising unemployment, escalating consumer prices, atmosphere of uncertainty, whatever, such a ceiling might be lower than one would like to think.

Consumer Prices for Goat Meat

Insofar as we know, there are no reporting mechanisms in urban areas to track retail prices of goat meat across time and place. We only *know* what live goats sell for in the major markets, and we can *estimate* the hauling charges and shrinkage costs to the packer. Beyond that, we know zip. The Big Three packers in New Jersey are, like other in the business elsewhere, extremely reticent about their processing costs and their mark-ups. We are told that ethnic neighborhood retailers continue to add 30% or so to their wholesale/packer costs to calculate consumer prices/lb for whole carcasses.

Retailers also charge more/lb when they sell half-carcasses, still more when they sell quarters and yet more for 'cuts' on request. Market players suggest that retail goat meat typically sells lowest in Texas, somewhat higher in Georgia and Tennessee, still higher in the Chicago metro area, and highest in the northeastern seaboard metro areas. Part of these price differentials are due to transportation/shrinkage costs, part to variable processing costs, and part to area-specific patterns of demand across time.

We know that the dockside prices shown in table 2 provide a 'base-cost' to importers who then add off-load, storage, distribution costs and mark-up as the product moves to wholesalers and retailers. Note that the average dockside price for frozen, imported meat in 2008, $1.51, was considerably lower than fresh-chilled domestic meat equivalent. Think here of a slaughter goat selling for, $1.25/lb in San Angelo…if he dressed a chilled carcass weight of, say, 47%, the carcass 'costs' $2.66/lb (1.25/.47) plus hauling and processing charges/lb…perhaps $3.80/lb wholesale, or $4.94/lb retail (adding 30% x 3.80). Accordingly, imported meat at retail 'should' be—and usually is—lower, all things considered, but, always with exceptions, of course.

Implications

Editor Hankins, various contributors to Goat Rancher, and other players have noted over the past year or so certain changes, small or large, in the meat goat industry regarding producer interest levels and enterprise tenacity. Some producers have elected to bail, some have reduced numbers, and some have, or intend to change enterprise focus and objectives to encourage continuation. On the other hand, there have been new herds established, or expanded, across a number of states.

One of the possible outcomes of this shuffle could be a reduction in numbers of smaller, hobby-like herds, but in concert with a corollary increase in larger, more 'commercial-oriented' herds with aggregate numbers rising in pursuit of the demand identified above. I suspect there may well be a modest decline in (high) dollar-driven breeder Show competition activities for a while, but I don't expect to see an appreciable drop in meat goat Youth Show participation. I do expect to see increased emphasis on on-farm sales, directly or indirectly, to consumers interested in product and relations building of sorts.

Inquiries to my Q/A column tend to cluster with reductions in costs associated with doe maintenance, with improving output per doe, and with better marketing strategies. I take this to mean that 'hanging-in' is their intention, that better cost-benefit ratios are their objective, and that they do expect to 'ride-out' this current difficulty. While some might think this a triumph of hope over reality, I don't…not really… because there is room for serious improvement in most herd management schemes and also for better marketing strategies, including more winter sales.

Moreover, I continue to receive regular requests from 'wannabes' and 'newbies', some of whom are, admittedly, more eager than informed. Still others, although ignorant, are not stupid, and are pursuing possibilities in an understandably cautious, but reasonable manner. I send certain of my Rancher pieces to all inquirers, suggest they subscribe, and make them aware of the pressing need to take to the road to see, to talk, and, if possible, to get some practical, hands-on counseling. (And, yes, I do know all about disastrous 'blind-leading-the-blind' opportunities, but...seekers frequently uncover useful information, too, including money-saving early-exit strategies, gracias a Dios).

Caveat: readers thinking of expanding enterprise output to meet the apparent under-supply of goat meat described above are urged to first get an *accurate* accounting of their present cost of producing slaughter kids and, secondly, to assess the alternatives for increasing gross income per current doe, and, only thereafter, to consider adding *more* does (as well as the required corollary resources). But, then, perhaps I am just being inordinately pessimistic, possibly due to the miserably poor recent performance by the betting slips held in my TAMU Optional Retirement Account. Also, my dab in Edward Jones Investments is now a half-a-dab…a sort of a replay of my earlier action in the Boer table-stakes game. I was not amused, then or now….

One last observation; there is currently renewed interest in the Spanish goat breed from many callers. This comes, I suspect, mostly from those smallholders primarily interested in 'conservancy of the breed' opportunities/obligations. Their numerous inquiries (some to rancher friends of mine and long-term breeders of such goats) typically solicit prices/availabilities for 1 buck and 5-10 does per inquirer and are, I think,

indicative of such interest. If this is true, this development should probably be considered as a 'mini-boom', not to be ignored certainly, but to be recognized for what it apparently is).

On the other hand, the newly constituted Spanish Goat Breed Organization and I, and others, see heightened interest in Spanish goats as a prospective, valuable contributor to commercial meat goat production, not least via crossbreeding programs, for improving saleable off-take and gross income/enterprise. I do remind, however, that the available data on percent boneless meat yield of Spanish goat carcasses, when compared to that from other 'breeds and crossbreds', is not yet conclusive. We have considerable data in this regard urge caution about any such claims.

Table 1. Top states in federal goat slaughter numbers, 2006-2008*

State	2006	2007	2008
New Jersey	216,078	237,562	240,912
Delaware-Maryland	37,995	53,736	52,815
Pennsylvania	31,927	30,991	41,881
Texas	32,856	39,091	41,233
Illinois	36,152	41,602	40,968
California	25,084	32,396	36,135
Georgia	31,886	30,527	32,141
Florida	19,145	22,081	26,666
New York	38,653	29,051	26,339
Tennessee	27,161	26,832	26,172
New England**	19,623	21,713	23,564
North Carolina	14,444	17,458	18,949
Other states	53,117	56,335	62,934
U.S. total federal slaughter	584,121	639,395	670,709

*No other state had slaughter of more than 10,000 head in 2008, but data was not released for states with only 1 federal slaughter plant.

** includes Connecticut, Rhode Island, Maine, Massachusetts, New Hampshire, and Vermont.

Table 2. Custom values in $ per pound declared for imported goat meat as the average, lowest, and highest values for all ports in each year.

Year	Average $ value/ pound	Lowest declared $ value/pound	Highest declared $ value per pound	Range in declared values, $
1998	$1.10	$0.99	$1.33	$0.34
1999	$1.08	$0.81	$1.54	$0.73
2000	$1.12	$0.96	$1.45	$0.49
2001	$1.04	$0.85	$1.43	$0.58
2002	$1.03	$0.78	$1.11	$0.33
2003	$1.17	$0.90	$1.63	$0.73
2004	$1.35	$1.28	$1.55	$0.27
2005	$1.58	$1.37	$1.74	$0.37
2006	$1.68	$1.01	$2.33	$1.32
2007	$1.64	$1.17	$2.07	$0.90
2008	$1.51	$1.02	$2.17	$1.15

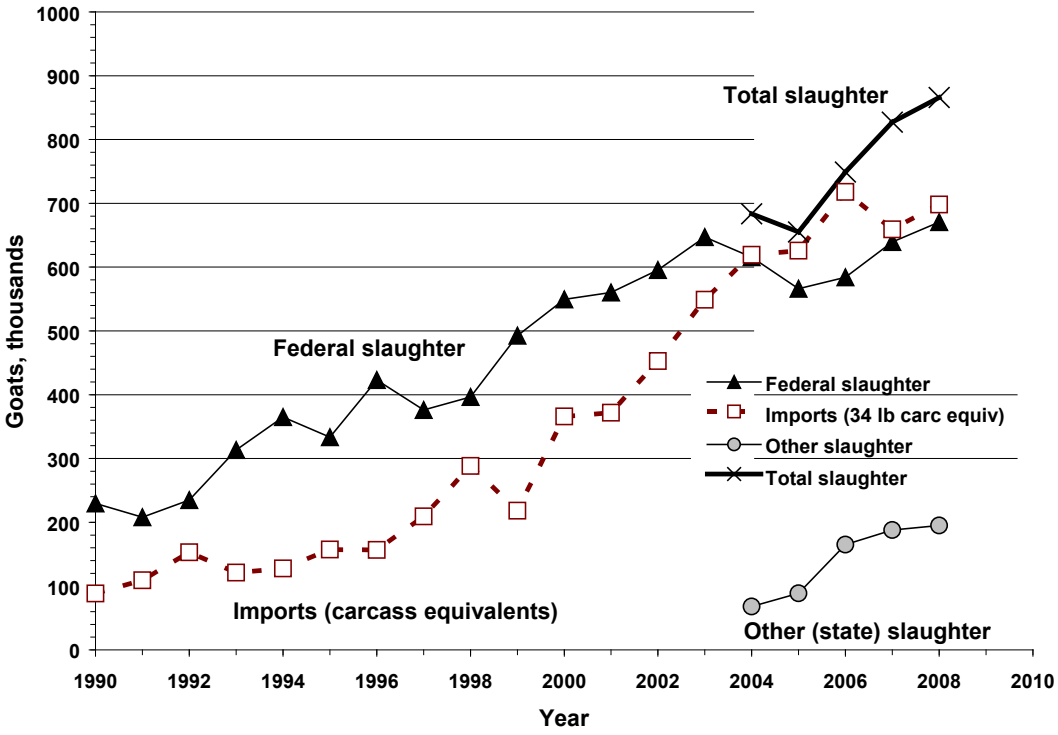


Figure 1. Trends in U.S. federal goat slaughter, other (state) goat slaughter, total slaughter (federal + other), and frozen imported goat meat on a 34-pound carcass weight equivalent basis.

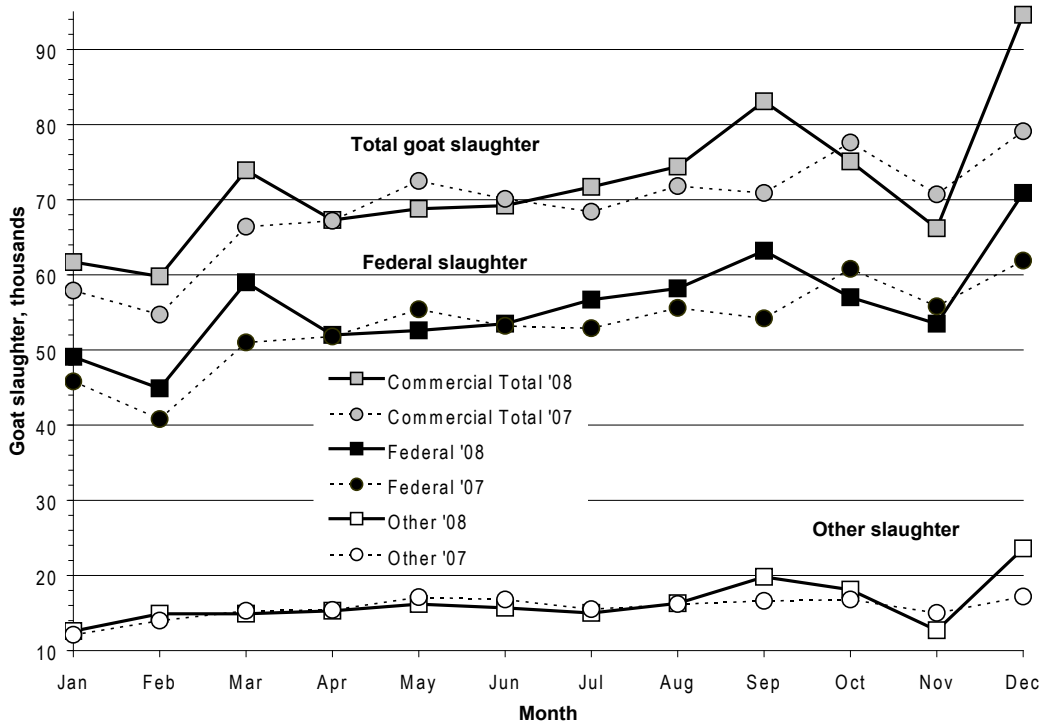


Figure 2. Numbers of goats slaughtered by month under federal inspection, other (state) inspection, and total commercial slaughter for 2007 and 2008.

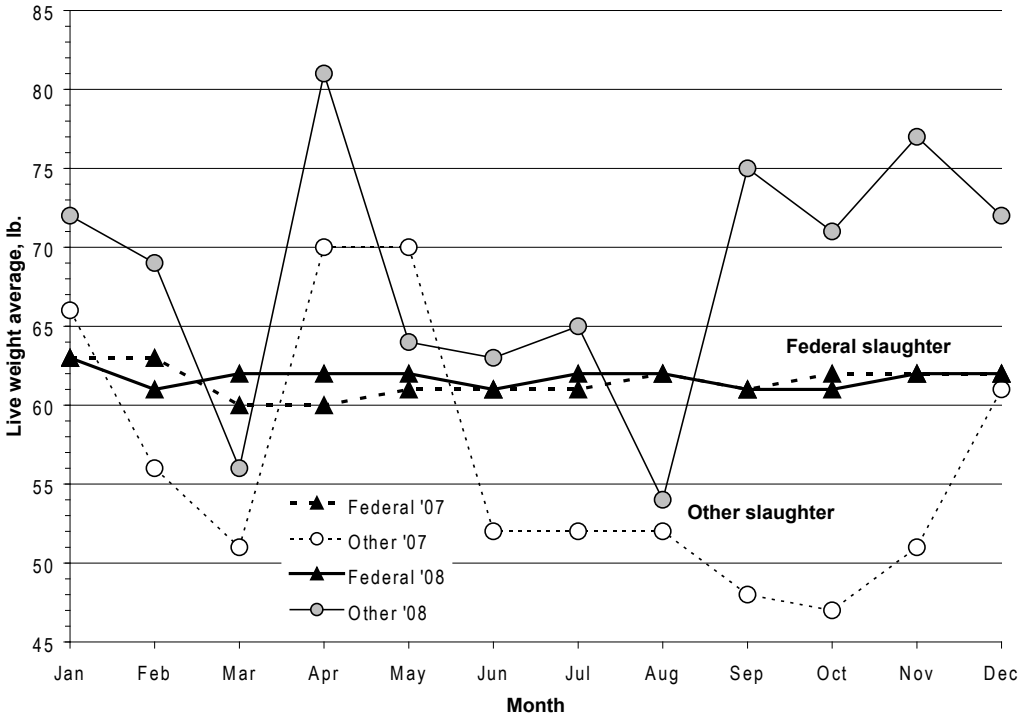


Figure 3. Average live weights of goats slaughtered by month under federal inspection and other (state) inspection for 2007 and 2008.

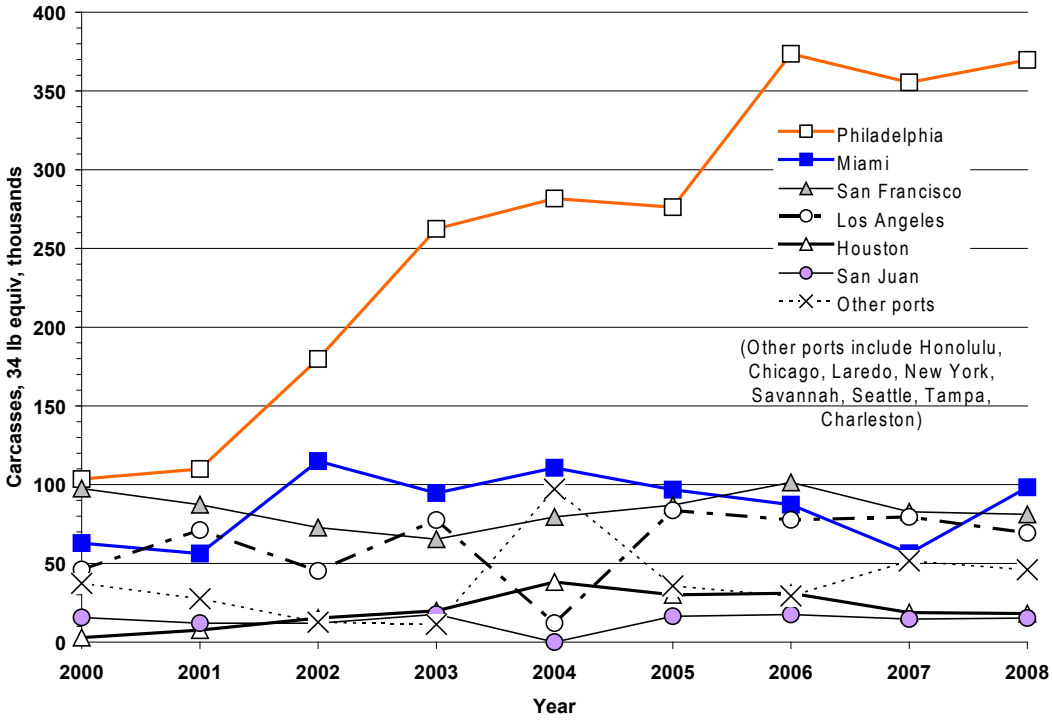


Figure 4. Ports of entry for frozen imported goat meat on a 34-pound carcass equivalent basis.

Reducing Doe Maintenance (non-feeding) Costs

Dr. Frank Pinkerton
Langston University (retired)

Introduction

In an earlier article on breakeven prices for slaughter kid production, I made the point that reducing the annual cost of maintaining a doe was paramount and, further, that cost of feed was the single largest component in this annual doe cost. This article discusses additional possibilities for reducing doe maintenance cost.

As you may know, the IRS-Schedule F, Profit or Loss from Farming, lists 21 specific expense categories plus "others'. To me, some of them seem more amenable to reduction than others. For example, what can one *really do* about insurance, interest, taxes, utilities, and fuel costs? Other expenses (chemicals, fertilizers, custom hire, labor, etc.) are, in some sense, at least 'negotiable' via bid-taking. Still others (repairs and maintenance, supplies, health care, breeding fees) are discretionary (up to a point), while the 'other expense' catch-all allows for miscellaneous items (Association dues, registration fees, travel costs, etc.).

Opportunities for Cost-reduction

I identify four possibilities for reducing doe maintenance costs; each is a significant contributor to non-feed expenditures.

The first is health costs. One logically avoids professional Veterinary care unless one feels the does' value is greater than the likely charges. (I quickly acknowledge the opportunity for emotion to overpower common sense in this decision). Most *commercial* goat owners necessarily act as their 'own Vet', learning as they go, from whatever sources available. Occasionally, it is the blind leading the blind, but in the absence of affordable, goat-knowledgeable DVMs, one necessarily does what one can…and lives with it, though the goat may not.

Generally speaking, internal parasites are the largest single health cost. One may dodge somewhat by rotating pastures in such a manner that the forage on offer is not less than 5-6 inches tall. In some areas, the use of high-tannin Lespedeza and Sanfoin has been found useful, particularly for suppressing re-infestations. In 'barn-shed' environs, cleanliness and sanitation seem to help a bit (particularly with coccidiosis), as also by reduced crowding and, possibly, by separation of goats by age and/or size.

Also, one can sometimes purchase replacement stock with known resistance to certain parasites. There is *some* on-farm, anecdotal evidence that Kiko and Savannah breeds have higher percentages of 'resistant' animals than other breeds, but all breeds have—and tolerate—some levels of parasites much of the time; do not believe otherwise; the rare exceptions only serve to prove the rule.

If management tactics prove to be inadequate, one necessarily resorts to using various de-wormers of varying effectiveness over time and place, each with variable costs, depending on source. Many producers have found catalogue sales to be the cheapest source. Experienced producers know that doubling the 'sheep dosage' of de-wormers for goats to be a more effective treatment. In any case, the routine use of the FAMACHA procedure to *target-treat* only suspicious animals is usually a worthwhile undertaking. It saves treatment costs and delays buildup of resistance to de-wormers.

And, finally, you can reduce health care outlays by disposing of repeat offenders—the cut-your-losses solution…sometimes painful, but always fiscally responsible.

The second possibility for lowering doe maintenance cost is be careful, even parsimonious, when purchasing replacement stock. (I readily concede it is usually more economical to raise your own breeding stock

rather than buying them—but *not* if they lack genetic quality, of course). Accurate, fair prices for breeding stock are always and everywhere contentious issues. Over the years, I have finessed this issue by saying, quite truthfully, that the 'only *correct price* of a goat is the one agreed to by buyer and seller—then and there, nothing else counts'.

In any case, the *real* annual costs of owning a doe encompass not just feed and other management costs, but also 'financial' expenditures. For example, you buy a breeding age doeling for $300; she stays in the herd for 5 lactations, and sells at auction for a net (after hauling and commission) of $100. As a consequence, this does depreciates by $40/year (300 - 100 = 200/5). To this figure, you must add the interest cost/yr, say, $18 ($300 x 6%) for a total cost of $58/doe/year. (Yes, I know, if you are in the 15% IRS bracket, the *after*-tax cost is only $49 (58 x 85%); every little bit helps).

How to reduce this 'fixed" cost? Well, don't pay as much initially, or get more than 5 kid crops, or 'pay' a lower interest rate, or get a higher salvage value. Note here that this fixed cost is independent of the does' other costs, and it has nothing to do with her income from kid sales. The fact is that every year her first kid is '$58 in the hole' when it hits the ground (it desperately needs siblings to 'share' this charge).

Concerning the purchase of a herd sire, the calculations are the same. Obviously, if the buck is eventually sold for breeding rather than for slaughter, his annual depreciation will be considerably reduced. In any case, the 'breeding fee' charge for buck use must be assigned to each doe as part of her annual maintenance cost.

For example, if you pay $650 for a promising yearling buck, use him for 4 seasons and sell him for $150 (slaughter), the depreciation cost is $125/year (650 – 150/4). Adding annual interest of $39 (650 x 6%) and annual upkeep charge of, say, $60 brings his annual cost to $224 (125 + 39 + 60). If he impregnates 50 does, the cost/doe is $4.48.

This figure must be added to each does' annual maintenance cost. To reduce breeding fee/doe, either pay less for the buck or breed more does/season or use him longer or sell him as a herd sire. (Passing thought… artificial insemination programs for commercial goat production are few and far between; there is a useful message therein).

I recognize, as do you, that if one or more of the aforementioned $300 does' offspring can be sold for appreciably more than its slaughter value, the increased income can do much to lower depreciation/interest cost. This is why producers of Youth Project prospects and breeders of purebred stock can be, and often are, much less concerned about purchase price, depreciation, etc. because they intend to 'make-it-back, plus'.

For buyers, higher prices for breeding stock are financially justified if, as expected, their off-spring perform at higher levels due to superior genotype. Such expectations may be buttressed by documentation of *proven, documented records of sire and dam performance;* unfortunately, this is seldom possible. Merely looking at a goat (phenotypic evaluation) is not nearly as helpful in selection as looking at its performance record (genotype).

The third possibility for reducing annual cost of doe maintenance—lowering land cost— is somewhat more difficult to accomplish because the '**land-use fee**' is itself difficult to precisely calculate. All goat enterprises have some parcel of land, large or small, dedicated to various needs—grazing, haying, loafing, etc. The annual cost of owning this land must be assigned and apportioned across doe numbers in order to calculate their total annual maintenance expense. To ignore 'land cost', however one measures it, is an accounting cop-out; avoidance may considerably inflate the apparent profit/doe/year.

So… what to do? If the land is currently being paid for in installments, the interest and taxes will be part of the annual accounting procedure and easily identified. Since land rarely depreciates in value and, indeed,

may appreciate markedly, most goat owners simply ignore the accruing-capital portion of the installment payments (technically incorrect, but very convenient, and certainly comforting).

Contrarily, if the land is already paid for, one could logically charge the fair-market 'rental value' to the goat enterprise to get an annual land-use charge/doe. We concede that determining such values can be difficult, but some sum is simply necessary to enable accurate accounting (would you have the land if you weren't doing goats?).

Alternatively, one could calculate an annual '*opportunity-cost*' figure (the amount you could earn on this land if you sold it and invested the proceeds in tax-free bonds). This is a rather straight forward way to assign a land-use price. Local land prices can be used as a guideline and investment firms are but a call away.

On the other hand, there may well be a near insurmountable *psychological* barrier to assigning such charges to the doe herd. For example, if your goats are pastured on land selling for, say, $5,100/acre with a carrying capacity of 3 does/acre (grazing, hay-making), each doe engenders an annual 'cost' of $68 (5100/3 = 1700 x 4% tax-free bonds). Such high-dollar land simply must produce a lot of forage (5 lb or so of forage dry matter per doe/day—about a ton of hay-equivalent/doe spread over 12 months). There are, of course, other costs for forage production in addition to this land-use cost. Consequently, such computations can sometime lead one to contemplate a 'dry-lot' operation with all forage purchased or, alternately, herd reduction or even total dispersal; divorce and suicide are not usually considered to be viable option in this evaluation.

Note here that, if the cost of TDN in such forages equaled or, worse, exceeded the cost of TDN in concentrates, my cherished 'forage-only' management strategy would be no longer tenable—just as I have elsewhere warned.

The fourth possibility for decreasing doe maintenance concerns facilities and equipment. Rustic is *good* if it is cheap, but there is a limit to parsimony…a decent set of working pens with *dependable gates* promotes labor efficiency and maintains worker tranquility, while an accurate, conveniently accessible scale is simply a must.

Nearly leak-proof fencing is also simply a must; however, there are a number of options, each with materials and labor costs particular to the specific option. Preliminary costing-out these alternatives can often result in considerable savings; utility and effectiveness are paramount considerations, not beauty in the eyes of passers-by.

Goats can tolerate, indeed, they can thrive in well-bedded tri-sided sheds open to the south or in well-ventilated old dairy barns, sheep sheds, etc. Overly elaborate facilities are as unnecessary as the associated interest, taxes, and depreciation are painful. The game here is timely maintenance of existing buildings, not expensive new facilities or equipment….patch it, make it do, use it up, or as I am wont to say, **frugal-it.**

And then there is the matter of owning or renting or hiring pasture maintenance and haying done on your acreage. One may usually custom-hire pasture establishment or renovation done cheaper than owning/operating the specialized equipment. Concerning haymaking, farm management specialists currently estimate one would have to run at least 250 momma-cows to justify haymaking equipment plus tractor usage. That figure extrapolates to around 1500 does…mercy.

In my own 50 or doe herd on 30 creek-bottom acres in east Texas, I practiced rotational grazing and, in most years, I stockpiled standing forage for winter grazing. I only bought hay to supplement a shortage of standing grass. Cheap is often good; in most goat operations, it is often necessary.

Recordkeeping, Analysis, and Utilization of On-Farm Performance Data

Dr. Frank Pinkerton[1] and Dr. Kenneth Andries[2]
[1]Langston University (retired)
[2]Kentucky State University

Preface

The article about On-Farm Performance Testing for Meat Goats in the August '09 issue of Goat Rancher described the theory and rationale for collection of performance data to enable owners to improve the productivity of theirs herds in the shortest possible time. This program identifies superior animals for retention as parents of succeeding generations; it is, in short, a process for making sustainable genetic improvement.

As Goat Rancher readers know, I have been a proponent of such programs for years. So also with my co-author in this article, Dr. Ken Andries, Animal Science Specialist at Kentucky State University, Frankfort. As an animal geneticist and goat extension specialist, Ken designed and has offered this program since 2006. To date, participation has been sporadic and limited, for whatever reasons.

My explanations for this poor showing are that some owners may feel that the results would not be worth the time, modest expense, and hassle of data collection and analysis. Others may feel that they lack the knowledge to properly evaluate the findings or to apply them advantageously. Still others may feel that they lack the necessary equipment and facilities for data collection. Some may be simply wary of documenting the actual levels of individual and herd performance, and some may be also wary of having the findings somehow made public. Not to worry: see below for details.

Introduction

It is the purpose of this article to describe the logistics (the how-to) of **collecting, analyzing, and utilizing** on-farm performance data. Put differently, how does one generate the performance figures, how does one evaluate the figures, and, most importantly, how does one put this genetic selection program into action. If you are interested in discussing participation in this program, contact Dr. Andries at 502-597-5094 (office) or 502-682-0067 (cell) or 502-597-5933 (fax); he may also be reached at kenneth.andries@kysu.edu. (While I would also be pleased to talk with you, I am the cheerleader, not the coach, in this game; he acts, I applaud—him, and you).

In any case, if you decided to participate, Ken would enroll you and discuss initial actions on his and your part. First, he would need your contact information: phone, email or surface mail address as well as your location and size of herd (breeding age females). Secondly, he would need your estimated kidding schedule(s) so that he could get the forms to you in a timely manner(and, if you are a Kentucky resident, so he could schedule a visit or bring a scale for '90 day' weight-taking). Ken has Administrative approval to make this program available to non-Kentuckians and, currently, there is no cost to participating owners, anywhere, regardless of herd size.

Data Collection

As kidding time approaches, Ken will send you two forms. The first is a *code sheet*. As shown in the first attachment, it enables you to identify certain information about the does and their kids. The code categories for breed, livability, birth type, rearing type, and kidding ease are crucial for analysis of doe performance.

The second attachment is entitled *kidding data sheet* that enables you to provide certain information about each doe and her offspring. Some of this information uses the code designations, and the remaining information provides additional data points for individual kids in each litter.

When all the litters in a given 'kidding-group' of does have been weighed (at not less than 70 nor more 110 days post-partum, you return the kidding data sheet (or multiple sheets, depending on the number of kids weighed) to Ken, by email or post. A 'group of does' is defined as those kidding within a 60-day interval of each other. A producer may have 2 or more such group depending on his breeding/kidding schedules. The rationale for this 'evaluation-by-group' is that the environment (climate and feeding program) changes over time; accordingly, it is not fair to compare litter performances from spring-kidding does to fall-kidding does to winter-kidding does.

Do note that, if it seems too inconvenient to get birth weights, you don't have to provide Ken birth weights of individuals or litters in order for him to compare 90-day (adjusted) litter weaning weights. If you had weaning weights, he could compare does on the basis of the litter's average daily gain (as adjusted) during the suckling period (final weight – birth weight = gain, divided by days = ADG). If you don't have birth weights, he could compare weight per day of age (final weight/days on test) as adjusted. Attachment 2 does ask for birth weights, but that column can be ignored without 'penalty' if you elect not weigh kids at birth).

FYI: there is usually a small, but positive correlation between birth weight and 90-day weight (reflecting birth weight per se and the more aggressive suckling by larger, more vigorous kids). Should early culling decisions be required, this correlation could be used to do so. Birth weights are also useful in assessing possible impacts on kidding-ease scores and livability scores. Perhaps it may be useful to remember that final litter weight, not ADG, is the most useful selection criteria. If you want to furnish birth weights, Ken will do the computations.

Data Analysis

When Ken gets your data sheets back (as described above), he will transpose the raw figures to his computer program which will magically apply adjustment factors to the data to derive 'adjusted 90-day litter weights' for each doe. Essentially, you give him the weight of each litter (and associated info) and the program will do the rest. The properly adjusted litter weight at weaning for each doe will reflect: calculated 90-day weights, age of dam at parturition, number of kids born in the litter, number of kids weaned in each litter, and sex of kids in each litter.

Caveat: presently Ken does not have sufficient data in hand to calculate adjustment factors for pre-weaning management; however, such adjustments can be calculated once enough producers provide sufficient data for calculation. As of now, Ken can only separate those does whose kids are being creep-feed from those that are not; thus, a participant would get two Doe Summary Sheets for the same 60-day weaning age groups to reflect this management difference.

In any case, Ken would send you a **Doe Summary** sheet (see third attachment below; the data is from a long defunct enterprise) showing the adjusted litter weaning weights for comparing all does in the 'group' (in the next-to-the-last column entitled TOTAL ADJ WT). The last column in the Summary, entitled TADJWT RATIO, provides the crucial figures for analyzing the *relative standing* among the does. (*All your does* should be evaluated, or else you would be lying to yourself, and also your prospective customers; why bother at all?).

During analysis, the computer program first calculates the average adjusted litter weaning weight for the group and, secondly, compares each doe's record to this average, and assigns it a 'Ratio' figure. For example, if the group's *average* adjusted litter weaning weight figure were 100 lb, and doe A posted a 125 ratio, she

was 25% above (better than) her group's average performance. If doe B posted an 80 ratio, she was 20% poorer than) the group-average performance.

As shown in the fourth attachment, Ken's computer program can also provide a Sire Summary if you have kids in given 60-day kidding group sired by two or more sires. Note that this Summary shows the number of kids weaned (having 90 day weights) from a given sire as compared to the number of his kids born—a most useful comparison indeed. One may calculate kid survival rates for each sire: number of kids weaned/number of kids born x 100. For example, Sire # 146 kid survival rate was 73 % (17/22 x 100) while Sire #859 rate was 94 (16/17 x 100); Sires 616 and 4006 posted rates in the mid-sixties and Sire 5052 posted a 100% rate, albeit on a smaller number of kids. **(**Caveat: the % kid crop *born* for each sire is not furnished in this analysis, but if producers knew the number of does exposed to each sire, then this figure could be calculated).

The crucial sire performance figures are the Average *adjusted* 90-Day Weights. The sires may be evaluated mathematically as shown below.

Rank	Sire	AAWW	Ratio
1.	616	34.58 lb	105.8
2.	859	33.82 lb	103.5
3.	4006	32.67 lb	100.0
4.	146	32.47 lb	99.4
5.	5052	29.81 lb	91.2
Average:		32.67 lb	100.0

As readers will perceive, this year's kid crops suggests that bucks 616 and 859 produced kids only 3.5 to 5.8% higher than the average weaning weight, respectively. With prior records for comparison, one could know if these 'findings' were consistent over 2-3 years. However, owners could also evaluate these sires by tabulating the performance Ratios of their daughters in this and prior years. Those sires having a majority of their daughters with 100-plus Ratios over the years would be the keepers (and sires of saleable young buck prospects, of course).

Utilizing Performance Data

If all your herd kidded within the requisite sixty-day interval and all does and kids were treated alike until weaning at about 90 days of age, you could use the Ratios shown to select keeper-does and to choose keeper kids from particular does. If you have two, or more, kidding periods, there is the problem of choosing between does with similar Ratios, but in different groups—a toughie only you can decide because only you know the seasonal situations, but look first at the group averages for guidance.

Caveat: the 'degree of selection pressure' you could apply across the entire herd would be dependent on your particular situation (herd size, expansion/contraction plans, cash-flow needs, prospective sales, expected feed supply, any resource limitations, etc.). For instance, if you were positioned to do so, you could immediately improve average herd performance appreciably by culling 'deeply', say, by selling all does that had below 100 Ratio scores. Assuming no outside replacements, your herd would be smaller, but of higher genetic worth. If you could only cull the bottom fourth of the herd, the rate of genetic progress would be noticeably slowed.

There are additional considerations. The average commercial herd typically replaces about 20% of its does every year. A few die, some are not decent producers, some leave for health reasons, some for old age, whatever. To maintain herd size (without outside purchases), one must save at least 25% replacement doelings.

If a 100 head doe herd is reproducing at the rate of 175% kid crop weaned (good), among the 175 kids born, there will be 80 or so doelings surviving from which to chose the 25 replacement doelings. These replacements should come from does scoring in the top half (Ratio of over 100) of all does or, better yet, the top third, but *only* if the individual doelings *warrant* saving. (There can be issues of poor conformation, bad mouths, and unacceptable rates of daily gain when a given doeling has really sterling littermates from a top litter).

And then there is the matter of saving buck kids. All else being equal (ADG pre-weaning, conformation, etc.), they should come from the top 5% or so of the does on test. They should be retained for further evaluation, post-weaning, before the *final* selection is made (and he should be re-evaluated after his first kids are weaned).

On-farm performance test programs are particularly good venues for comparing multiple herds sires, but only if the objects of their affection are 'randomly' chosen and treated equally during the test period. Otherwise, the comparison will be compromised. Putting buck A on your top does and buck B on your bottom does is unfair—worse still, it is inaccurate.

And then there is the too typical farm situation where the 'top' buck is untested but is really horny and very pretty and cost a lot of money and stood real high in the Ring and/or has mighty ancestors, however defined (but also not performance tested). A scale under his progeny and another scale under his daughter's progeny can be an enlightening, sometimes sobering, experience indeed; if so, I can recommend a really good sausage recipe.

Commentary

Sustained participation in this performance-based program would allow you to cull-or-keep with more accuracy and confidence than your current procedure likely permits. You may have a keen eye for phenotypic evaluation of does and a good eye for estimating weaning weights of kids. However, if you *document* doe and kid performance via scale weights, you don't have to *guess* at their performance; you *know* their performance—and so would a prospective buyer who could peruse the Doe Summary and Sire Summary furnished by Dr. Andries (who doesn't have a dog in your hunt).

When deciding among keeper does from these records, the choice between does with very close Ratios can be dicey. One way to solve such a dilemma, would be to calculate an 'efficiency rating' (ER) of the individual does by dividing her adjusted litter weaning weight by her body weight at weaning time. Litter weight per pound of doe is the ultimate evaluation for keepers. For example, if doe A produced 120 lb litter weight and weighed 130 lb at weaning; her ER would be .92 (120/130). If Doe B also produced 120 lb litter weight, but weighed 110 lb at weaning; her ER rating would be 1.09. Mathematically speaking, doe B would be about 18% better (more efficient) than doe A (1.09 - .92 = .17/.92 x 100 = 18.4).

Such efficiency ratings could of course be determined on *all* your does and then ranked from high to low. Such rankings could be more useful to you (and prospective customers) than the Ratio figures shown in the Doe Summary. Doubtless Ken's computer program could be modified to derive such efficiency figures and their rankings; he just needs participants to start furnishing doe weights. Personally, I would prefer using ER rankings over Ratio rankings. (If I were pressed for time, I would opt for doe weights-at-weaning over obtaining birth weights of kids).

To pose a further dilemma for your consideration/education, suppose doe A above had an obviously superior phenotype (larger/day of age and better conformation… prettier, so to speak) than did doe B. The same litter weight from a prettier doe (perhaps with a ribbon or two to 'prove' it). What to do? If you were not flogging 4-H kids at premium prices, offer doe A with a pseudo show of reluctance (but try for a premium on 'potential'). In any case, try not to smile as you load her and retain doe B for herd improvement.

A concluding word about confidentiality of this performance evaluation program is in order. Only you and Ken would know the Ratios (or efficiency rankings) of your herd. Ken won't tell, so any leaks would be on you. Also, remember, these tests are only useful in your site-specific herd. You cannot *logically* compare your herd to another producer's herd.

However, Ken *could* do an annual 'participant comparison' and publish it as being from producers A, B, C, etc. so that all could know the *relative* performance of their herds but *without* knowing who had what breed or who did forage-only feeding or who did creep-feeding, etc. For example, Ken could report that herd A had a herd of X does with an *average* total adjusted weaning weight of, say, 70 lb with a range of, say, 45 to 100 lb, while herd B had a herd of Y does averaging, say, 90 lb with a range of, say, 55 to 115 lb.

Ken could also institute a Breed Code for Sire-of-Kid. This would allow participants to compare crossbred kids within their herd. To accurately evaluate sires of different breeds, each would have to be bred to dams of just one breed. For example, a Boer or Savannah buck on Kiko or Spanish does.

If enough participants did evaluations of purebreds and crossbreds over time and place, the accumulated data could be used to identify *apparently* superior breeds and crosses. I use 'apparently' because the multiple comparisons would not be in made in the same environments across the country. But do remember that the long-running DHIA program comparisons as between Holstein, Jersey, Guernsey, Ayrshire, and Brown Swiss dairy cattle that led to a near monopoly of Holsteins did not have the same environments either.

Conclusion

Human nature being what it is, I would rather expect that those owners with the best does (highest litter weights and/or efficiencies) would not be above using the 'participant reports' and, more importantly, their own Herd Summaries to 'educate' would-be buyers. Indeed, using such data for merchandizing purposes would, in my opinion, be second only to achieving the 'genetic improvement objective' of participation in the on-farm performance evaluation program.

My feeling is: if you have it, flaunt it; if not, buy a better buck (with some sort of performance data other than standing first in the Jones County or State Show or having a pedigree indicating ancient lineages to South Africa, New Zealand or the TX Hill Country).

In short, we urge you to enroll, to help yourself, to be thoughtfully persuasive in pursuit of self-interest, and to let others know of your efforts. After all, putting lesser players in your review mirror is a so satisfying thing.

BREED CODES

BREED	CODE
ALPINE	AP
ANGORA	AG
BOER	BR
KIKO	KK
KINDER	KR
LAMANCHA	LM
NIGERIAN DROWF	ND
NUBIAN	NB
OBERHASLI	OB
PYGMY	PY
SAVANNA	SV
SPANISH	SP
TENNESSEE FAINTING	TM
TOGGENBURG	TO
CROSS BRED	XX

PREWEANING MANAGEMENT

NO CREEP	1
CREEP GRAZED	2
CREEP FEED	3

POST WEANING MANAGEMENT

FED AS MARKET KID	4
FED AS REPLACEMENT	5
PRODUCTION TEST	6
FORAGE ONLY	7
FORAGE /SUPPLEMENT	8

CULL REASON CODES

DIED	1
AGE	2
OPEN/FAILED TO KID	3
LOST KID EARLY	4
BAD UDDER	5
FOOT PROBLEMS	6
CL	7
SINGLE BIRTH	8
POOR PERFORMANCE	9
DISPOSITION	10
OTHER	11

LIVABILITY CODE

BORN ALIVE AND WEANED	1
DIED AT BIRTH/STILLBORN	2
DIED WITHIN 72 HRS	3
DIED AFTER 72 HRS	4
DIED AFTER 2 WKS	5
ABORTED	6

BIRTH TYPE CODES

SINGLE	SN
TWIN	TN
TRIPLET	TR
QUAD	QU
OTHER	OT
IF KID IS RESULT OF EMBRYO TRANSFER	
PLACE AN "E" IN FRONT OF BIRTH CODE	

REARING CODES

Born	Raised	
Single	Single	1
Single	Twin	2
Twin	Single	3
Twin	Twin	4
Triplet	Single	5
Triplet	Twin	6
Triplet	Triplet	7

For more than Triplet use Triplet code

If Fostered, put foster dam ID in comment

KIDDING EASE SCORE

NO ASSISTANCE	1
SLIGHT ASSISTANCE	2
HARD PULL	3
CAESAREAN SECTION	4
ABNORMAL PRESENTATION	5

PURCHASE CODES

PRIVATE TREATY	PT
SPECIAL BREEDING SALE	BS
PRODUCTION SALE	PS
SALE BARN	SB
OTHER	O

SALE CODES

PRIVATE - BREEDING	PB
PRIVATE - MEAT	PM
SPECIAL BREEDING SALE	BS
SPECIAL MEAT SALE	MS
SALE BARN	SB
OTHER	O

SEX CODE

DOE	D
BUCK	B
WEATHER	W

KIDDING DATA SHEET

KID ID	DAM ID	SIRE ID	AGE OF DAM	BREED CODE	BIRTH DATE	SEX	LIV CODE	KID EASE	BIRTH TYPE	BIRTH WT	90 d DATE	REAR TYPE	90 d WT	ADG 90 d	ADJ 90 d WT	REAR CODE	COM-MENTS
7201	6027	146	1	**BR-X**		M	1	1	TW	7.69	3/5/2008	**4**	37	0.30	34.88		
7202	6027	146	1	**BR-X**		M	1	1	TW	6.75	3/5/2008	**4**	32	0.26	30.18		
7203	62	859		**BR-X**		F	1	1	TW	7.31	3/5/2008	**4**	39	0.34	37.98		
7204	62	859		**BR-X**		M	1	1	TW	9.69	3/5/2008	**4**	57	0.51	55.47		
7205	6032	859	1	**BR-X**		F	1	1	TW	6.88	3/5/2008	**3**	30	0.25	29.25		
7206	6032	859	1	**BR-X**		F	4	1	TW	5.13							DIED 12/9
7207	40	146		**BR-X**		F	3	1	TW	7.06							DIED 12/6
7208	40	146		**BR-X**		F	1	1	TW	7.06	3/5/2008	**3**	37	0.33	36.35		
7209	6	616		**BR-X**		F	1	1	TW	8.31	3/5/2008	**4**	45	0.40	44.60		
7210	6	616		**BR-X**		F	1	1	TW	9.06	3/5/2008	**4**	48	0.43	47.57		
7211	82	859	3	**BR-X**		M	1	1	TW	9.06	3/5/2008	**4**	42	0.36	41.64		
7212	82	859	3	**BR-X**		M	1	1	TW	9.38	3/5/2008	**4**	45	0.39	44.61		
7213	6081	616	1	**BR-X**		M	1	1	S	7.06	3/5/2008	**1**	44	0.41	44.00		
7214	6031	859	1	**BR-X**		F	1	1	TW	6.13	3/5/2008	**4**	30	0.27	30.00		
7215	6031	859	1	**BR-X**		F	1	1	TW	7.00	3/5/2008	**4**	32	0.28	32.00		
7216	35	616		**BR-X**		F	1	1	TW	8.31	3/5/2008	**4**	29	0.23	29.00		
7217	35	616		**BR-X**		F	1	1	TW	7.13	3/5/2008	**4**	33	0.29	33.00		
7218	6052	616	1	**BR-X**		M	1	1	TW	7.56	3/5/2008	**4**	34	0.30	34.60		
7219	6052	616	1	**BR-X**		F	1	1	TW	8.31	3/5/2008	**4**	25	0.19	25.38		
7220	21	616		**BR-X**		M	1	1	S	13.00	3/5/2008	**1**	62	0.56	63.11		
7221	19	146		**BR-X**		M	1	1	TW	8.13	3/5/2008	**4**	27	0.21	27.21		
7222	19	146		**BR-X**		F	1	1	TW	7.13	3/5/2008	**4**	18	0.12	18.12		
7223	29	616		**BR-X**		M	1	1	TW	11.31	3/5/2008	**3**	44	0.37	44.74		
7224	29	616		**BR-X**		F	5	1	TW	9.06							Died 1/25
7225	76	146		**BR-X**		M	2	5	TW	9.00							BORN DEAD
7226	76	146		**BR-X**		F	1	1	TW	9.50	3/5/2008	**3**	34	0.28	34.56		
7227	26	859		**BR-X**		M	1	1	TW	10.00	3/5/2008	**3**	46	0.41	46.82		

Doe Summary

DAM ID	AGE OF DAM	KIDDING DATE	NUM BORN	BIRTH WT	WEAN DATE	WEAN WT	NUM WEAN	AGE AT WEAN	ADJ 90 D WT	AGE OF DAM ADJ	SEX ADJ	TOTAL ADJ WT	TADJ WT RATIO	COM-MENTS
185	3	11/12/2006	2	16.0	3/1/2007	101.9	2.0	109	87.0	87.0	83.0	97.9	133.4	
177	2	11/15/2006	1	3.0										
118	6	11/14/2006	2	21.0	3/1/2007	103.5	2.0	107	90.4	90.4	90.4	106.7	145.4	
199	3	11/14/2006	2	14.0	3/1/2007	95.4	2.0	107	82.5	82.5	75.0	88.5	120.6	
200	4	11/14/2006	2	15.0	3/1/2007	64.8	2.0	107	57.8	57.8	52.5	62.0	84.5	
201	4	11/14/2006	2	17.0	3/1/2007	103.6	2.0	107	89.8	89.8	89.8	106.1	144.6	
202	4	11/14/2006	2	15.5	3/1/2007	78.9	2.0	117	64.3	64.3	58.5	69.0	94.0	
204	3	11/16/2006	2	16.0	3/1/2007	58.8	2.0	105	52.7	52.7	52.7	62.1	84.6	
285	3	11/18/2006	2	16.0	3/1/2007	76.4	1.0	103	36.4	36.4	36.4	39.1	53.3	1 bottle fed
301	3	11/21/2006	1	10.0	3/1/2007	41.8	1.0	100	38.6	38.6	35.1	35.1	47.8	
335	2	11/10/2006	2	14.0	3/1/2007	88.5	2.0	111	74.4	79.6	76.4	90.3	123.0	
485	2	11/11/2006	2	12.0	3/1/2007	55.5	1.0	110	46.5	49.8	45.3	47.1	64.2	
889	4	11/13/2006	2	20.0	3/1/2007	113.1	2.0	108	97.6	97.6	93.5	110.4	150.4	
910	6	11/19/2006	3	24.0	3/1/2007	85.6	2.0	102	77.4	77.4	77.4	95.2	129.7	1 kid died 1/31
915	3	11/16/2006	2	19.0	3/1/2007	95.2	2.0	105	84.3	84.3	84.3	99.5	135.6	
918	2	11/19/2006	1	10.0	3/1/2007	47.6	1.0	102	43.2	43.2	43.2	43.2	58.9	
920	3	11/12/2006	2	17.0	3/1/2007	104.0	2.0	109	88.8	88.8	80.8	95.4	130.0	
922	3	11/13/2006	2	14.0	3/1/2007	39.7	1.0	108	34.1	34.1	34.1	35.4	48.2	1 kid died w/72 hrs
957	3	11/15/2006	3	24.0	3/1/2007	135.3	3.0	106	118.5	118.5	107.8	136.9	186.5	
958	2	11/17/2006	1	10.0	3/1/2007	46.9	1.0	104	41.9	44.8	40.8	40.8	55.6	
967	2	11/17/2006	1	9.0	3/1/2007	41.8	1.0	104	37.4	40.0	36.4	36.4	49.6	
996	5	11/11/2006	2	19.0	3/1/2007	110.7	2.0	110	94.0	94.0	89.0	105.0	143.1	

Sire Summary							
Sire ID	**Number Born**	**Birth Date**	**AVERAGE BWT**	**Number 90 D**	**Average 90D Wt**	**90D ADG**	**Average Adjusted 90D Wt**
146	22	3/22/2007	6.82	17.00	33.53	0.28	32.47
616	36	3/23/2007	7.59	24.00	34.79	0.29	34.58
859	17	3/22/2007	7.44	16.00	34.63	0.29	33.82
4006	34	3/22/2007	7.24	22.00	33.71	0.28	32.67
5052	12	4/27/2007	7.07	12.00	21.75	0.25	29.81

Management Influences on Break-Even Price/ Pound of Slaughter Kids

Dr. Frank Pinkerton
Langston University (retired)

Introduction

The paramount obstacle to increasing goat numbers is enterprise profitability. Accordingly, it is the purpose of this presentation to describe the three essential factors affecting the profitability of meat goat enterprises.

There are a number of traditional ways to undertake partial or complete business enterprise analyses, but, for goat producers, we have found that calculations to determine their break-even price/lb (BEP) of slaughter kids provide valuable information about both production and economic returns. Obviously, the difference between the BEP/lb and the selling price/lb is the margin of profit/lb and per kid. In the aggregate, these margins constitute enterprise profitability. **Three** crucial figures are needed to calculate BEP.

First, we need to calculate the percent kid crop **weaned (**not just born). To do this, we divide the total number of kids weaned (both sexes) by the number of does **exposed** (not the number of does actually kidding). For example, if 100 does were exposed and they together weaned 150 kids, the % kid crop weaned would be 150. (In the real world, nearly all of the does would cycle and most would conceive and perhaps 90 or so would kid and produce X number of kids, Y of whom would survive until weaning time).

Secondly, we need to determine the **average** cost/exposed doe of "maintaining" her for one year. Such costs must be *all-inclusive* (her feed, any creep-feed, all health costs, breeding fee, "overhead", depreciation of assets, land use fee, etc.) In this reckoning, each doe may be viewed as a profit-center, but *all* does generate *all* the income and they bear *all* the costs.

Thirdly, to accurately determine BEP/lb of kids sold at weaning time (or shortly thereafter), we must know their selling weights (in actual practice, their 'shrunk' weights after hauling to market).

Calculation of Break-Even Price Per Pound of Slaughter Goats

The interrelated influence of these three factors/figures on break-even cost/lb of slaughter kids are shown in Table l. To illustrate usage of this table, first select an average selling weight, say, 65 lbs; then select a weaning rate of, say, 150% (1.50 kid/doe/year); then select a doe maintenance cost (*including an estimated $15/doe for marketing costs—hauling and commission)*, say, $85/year. Follow the 150 % **kid crop weaned column downward to the 65 lb *shrunk* selling weight section;** then, to the left, locate the annual **doe-cost line for $85**; the intersection of this line/column duo shows a figure of **$.87**.

This is the **break-even price/lb (BEP),** that is, if you sold at this price/lb, you would neither lose nor make money on this doe. If you sold for a higher price/lb than $.87, for example, $1.57, you would make a profit of $.70/lb (1.57 - .87) or on this doe $68.25 (.70 x 65 x 1.5).

To illustrate the positive influence of **increasing** percent-kidding-rate on BEP (for a 65 lb goat from a doe whose maintenance cost was $85), note the **decline in** BEP prices/lb as the kidding rate increases from 100 % ($1.31) to 200% ($.66). As the BEP falls across improved kidding rates, profit per doe rises sharply. To illustrate, at 100% kidding rate and a sales price of $1.57/lb, the profit/lb of kid is $.26 (1.57-.1.31); consequently, the 1.5 kids weighing 65 lbs/head would generate a doe profit of $25.36 (.26 x 65 x 1.5). At 200% kidding rate, however, the profit is $.91/lb (1.57 - .66), and the profit on the two goat litter would be $118.30 (.91 x 65 x 2.0).

To illustrate the positive influence of **decreasing** the annual doe maintenance cost on BEP (65 lb kid), examine the **decrease** in BEP prices/lb as the doe-cost decreases from $85 ($1.31) to $50/yr ($.77) *at a 100%* kidding rate; at 200% rate, the figures are $.66 and $.39, respectively. As shown above, a doe producing 1.5 65 lb kids nets $68.25 if her maintenance cost is $85/year. If her maintenance cost were only $50/year, however, her profit would be $103.35 (1.57 - .51 x 65 x 1.5). The increase in profit/doe of $35.00 (103.35 – 68.25) is, of course, exactly equal to the savings in maintenance cost/head of $35.00 (85 -50).

To illustrate the positive influence of **increasing** the selling weight of weanlings, let us examine the results using, arbitrarily, $85 doe cost/year and a 150% kidding rate. At 50 lbs sale weight, the BEP is $1.13; at 65 lbs it is $.87, and 80 lbs it is $.71. Assuming the same $1.57 cents/lb selling price used above, the profit margins are, per lb, $.22, .70, and .86, respectively, for these sale weights. In this example, a doe selling 1.5 **50** lb kids would yield a profit of $16.50 (50 x .22 x 1.5)**,** while **65** lb kids would yield a profit of $68.25 (65 x .70 x 1.5); **80** lb kids would yield a profit of $103.20 (80 x .86 x 1.5).

Cautionary notes: first, the foregoing paragraph assumes the same selling price/lb across all three weights. This is *not realistic* because, historically, San Angelo and New Holland prices demonstrate distinct, *adverse* responses to increasing sale weights.

Secondly, most commercial does **can not** wean litters of kids averaging 60 lbs or more in 4 months or so **unless the she and/or kids receive supplemental feed.** In BEP calculations, the cost of this added feed must be included as part of the doe maintenance cost; any feed given to kids post-weaning is also treated this way (to do otherwise, would lead to separate post-weaning cost-benefit calculations).

Discussion Points

The foregoing computations describe the economic consequences of **reproductive efficiency** (number of kids/weaned per doe exposed and their collective weaning (selling) weight) and **management efficiency** (reducing the aggregate cost of maintaining a doe for one year). It is self-evident that reducing the break-even selling price/lb for market kids is the paramount consideration in managing a commercial slaughter goat herd.

The relative importance to enterprise profitability of the three factors (% kid crop weaned, doe maintenance cost/year, and litter weight) will vary somewhat among herds and venues, but, in any case, **all** are crucial to enterprise profitability. Remember, slaughter goat production (profitability) is, essentially, **a numbers game**.

For instance, within a given herd size/venue, the **number of kids weaned/sold per/year** is more important than individual, or even litter, weaning weights. Also, note that the "quality" of the kids sold (their live selection grade) is of lesser importance than numbers or weight.

In the foregoing prose, I used 100 and 200 percent kid crop rates for illustration; are these figures representative? Well, yes and no…many TX goat owners of extensive-type operations (3-5 acres/doe with somewhat erratic nutrition levels, limited environmental protection, and subject to 15%-plus annual kid loss to predators/diseases) would likely consider a 100% weaned kid crop/per exposed breeding-age doe acceptable; in drought times, 75% or less may be experienced. The better operators, with good rainfall, would be pleased to achieve 125%, while 150% would be an exceptional expectation, at least for many of them.

Can producers in areas of higher rainfall, more forage/acre, longer growing seasons, warmer winters, etc. expect higher kid crop percentages? Yes, more kids will likely be born and more will likely survive to weaning/sale time (**but only if parasite and other problems can be controlled).** The typically small herds in southeastern states (30-100 does) can, with decent goats and adequate management, usually achieve 150%. With superior forage and parasite management, many could achieve 175%, occasionally even more. Producers

in more northern areas should match such figures. (Note: all these percentages are from **mixed-age** herds—abnormal numbers of first-timers and old-timers within a given herd will surely lower such figures).

Is a 200% kid crop/per exposed doe achievable? Not too likely....not with once/year kidding…for every doe that did not breed, another doe would have to wean quadruplets or two does would have to wean triplets. Not to say 200% couldn't be done, but it would require an unusual confluence of genetically superior does and above-average management.

Of course, if an owner decided to undertake an accelerated kidding program (three kid crops in 24 months), he could easily reach a 200% crop/year (by averaging only a 133% kid crop across the three kidding times). If he averaged a 150% rate in such a program, he would achieve a 225% kid crop on an annual basis. Striving for even higher rates might, one imagines, require a bit of considerable faith-based optimism by the striver, possibly even some divine intervention.

Table 1 provides annual doe-maintenance cost figures from $50 to $90. Are these realistic? **I** think so, but a lot of west TX ranchers would argue that they couldn't stay in business if it cost *them* $50/year to "run" a doe. For example, at a kidding rate of 100% and a weaning weight of 50 lbs and using the $50/head figure, the BEP/lb is $1.00. If the kid sold for $1.50/lb, it would generate a profit/doe of $25 (1.50 –1.00 x 50). After paying a marketing charge of, say, $5/head, the return to labor/management would $20/doe.

(In such a situation, one would need to own/manage about 1,500 does, and have an employed (off-farm) and frugal spouse, as well as unusually undemanding children who could/would work goats on about 5,000 acres to generate $30,000/year. Alternatively, the ranch might be leased to 20 hunters at $1500/gun to generate the same $30,000, so…).

Contrarily, an $85/doe/year maintenance cost (including marketing charges) for corn-belt/northeastern producers does not seem particularly onerous to me (as compared to TX), even given the shorter grazing seasons, higher production inputs/costs associated with a doe herd of 100-200 head. To illustrate, at this cost and with a kidding rate of 1.5 and selling 65 lb kids, the BEP is $.87. Selling at $1.57/lb, the profit/doe is $68.25 (1.57 - .87 cents/lb x 65 lb x 1.5). In this same circumstance, just getting an extra ¼ kid/year (1.75% kidding rate), would raise the profit/doe to $93.28 (1.57 -.75 x 65 x 1.75), while twins would yield $118.30 (1.57 - .66 x 65 x 2.0).

Possibilities for Reducing Enterprise BEP for Improved Enterprise Profitability

There are but two ways to reduce BEP. The first is to **improve reproductive efficiency** of the doe herd via increasing the percentage kid crop weaned and the litter size/weight sold. Proper nutrition, good health status, and adequate general management of the does and bucks are necessary, but insufficient, conditions to do this. Improving the genetic quality of the breeding herd offers further opportunity…better mamas do indeed produce lower BEPs.

The second, and most rapid, way to lower BEP is to **reduce the cost of doe maintenance.** This reduction may take many forms. For instance, while some of the line items listed under FARM EXPENSES in your IRS Form-1040/Schedule F must necessarily be prorated across all does, others offer prospective saving opportunities. Logically, those items that are the largest, recurring outlays offer the best opportunity for making substantial reductions. (See other information in this Section).

But first, I offer a cautionary tale of two does…of the same 'breed', similar in age and phenotypic characteristics, both of whom kidded at 14 months of age in late winter '03; each completed of 5 lactations.

Doe A averaged 180 % kid crop weaned/sold; these 9 kids averaged 73 lbs at weaning and all sold as Selection 1 at $1.85/lb each (shrunk wt). Thus, doe A generated sales of $1,102.50 (9 hd x 70 lb x $1.75), less

$5/hd commission each on 9 kids, = $1,057.50 gross income. During this 5 yr time span, the *average* annual maintenance cost for the herd was $80/hd; however, doe A was de-wormed only twice yearly, had no other health costs, and her feet were only trimmed twice yearly for an estimated savings of $4/hd (5% below average) for a 'real' maintenance charge of $76/yr. This being the case, doe A cost $380 (76 x 5) over the five lactations. Consequently, does A netted $677.50 (1,057.50 – 380.00) for an average of $135.50/year.

In contrast, doe B averaged 160% kid crop weaned/sold; her 8 kids averaged 67 lbs at weaning (4 sold as Selection 1 and 4 sold as Selection 2) for an *average* of $1.70/lb each (shrunk wt….about 8% less than doe A kids). Thus, doe B generated sales of $884.00 (8 x 65 x 1.70) less $5/hd commission each on 8 kids = $ 844.00 gross income. During this time, doe B averaged $84/yr maintenance cost (5% over the average $80/hd cost) and, as a consequence, cost $420 for the five lactations. Thus, doe B netted only $424 (844 – 420) or $84.80/yr.

With approximately 10% more kids, 8% more kid value/lb, and about 10% lower maintenance cost, doe A netted $50.70/yr (135.50 – 84.80) more than doe B, or about **59% more/year** (50.70/84.80 x 100).

The moral of this tale is…10% better 'performance' led to nearly 60% more profit/head. Think about this when you are pricing breeding stock…*more can indeed be less*—at least in certain circumstances. Buying cheaper, 'untested/unproven' foundation stock can be dangerous to your economic health. Depending on phenotype to predict genotype is likewise dangerous; no scale, no record, no go….

Table 1. Break-even Selling Price per Pound for Kid Goats with Different Kid Crops Weaned, Doe Maintenance Costs, and Kid Selling Weights

Annual Doe Cost, $ per head	Breakeven Price, $/lb. (rounded to nearest penny)					
	Kid Crop Weaned					
	100%	125%	150%	175%	200%	225%
	Selling weight: 50 lb. per head					
50	1.00	0.80	0.67	0.57	0.50	0.44
55	1.10	0.88	0.73	0.63	0.55	0.49
60	1.20	0.96	0.80	0.69	0.60	0.53
65	1.30	1.04	0.87	0.74	0.65	0.58
70	1.40	1.12	0.93	0.80	0.70	0.62
75	1.50	1.20	1.00	0.86	0.75	0.67
80	1.60	1.28	1.07	0.91	0.80	0.71
85	1.70	1.36	1.13	0.97	0.85	0.76
90	1.80	1.44	1.20	1.03	0.90	0.80
	Selling weight 65 lb. per head					
50	0.77	0.62	0.51	0.44	0.39	0.34
55	0.85	0.68	0.57	0.49	0.43	0.38
60	0.92	0.74	0.61	0.53	0.46	0.41
65	1.00	0.80	0.67	0.57	0.50	0.44
70	1.08	0.86	0.72	0.62	0.54	0.48
75	1.15	0.92	0.77	0.66	0.58	0.51
80	1.23	0.98	0.82	0.70	0.62	0.55
85	1.31	1.05	0.87	0.75	0.66	0.58
90	1.38	1.10	0.92	0.79	0.69	0.61
	Selling weight 80 lb. per head					
50	0.63	0.50	0.42	0.36	0.32	0.25
55	0.69	0.55	0.46	0.39	0.35	0.31
60	0.75	0.60	0.50	0.43	0.38	0.33
65	0.81	0.65	0.54	0.46	0.41	0.36
70	0.88	0.70	0.59	0.50	0.44	0.39
75	0.94	0.75	0.63	0.54	0.47	0.42
80	1.00	0.80	0.67	0.57	0.50	0.44
85	1.06	0.85	0.71	0.61	0.53	0.47
90	1.13	0.90	0.75	0.65	0.57	0.52

Target Marketing of Slaughter Goats

Dr. Frank Pinkerton[1], Dr. Ken McMillin[2], Dr. Bob Herr[3], and Dr. tatiana Stanton[4]
[1]Langston University (retired)
[2]Louisiana State University AgCenter
[3]Nix Besser Livestock Company
[4]Cornell University

Preface

For several years we have provided Goat Rancher readers with information about various aspects of goat marketing: supply, demand, channels, import competition, pricing patterns, constraints, and opportunities. We have also documented the seasonality of our domestic goat supply and its recurring, adverse effects on prices received by producers.

Basically, our heaviest supply and lowest price months are Jul, Aug, Sep, and Oct, primarily due to large auction runs from extensively managed operations in western TX and other low rainfall locations. Beginning in mid-Nov, supply lessens and prices begin to rise, sharply so in Dec, and stay relatively high during the winter and until just after the two Easter dates. Thereafter, prices decline slowly toward the summer slump. (We are uncertain whether this decline is primarily due to slowly increasing supplies or to a diminution of demand-- probably both).

Certain price spikes occur even during the higher-price winter months as a result of more intense demand associated with holidays observed by large ethnic groups. Other price spikes are engendered in other months by non-religious holidays observed by other cultures and by certain Muslim holidays (which shift forward annually with the lunar calendar). See below for more detail.

Introduction

We define target-marketing as a management scheme in which portions of one's herd are bred to produce kids that will reach desirable age/weight/condition (as defined) for sale at a predetermined time, e.g., the winter quarter, or during a 7-10 day interval prior to a major, peak-demand holiday in any month.

We readily concede that target-marketing of slaughter goats may not be a logical strategy for all producers. Goat production, particularly that from large, extensively managed herds in low rainfall areas (with high spring/summer temperatures and reduced milk yield), is dictated mostly by agro-climatic conditions (seasonal availability of brush species, native grasses, and weeds; little winter shelter, erratic labor requirements/availability, and the traditional practice of 'natural' breeding time—year-round exposure to bucks).

Also, many producers in the Southeast (whether large or small) historically favor fall breeding/spring kidding mostly because of forage availability and, also, the convenience of pasture-kidding limits labor/facility needs. This practice does, however, almost ensure lowest selling prices for 50-70 lb kids as well as more costly parasite-control programs. Some portion of these producers should probably consider target-marketing as a more profitable option.

However, we feel that producers in those states closest to our largest ethnic populations (Washington, D.C., Philadelphia, NYC, NJ, CT, and MA) are probably best positioned to undertake target-marketing programs. Typically they are smaller, more intensively managed operations enabling the required closer control of their animals.

Too, these areas have relatively cheaper preserved-forage routinely available and can often provide economical by-product feedstuffs for supplementation. Moreover, the harsh climate enables somewhat better parasite

control than the warmer, more humid production areas to the south. Contrarily, they have a shorter growing season, more inclement weather, require more facilities, and may experience higher off-farm labor costs.

We acknowledge that successful target-marketing requires "out-of-season" breeding which is a marked departure from the more traditional fall breeding practice. We also concede that some portion of does, regardless of breed (or breeder claims), experience **anestrus** (will not cycle/come into heat) during some months of the year (spring seems to be the worst time). A high incidence of such behavior within a herd would make it difficult to meet certain target-marketing dates.

Contrarily, almost all herds, regardless of breed, contain some portion of does that cycle out-of-season. Such animals could be 'selected-out' for use in target-marketing programs. I am uncertain of the heritability of this trait, but suspect it, like other repro traits, is rather low.

In any case, does **can be induced to cycle** during a period of anestrus by using reproductive management procedures. Moreover, **cycling** does can be economically **synchronized** to produce groups of kids of similar age (3-10 days) for management and marketing convenience. Procedures for managing estrus are briefly described below.

Implementing a Target-marketing Program

To properly consider undertaking a target marketing program, producers must ask themselves certain questions and carefully evaluate answers, whatever the source. We illustrate below.

WHY should you do this program? To take advantage of the higher prices paid for slaughter goats during a certain season or month or religious or secular holidays throughout the year. Seasonal premiums typically exceed contemporaneous prices by 20-25% or more, while certain holiday premiums may also exceed their contiguous weekly prices by similar amounts.

WHEN are these premium prices paid? The winter quarter typically sees the highest prices paid during the year. Christmas and Easter (Roman and Eastern Orthodox) holidays bring even higher premiums as do Muslim and Jewish holidays and also some secular holidays. See Table 1 for a five year listing of these holidays; see also www.interfaithcalendar.org for more detail.

WHERE are the major sales venues for these holiday venues? Co-author Herr identifies the New Holland, PA auction as the largest such venue, but notes additional venues along the eastern seaboard, Southeastern states, and 'corn-belt' states which have regional and local auction barns, long known to experienced producers. Caveat: there is some 'turnover' of these sites, particularly the smaller ones, and, too, sufficient buyers are not always present at some of them.

Traders/brokers also work many of these areas seeking private-treaty transactions. Moreover, certain states have 'buying stations', public or private, for collecting/purchasing goats. Their presence is known to experienced producers, and some of these units advertise in agricultural trade publications. Additional buying sites are described at www.sheepgoatmarketing.info.

Some portion of goats purchased at these smaller, more remote locations in the Midwest and Southeast move directly to the larger packers in NJ, PA, and NY or to local/regional packers. Most of the remainder (together with some from TX, OK, MO) passes through the New Holland Sale with substantial numbers going to small packers serving specific clientele with rather particular needs and also to entrepreneurs stockpiling goats and sheep for direct-marketing to 'walk-in buyers' at their small holding facilities.

Producers should understand that prices paid at New Holland (current or 'expected') seriously influence prices offered at the more remote sales venues where the buyers necessarily factor-in transportation costs, shrinkage, death loss, and, of course, profits).

Producers should also be aware that New Holland premium prices paid for the high-demand holidays may suffer occasional, but sharp downturns because unexpected surges in supply may exceed demand for certain live weight classes. Gambling on supply/demand at Easter can be particularly fraught.

Caveat: unlike most regional auctions, New Holland still sells goats (and sheep) on a per-head basis, not per-pound. Co-author Herr and others have sought to get this practice changed, but to no avail. This situation is thought to benefit buyers to the detriment of sellers and producers, but the owners remain unmoved to date.

WHAT are the preferred characteristics of holiday kids? We recognize that producers considering target-marketing must have reasonably reliable information about the *preferred* physical characteristics of goats demanded for specific holiday markets. However, in the real world of goat marketing, there is considerable variation ('acceptable flexibility') in these optimum characteristics as affected by specific venue, the ethnic diversity of the buyers present, and the shifting supply/demand patterns as the sales progress.

Generally speaking, 'holiday-market' goats need to be 'clean', in good body condition, and have desirable body conformation/grade (not less than a mid # 2, but preferably higher). Optimum weight ranges, ages, and sexes are described for certain of the major holidays at www.sheepgoatmarketing.infoNote therein the specific proscriptions against certain characteristics of age and sex and weight range; goats failing to meet such specific demand characteristics will be considered 'unacceptable' (although they may well be taken, but at appreciably lower prices, for alternative uses, or by less discriminating buyers filling pressing individual orders).

HOW do producers plan and execute breeding programs to achieve target-marketing goals? **First**, of course, you decide the holiday date to be targeted.

Secondly, you subtract 7-10 days to get a ***delivery date*** *to the sales venue* (this will allow necessary time for selling, transporting, slaughter/processing, and delivery to retail venues just in time for the actual holiday sale date).

Thirdly, you identify the *permissible* ***weight range*** *to be achieved* in time for the targeted delivery date.

Fourthly, you estimate the average daily gain (adg) your kids are *likely* to achieve, birth to sale date. (On-farm experiences have found that the adg of well-bred, well-managed kids will typically be about .4 lb with a range from .33 to .50 lb, depending on birth size, litter size, sex, available milk, supplemental feeding program, length of growing period, and health status. If you know the typical adg of your prior kid crops, use this figure rather than the estimated .4 lb).

Fifthly, calculate the number of days, birth to sale time, needed to grow newborn kids to the mid-point of the desirable weight range. To illustrate, suppose the targeted weight range is 50-70 lbs with a mid-point of 60 lbs. Subtract the average birth weight of your kids (male and female), say, 7 lbs from 60 lbs = 53 lb of gain to be achieved. Divide 53 by .4 (expected adg) = 132 days required to grow the kids from birth date to sale date.

Sixthly, calculate the required average kidding date needed by subtracting the needed 132 days from the sale date.

Seventhly, count backward from the kidding date 150 days to determine the average breeding date needed. Ideally, you would like for all the does to be bred on this date, plus or minus a few days. Can a two-week 'breeding window' be realized in actual practice? No, not absolutely, but… you can come surprisingly close using well-researched reproductive management practices, as described below.

But first, *an important caveat*; none of us are Veterinarian or specialists in reproductive physiology. Therefore, for those readers seriously contemplating the use of estrus management techniques as generally/briefly described below, we suggest you review the latest Update on Estrus Synchronization in Goats: A Minor Species (J. Anim. Sci. 2004), authored by N.C. Whitley and D.J Jackson, U MD-Eastern Shore.

Dr. Whitley may be reached at nwhitley@umes.edu or 410-651-61994 for a copy of this publication and for further assistance if/as needed. In the meantime, we offer certain information concerning the twin topics of synchronizing estrus in cycling does and inducing estrus in anestrus **(**non-cycling, aka out-of-season breeding) does.

Experienced breeders sometimes use the well-known 'buck-effect' phenomena to good advantage in scheduling tight breeding intervals. In this scheme, the buck is first separated from the cycling does for at least 4-6 weeks, or longer, prior to the expected breeding period (isolate him beyond sight, hearing, and, if possible, *smell*). Thereafter, he is introduced to the (cycling) does 5-7 days prior to the chosen 'breeding window'; a few days thereafter, many of the does will begin to exhibit estrus and breed within the chosen interval; 60-80% conception rates are typically achieved. (Those that do not breed will usually return to estrus in 20-21 days and can join a subsequent breeding group).

Breeders wishing to tighten the programmed breeding interval and/or perhaps to improve conception rate within the chosen interval can use an endocrine treatment to *synchronize* estrus cycles (with/without using the buck-effect). The most common pharmaceutical so used seems to be dinoprost tromethamine, trade name Lutalyse, available from Pfizer or via Veterinarians. There are, of course, additional options, each with varying rates of success (none are a 'sure-thing', but conception rates of 70-90% are reported).

The pharmaceuticals necessary to *induce estrus* in anestrus does are much harder to come by, at least in the U.S. Not very long ago, a commercial product, SynchroMate-B (norgestomet, one of a number of pharmaceuticals called progestogens) was successfully---and legally--- used to induce estrus in anestrus sheep; it also worked well in goats and was widely used in artificial insemination and embryo transplant programs. It is no longer being manufactured; I don't know why.

However, a number of intravaginal progestogen sponge products and CIDRs are successfully used worldwide for inducing estrus in anestrus goats. Unfortunately, none may now be legally used here except for 'experimental' purposes by researchers.

Contrarily, some hope for producers may be on the way. The nation's largest pharmaceutical company, Pfizer, received approval 10-3-06 from the Food and Drug Administration, Center for Veterinary Medicine, for its new CIDR vaginal implant under the name (trademark), Pfizer Progesterone EAZI-BREED CIDR Goat Insert.

However, follow-up our inquiries to Pfizer sales representatives have elicited little, if any, information on product availability/price. Insofar as we can tell, the product is still unavailable, for whatever reasons, except to research professionals…bummer. We will update readers as developments permit.

Alternatively, for those producers wishing to do out-of-season breeding, our dairy goat brethren have a considerable history of successfully using artificial lightening (combined with 'buck-effect') to enable spring breeding for increased fall kidding (to obtain 'year-round' milk for cheese-making and retail milk markets). However, we concede that time, labor, or housing constraints might make such a program difficult, if not impossible, to implement by some producers. See once again the repro article described above for more detail and possible combinations of light manipulation and pharmaceuticals (nwhitley@umes.edu).

FYI, my PVAMU colleague, Dr. Louis Nuti, and I conducted a research/demonstration project in 1982/3 to evaluate the effects of 'lighting' non-lactating Alpine and Nubian does **(and bucks)** during Jan and Feb

for 16, 20, and 24 hours/day; our 'control' group got only natural diurnal light. We abruptly put all groups back on natural lighting on 1 March and introduced the 'lit' bucks to their doe groups in mid-April.

Romance flowered almost immediately and does kidded in a very close time-span some five months later. The observed kidding rates for the light treatments were: 2/24 for the control group (8%), 11/24 for the 16 hr group (46%), 20/24 for the 20 hr group (84%) and 18/24 for the 24 hr group (75%); imperfect, but quite useful.

We originated this comparative study to confirm large-scale commercial dairy goat experiences in WI (20 continuous hrs/day of artificial lighting in Jan/Feb which achieved kidding rates of 80%-plus across years) and in CA (24 hrs of lighting over hay bunks and adjacent covered loafing area). We found CA kidding rates and intervals to much more variable (not so closely grouped and scattered over a longer time period) following the introduction of the bucks than in WI.

Despite intrepid effort, my on-site evaluation/explanation of this curiously lower performance was unsuccessful---at least until the night-herder, Sr. Juan Garcia, called my attention to the fact that an indeterminate number of does in the 600 head herd 'usually' ate little at night and 'always' seemed to prefer sleeping as far away from the (unfenced) lighted-site as possible. Having 'found' the cause of the problem (improper light exposure), my scientific reputation was quickly rehabilitated.

HOW to calculate expected cost-benefit ratios of a prospective target-marketing scheme? First, sharpen your pencil, locate your calculator, find a comfortable, silent workplace, send the spouse/children to the Mall, and proceed with an open and inquiring mind using IRS returns and/or your private-- possibly more accurate-- accounting records. If such records are incomplete, creative analysis may be required; if not possible, you, too, could go to the mall.

In any case, try to determine the cost-benefit ratio of your most recent kidding scheme/marketing strategy. This may be a novel (but not less necessary) undertaking for some of you. The bottom-line calculation is, of course, how much did you really net per doe or per kid sold last year? If you can't come up with a reasonably reliable figure, there is not much incentive to proceed further; the mall awaits.

However, if you can derive such a usable figure, you can proceed apace by next assessing the likely costs to be incurred if you should change your kidding scheme to pursue a particular target-market. Thereafter, estimate the likely income to be received from selling into the (usually higher-priced) targeted market. The difference between the two computations will be the estimated net from the new scheme.

You may at this time consider certain options…..go for it, don't go for it, herd reduction, breeding-herd dispersal, alternative hobby livestock/poultry/exotic wildlife, golfing, crocheting, etc. Should you elect to go for it, however, I would be pleased to be apprised of your decision and, later, the results. Were they positive, I would applaud your sterling entrepreneurship; were they negative, I would applaud your daring risk-management. In either case I would sincerely appreciate your efforts.

Variations in Prices Received for Slaughter Goats

Dr. Frank Pinkerton
Langston University (retired)

Introduction

This article was written for producers interested in goat pricing patterns, their causes, and their influence on seasonal marketing opportunities. It also suggests that one can predict, with due caution, what prices are likely to be in the near-term future based on current and previous pricing levels and trends.

Experienced producers of slaughter goats are well aware that the prices they receive at local and regional auctions vary widely across time and place. Since the advent of the live-grading and pricing report systems at many of the larger, regional venues a few years ago, the USDA/Agricultural Marketing Service has published weekly sales prices for goats via Market News Reports from certain of these markets. The prices are most often quoted on a per-pound basis, but, at a few auctions (most notably the New Holland, PA regional auction) they are still quoted on a per-head basis. Both quotation methods present high/low ranges of prices for live-grades, but neither provides arithmetic or weighted averages….bummer.

We have accessed the Market News Reports from Producers Livestock Auction in San Angelo (some 200,000 goats annually) and, for certain comparisons, the New Holland auction (under a 100,000 annually) via the USDA Livestock & Grain Market News Portal to obtain weekly/monthly Reports for CY 2004 through CY2007. We have sifted the data to identify sources of variations in prices received and, secondly, to discover recurring patterns of price responses.

You may access the weekly Reports from San Angelo at www.ams.usda.gov/mnreports/sa_ls320.txt ; for New Holland: www.ams.usda.gov/mnreports/LN_LS320.txt; for Nashville: www.ams.usda.gov/mnreports/nv_ls320.txt.

Note that prices are reported in ranges which we convert to averages for use in constructing Figures 1-9 in this paper. Over the years, we have observed that the typical price range, top to bottom, to be about 12-14 cents with most of the goats selling rather close to the mid-points (calculated averages).

As you will see in the accompanying figures, prices vary across years, months, and venues as well as by live grades and categories of selling weights. These variations are the result of supply/demand ratios existing at any given time and place for numbers, grades, and weights of slaughter goats on offer.

Remember, in classical economic theory, there is always the assumption of 'sufficient supply' and 'adequate demand' at any given marketplace, and the prices paid/received therein merely reflect the equilibrium between these two market 'forces'. However, goat producers are all too familiar with non-theoretical, real-world situations in which localized demand (too few bidders) or over-supply (too many goats on a given date) causes them a world of hurt. It is not particularly comforting to know that, historically, this is a recurring fact of goat ownership; one necessarily lives with it.

Sources of Price Variation

Seasonal variation in prices received is most conveniently demonstrated by 'graphing' the numerical four-year ('04/'07 average) monthly prices, as shown in Figure 1 (Figures for '08 do not differ appreciably). Note the wide price differences received across the year for Selection 1 goats weighing 40-60 lb (other grades and weights behave quite similarly). Following summer/early fall lows, prices begin to rise in November, go a bit higher in Dec, increase some in Jan, and increase sharply in Feb reaching annual highs in Mar or Apr (depending somewhat on Easter time). Prices typically fall off a bit in May, and then comes the 'June-

swoon'; thereafter, prices remain low during the summer and into Oct. Over the past decade we have found that winter highs may exceed summer lows by 25-30%, occasionally more at various venues.

Although we don't show the numbers of goats sold in Figure 1, the prices paid rather closely reflect the quantities of goats on offer across any given week/month (the fewer the goats, the higher the prices). The production of goats in TX is highly seasonal, most kids being born Dec/Mar with another, smaller wave in late spring; other, colder states show late spring highs. In the Southeastern states, late Feb/late Apr kidding is the norm…mostly a matter of forage availability, but also due to owner preferences for warm weather/outside kidding). Kids are typically sold as warm-season forages are depleted by late fall. Consequently, these combined management practices combine to cause the recurring July/Oct price lows and winter highs due to imbalances in supply/demand.

Annual variations in prices paid occur over time because of different supply/demand ratios then prevailing. Figure 2 documents this variability across the years, '04/'07. Note that no matter the degree of variation between each of the years, the seasonal pattern described above recurs across all four years. FYI, '06 and '07 were abnormally dry years which resulted in more goats coming on the market with concomitant lower prices in the summer than in '04 and '05 when range moisture was better. Since demand apparently remains fairly stable in the face of varying supply numbers, prices rise/fall accordingly.

Figures 1 and 2 use monthly-average figures to illustrate seasonal and annual variation in prices paid. These figures are the numerical averages from the number of Sale events in any given month (each may contain 2-5 weekly reports, depending on calendar configuration and the number of holiday-induced, or other, auction closings). Figure 3 graphs the weekly gyrations within the months in CY 2007. As is apparent, there is an element of 'gambling' in choosing the 'best' week of any given month to market one's goats. Long observation has led us to believe that late Jan, early May, late Nov, and early Dec are preferable in those months; otherwise, it seems to be a crapshoot.

Price variations due to live grade: experienced producers are well aware that, within weight categories, Selection 1 goats bring a premium over Selection 2 goats which, in turn, bring more than Selection 3 goats. Figure 4 conveniently documents these price relationships across CY 2006 and 2007. It has been a very repeatable pattern since the beginning of graded sales and Market Reporting, but, over the years, we have noted a tendency for prices for Selections 1 and 2 to move 'closer together' in times of short supply/higher prices. Contrarily, when summer supplies are high relative to demand (thus causing prices to drop), Selection 2 and 3 prices tend to move closer together as buyers 'cherry-pick' Selection 1 goats while paying noticeably less for lesser goats.

Price variations due to sale weight: experienced producers are also aware that, at given grades, certain weight categories bring higher or lower prices. Table 5 conveniently documents such price responses to Selection 1 goats during CY 2006 and 2007. Goats weighing 40-60 lb typically bring a relatively small premium price over those weighing 60-80 lb. However, this premium may all but disappear when demand is high; as a result, prices are often reported for 40-80 lb goats as a single category.

Goats in the 80-100 lb category sell for significantly lower prices/lb than lighter goats. It is not just size differential alone, but rather a negative response to degree of fatness. Remember, internal fat deposits are not salable; this effectively lowers the 'dressing percent' of overly-conditioned goats. Do note that in the general summer price slump due presumably to lower demand, prices for the three weight categories tend to 'cluster' much closer together.

Price variations due to sale venues: in an earlier article (Goat Rancher, 2006), we documented the levels of prices paid for goats of similar weight and live grade at six regional auction sites. We now reproduce certain of that information here to demonstrate the range of prices paid as between San Angelo, TX, Nash-

ville, TN, and New Holland, PA. As documented in Figure 6, prices are lowest at San Angelo, intermediate at Nashville, and highest at New Holland.

These price differences are thought primarily due to differences in hauling costs from these three sites to the major packing plants in NJ, NY, and PA. However, there are some differential responses to weight categories also; see figures Tables 7 and 8 showing disproportionately higher prices for the smaller 20-40 lb goats in New Holland than in San Angelo. This premium is thought to reflect localized ethnic preferences for small goats, especially for certain holiday trade.

It is also of interest to note that the price differences between 40-60 and 60-80 lb goats are relatively larger in PA, reflecting, we think, the Muslim preference for 'smaller' goats. Note also the heavy discrimination in San Angelo prices for goats over 80 lb (although not shown in the figure, New Holland prices follow suit).

Figure 9 contrasts the price differentials for Selections 1 and 2 goats paid at San Angelo and New Holland. It appears that the spreads between grades 1 and 2 are wider in New Holland, reflecting relatively higher ethnic demand for grade 1 animals in New Holland.

Caveat, readers: San Angelo Auction personnel unload each seller's goats into separate pens. At Sale time, personnel do an alley-sort of 'the pen' into groups of nannies, bucks, and slaughter kids. If the group of slaughter kids is large enough, they then sub-sort it into weight groups, and, if one or more of these groups is big enough, they rough-sort it by Selection grade. In no case are the goats of two or more owners commingled; this would require individual goats to be tagged and add tremendously to the book-keeping chores, thus increasing commission charges and slowing Ring flow appreciably.

In Nashville, the goats are 'roughly' pre-sorted by Selection grade with the result that each sale group may be composed of, say, mostly #1 goats with a few borderline #2; an offering of mostly #2 goats may have a few borderline #1 or borderline #3. In New Holland, the goats are usually pre-sorted by weight groups which typically contain varying proportions of grades 1-3. (Remember, NH sells on a per-head basis, not per-pound).

At each Sale venue, USDA Market Reporters observe (for hours on end) the offerings being sold and evaluate/decide price responses across grades and weight. There being no 'magic measuring-machine', their accuracy is a function of their experience and capability; so also with packer-buyers and order-buyers.

Caveats to readers: mathematically speaking, historical trends are 'reasonably predictive' of future trends only if short-term situations do not exhibit substantive, 'abnormal' conditions, i.e., sudden, unusually sharp deviations from the 'norm'. Accurately predicting goat prices at time and place in the short-run requires a certain degree of faith-based confidence in one's ability to discern the unknown; to take action on this assessment-of -probability requires a bit of the gambler mind-set. (Like Kenney Rodgers sings, you gotta know when to hold 'em and when to fold 'em).

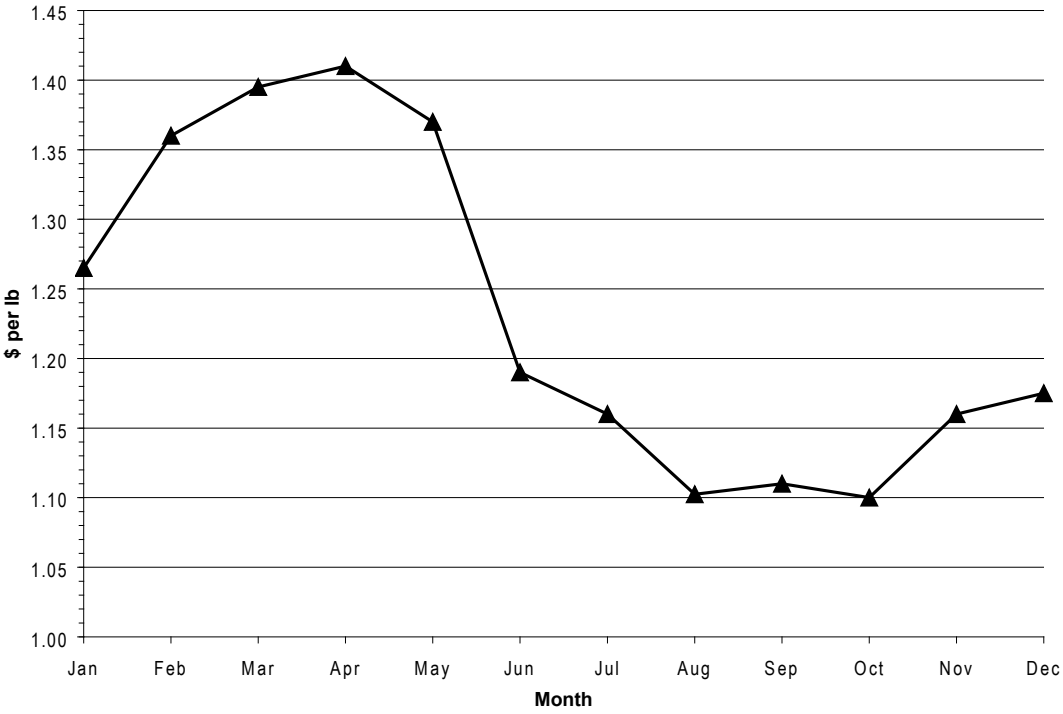


Figure 1. Average Seasonal Variation in Slaughter Goat Prices: Selection Grade #1, 40-60 lb Live Weight, 2004/2007, Producers Livestock Auction, San Angelo, Texas.

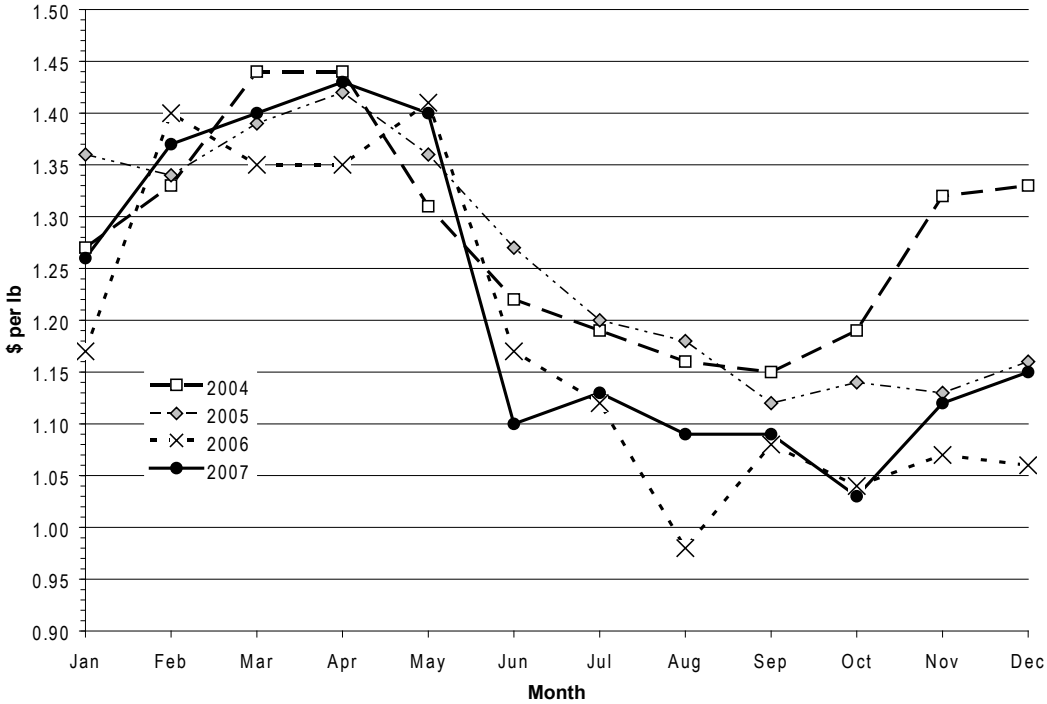


Figure 2. Annual Variation in Slaughter Goat Prices: Selection Grade #1, 40-60 lb Live Weight, 2004/2007, Producers Livestock Auction, San Angelo, Texas.

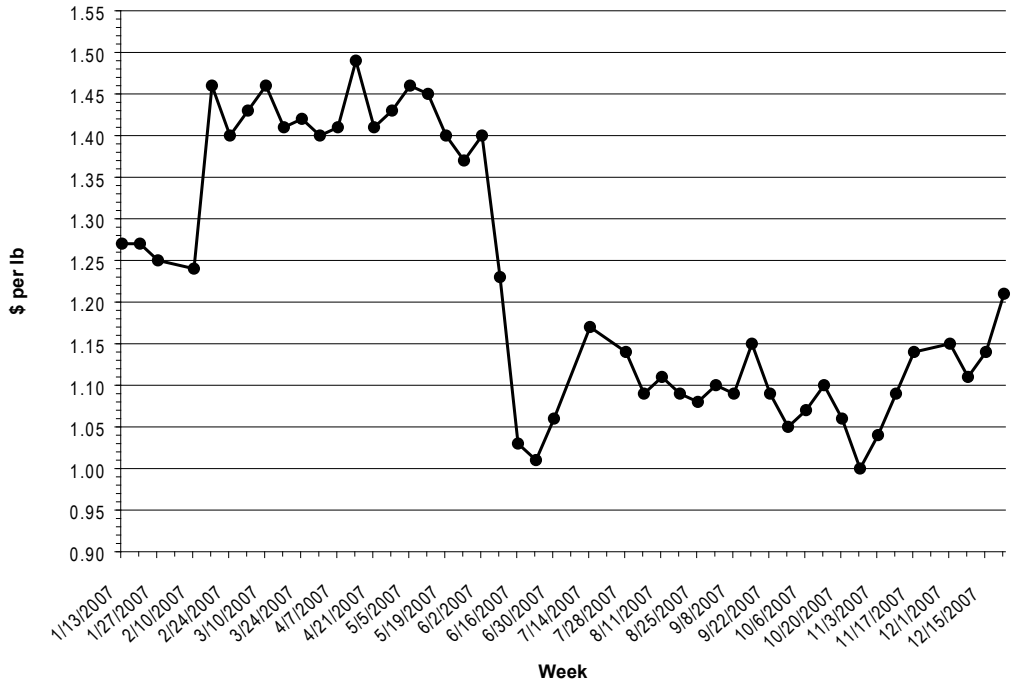


Figure 3. Weekly Variation in Slaughter Goat Prices: Selection Grade # 1, 40-60 lb Live Weight, CY 2007, Producers Livestock Auction, San Angelo, Texas.

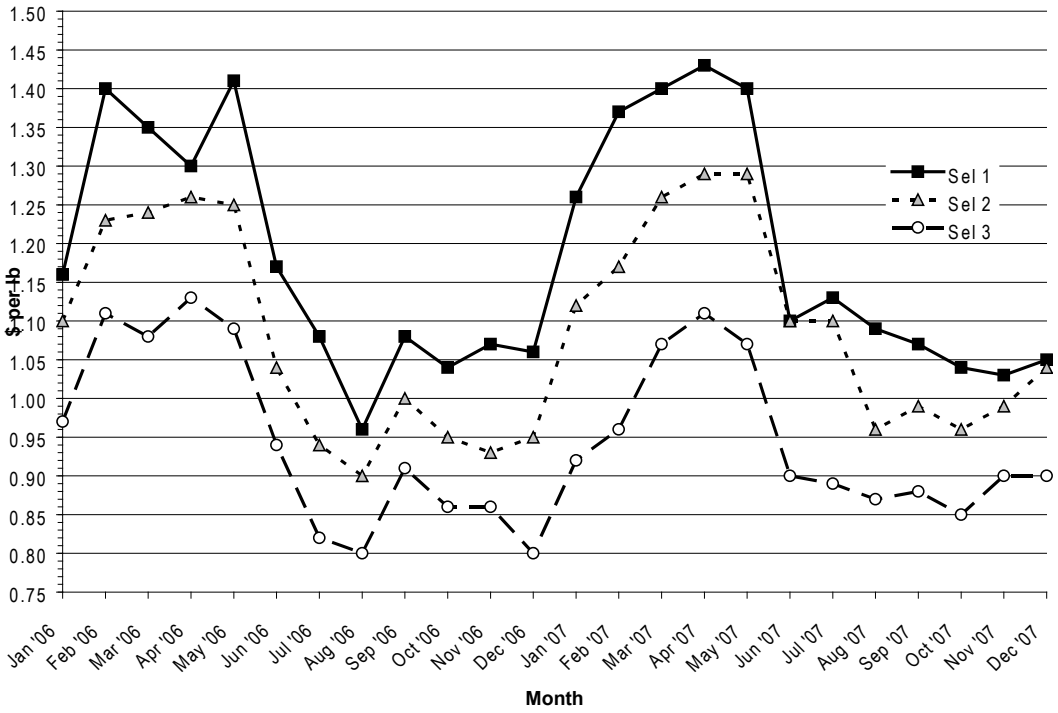


Figure 4. Variation in Slaughter Goat Prices Due to Live Grade, 40-60 Live Weight, CY 2006/2007, Producers Livestock Auction, San Angelo, Texas.

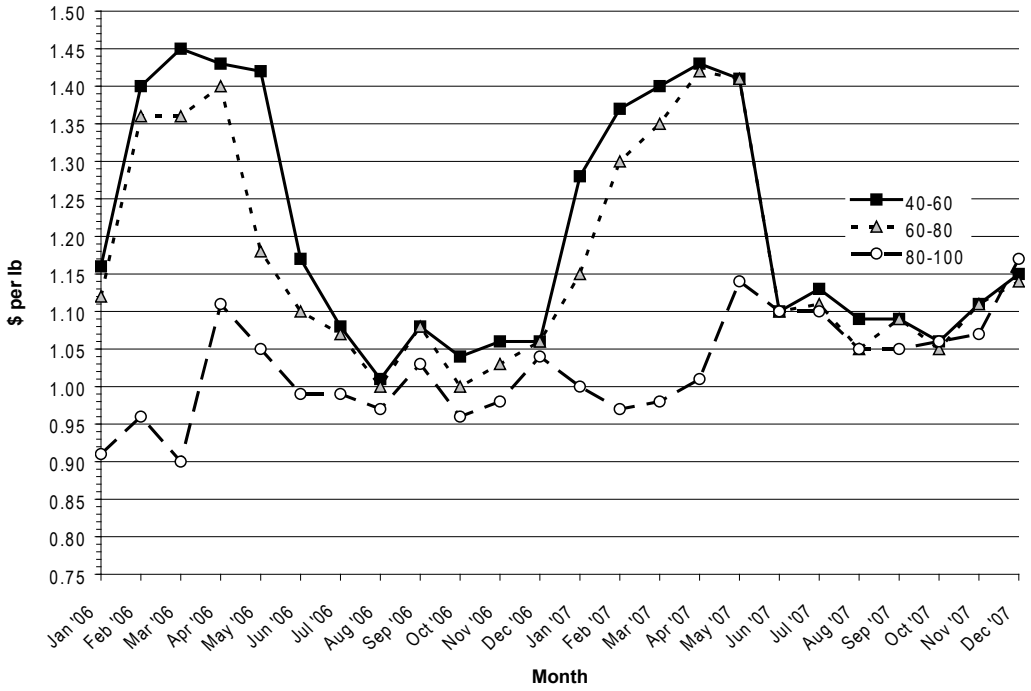


Figure 5. Variation in Slaughter Goat Prices Due to Sale Weight Category, Selection 1, CY 2006/2007, Producers Livestock Auction, San Angelo, Texas.

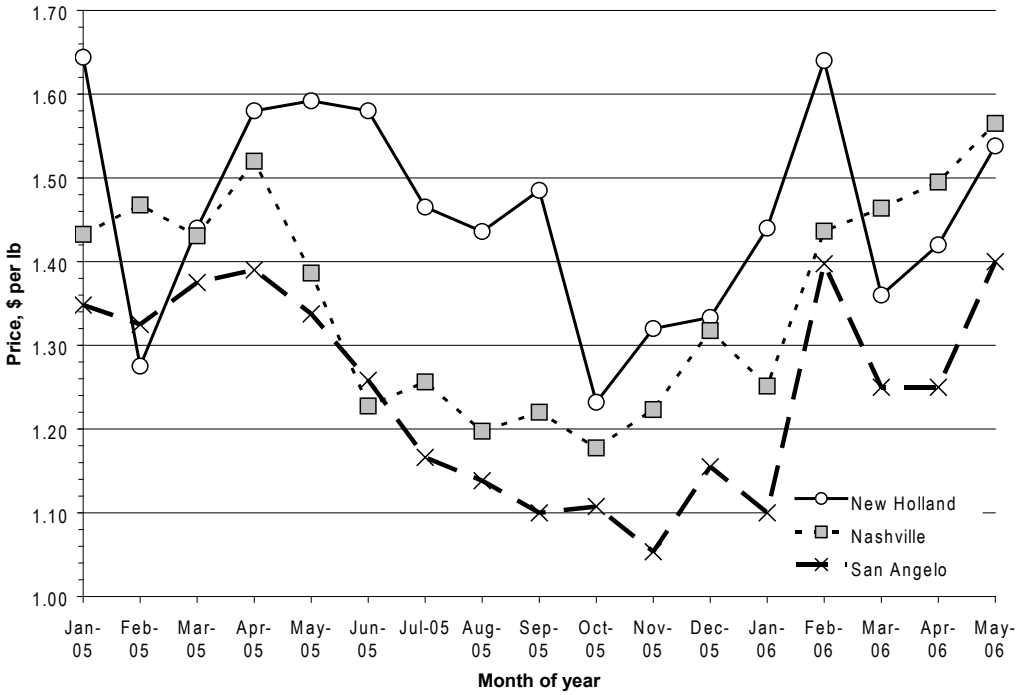


Figure 6. Reported auction prices on a $ per pound basis for San Angelo, Nashville, and New Holland for January 2005 through May 2006 for Selection 1 kid goats weighing 40 to 60 pounds.

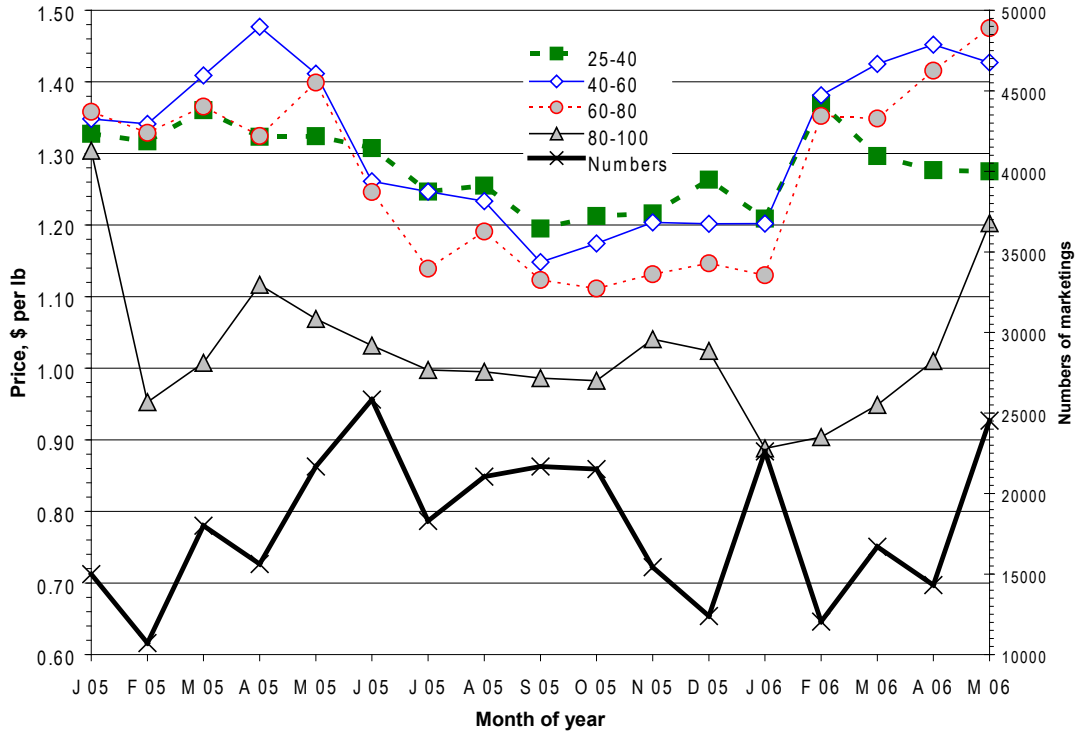


Figure 7. Reported auction prices at San Angelo for different weights of Selection 1 goats and the number of marketings each month.

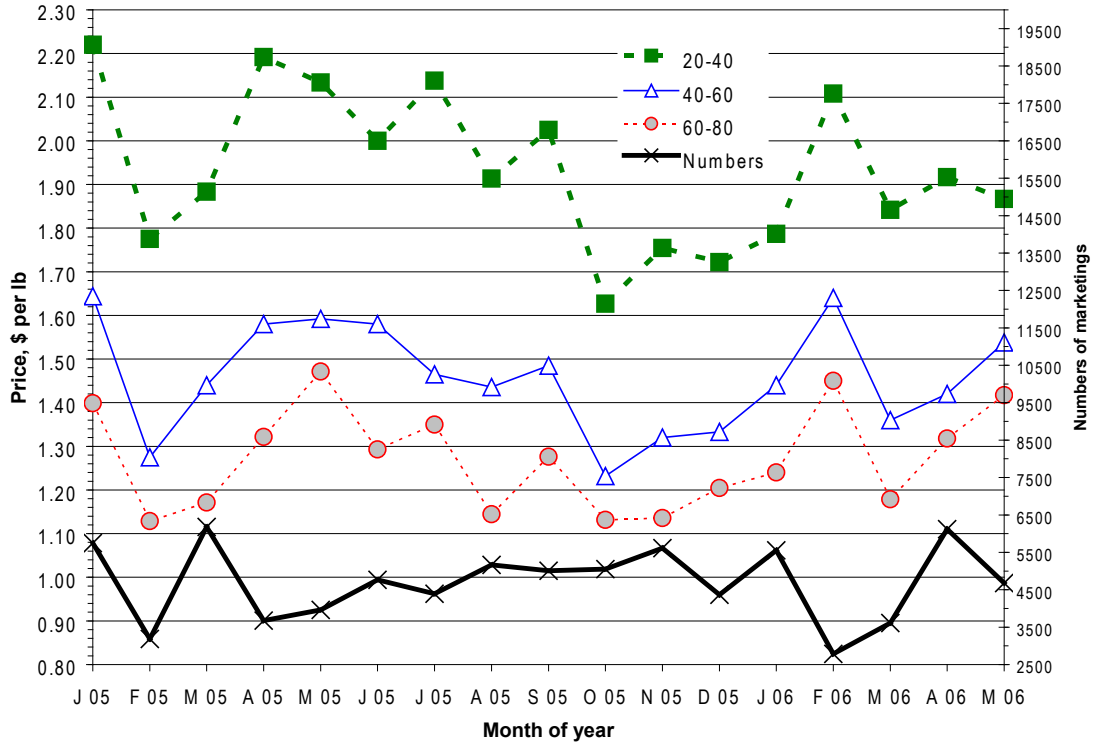


Figure 8. Reported auction prices at New Holland for different weights of Selection 1 goats and the number of marketings each month.

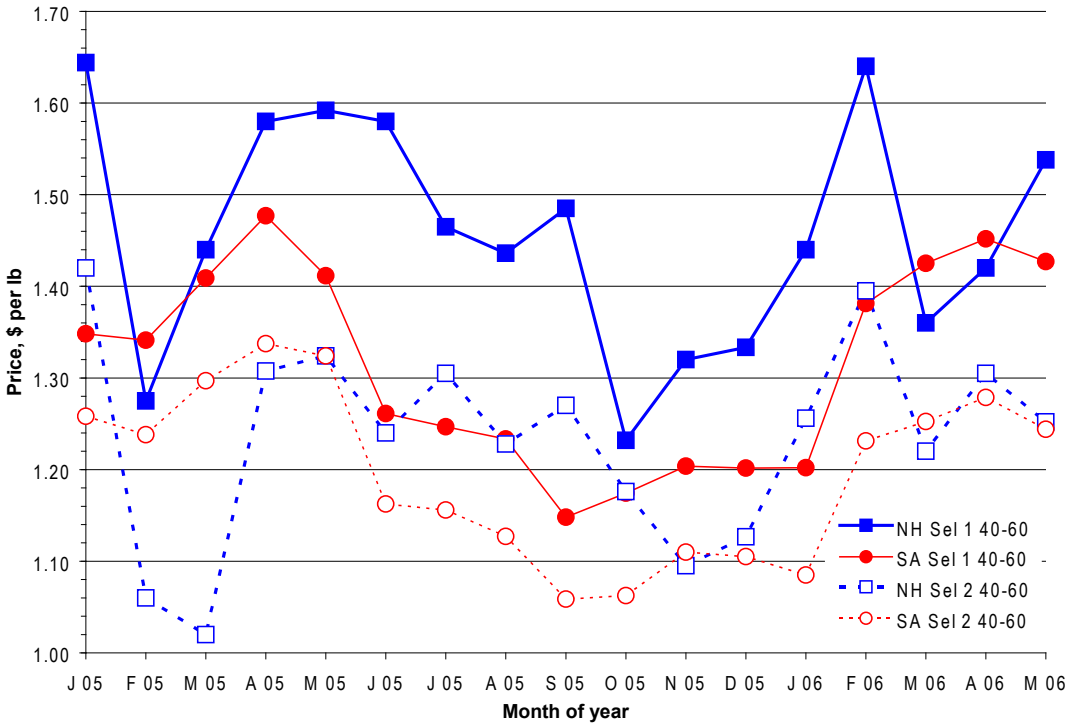


Figure 9. Auction prices at New Holland and San Angelo for Selection 1 and Selection 2 kid goats weighing 40 to 60 pounds.

Meat Goat Herd Health Procedures and Prevention

Dr. Lionel Dawson
Oklahoma State University

Introduction

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

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

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

Common Herd Health Procedures

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

Taking temperature – rectally

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

Pulse or heart rate

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

Respiration

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

Rumen movements

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

Checking mucous membranes

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

Drenching and dosing

Drenching or dosing an animal entails the oral administration of a liquid. The obvious goal of this procedure is to ensure that the animal swallows the full amount given. Grasp the animal under the jaw to raise its head. Raising the head of the animal will assist in ensuring the liquid is swallowed. A finger or thumb can be put into the mouth where there are no teeth (goats lack canine teeth as do all ruminants) to assist in opening the mouth for the drenching equipment. Generally a bottle with a tube over the end or a drenching gun is used. Liquids should be given slowly to allow time for the animal to swallow. Dewormers must be given using appropriate drenching equipment ensuring that they are given over the back of the tongue and swallowed.

Tubing an animal

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

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

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

Another check can be done while midway down the trachea/esophagus is to suck on the end of the tube. If you are in the esophagus, it will collapse on the tube and you will create a vacuum. Alternatively, blow in the tube and you will see a bolus of air go down the esophagus. If using a stethoscope applied to the goat's rumen on the left side of the body, you will hear air bubbling. Sucking on the tube while it is in the rigid walled trachea will not create a vacuum. One can also check for the smell of rumen fluid to ensure correct placement. To ensure proper depth of penetration, place the tube along the outside of the animal stretching from the mouth to the last rib, a point that would be inside the stomach, and put a mark on the tube. Use this as a guide when inserting the tube. Never rely on the goat coughing as a guide to proper tube placement. It is not a reliable test.

Bolus administration - "Balling"

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

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

Paste administration

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

Giving injections

Administering drugs via injection is a common herd health procedure routinely practiced by almost all producers. Following proper guidelines for each type of injection and using proper equipment will ensure that injections are done correctly and inflict minimum stress on an animal. Proper sanitation will ensure that you don't inject bacteria into your goat and cause an infection. Dirty needles and syringes should never be

used. Using needles and syringes on multiple animals can transmit disease. After making six to ten injections with a needle it will be dull and should be changed and disposed of properly.

Needle selection

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

Proper injection sites

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

Common injection methods

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

Subcutaneous injections

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

Intramuscular

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

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

Intravenous

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

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

Minor Surgical Procedures

Castration

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

Some producers may delay castration until bucks are 2 to 3 months of age. This may lessen the incidence of urinary calculi or bladder stones (see the Goat Diseases section) in animals on a high grain or concentrate diet. Also, remember that intact bucks have high levels of testosterone which acts as a growth promotant and stimulates the production of lean muscle mass. Many goat meat consumers that eat young goats do not care if the meat comes from intact or castrated males. There are some ethnic markets that actually prefer meat from mature bucks. Know the market in your area. The point being that if it is not necessary to castrate goats for marketing purposes, then don't. However for breeding purposes realize that some bucks are fertile and ready to breed by 3 months of age and unwanted males should be castrated or separated from fertile females. In most climates photoperiod effects keep this from being a practical problem until kids are 9 to 12 months of age. In general, castration at an early age is the normal practice to reduce shock to the animal. Older animals should receive some type of anesthesia prior to castration and a veterinarian consulted.

Dehorning

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

doing the job, a disbudding box offers the best and safest restraining device. Approximate dimensions are given the accompanying illustration.

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

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

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

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

Lancing abscesses

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

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

Since pus is infectious to other animals and humans, wear gloves when performing this procedure. Remove any remaining hair from the region. Scrub the area with disinfectant soap (Betadine Scrub®) and restrain the goat. If this is done correctly it is not a painful procedure for the goat. Take a pinch of skin in the center of the abscess with your gloved hand or a surgical tool (such as a towel clamp) and stab a scalpel or sharp, sterilized knife blade deeply into the abscess and cut out a circle of skin. Just slashing the abscess

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

may allow the cut to seal over before the abscess has healed from the inside out. There will be some white, or greenish white, odorless puss come out of hole created in the abscess. Catch it in a disposable bag and dispose of it where other goats can't get into it. Caseous lymphadenitis is a contagious disease. It is also a zoonotic disease, meaning it can be transmitted to humans, so wear gloves and sanitize your hands and equipment used after this procedure.

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

Normal Range for Goat Physiological Parameters

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

Extra-Label Drug Use

There are few drugs for use in goats that have Food and Drug Administration (FDA) approval. Administering any drug not specifically labeled for use in goats or any product, either prescription or over the counter, that is not used as directed on the label is considered "Extra-label" or "off-label" drug use. Only veterinarians may prescribe or use products "off-label" or "Extra-label" provided they have a valid veterinarian - client - patient relationship (VCPR) with the producer.

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

Most goat producers are unaware that they do NOT have "extra-label" drug use privileges. Only veterinarians who have established a VCPR with a particular client may prescribe or use drugs in an extra-label

manner on that client's animals if the animal health is threatened and suffering or death may result from failure to treat. To establish a VCPR, the veterinarian should have visited the farm, and have a thorough knowledge of the management of these animals, or has recently seen the animal to be treated. Once a VCPR has been established, the veterinarian may use drugs in an extra-label manner provided that the client has agreed to follow his or her recommendations.

Three conditions of extra-label drug use:

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

FDA criteria for Using Pharmaceuticals Extra-Label

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

1. The veterinarian must first examine the animal and assumes responsibility for making clinical decisions regarding the health and treatment of the animal within the guidelines of a VCPR. Often a goat owner will not have the animal examined by a veterinarian, but will telephone a veterinarian, who may never have visited the farm, with a list of symptoms and ask for a recommended treatment. This does not qualify as VCPR!
2. The second criterion requires that the veterinarian determine there is no marketed drug specifically labeled to treat the diagnosed condition, or that the recommended dosage on the label for that product is clinically ineffective. Since there are few drugs labeled for use in goats, it is not difficult to determine whether or not there is a legally licensed product available.
3. The third criterion requires that the individual animals to be treated are clearly identified, and that accurate records be maintained regarding the treatment of those specific individuals. If there is no permanent identification such as an ear tag, notch, or tattoo, the owner must make some effort to identify the treated animals with a visible temporary mark by using temporary tags or paint. If possible, these animals should be isolated. Records on animals and treatment must be kept for future reference to avoid any drug residues in the meat or milk.
4. The fourth criterion requires that a significantly extended time period be assigned for drug withdrawal prior to marketing meat or milk from treated animals. The owner must keep accurate records of the treatment, namely the person treating this animal, date, route of administration, product used and a proper withdrawal period. Proper withdrawal period can be obtained from your veterinarian. Veterinarians can access drug information at the Food Animal Residue Avoidance Databank, http://www.farad/org.
5. Many goat owners casually treat their animals and do not keep proper records of animals treated, drugs used, or proper withdrawal period for that product. If no information is available to establish a withdrawal time, then the treated animal or animal products such as milk and meat are permanently barred from the human food chain. This is to prevent illegal drug residues in products for human consumption. Although there are no drug residue test kits marketed specifically for goat meat, owners should be aware that drug residue testing is conducted on milk and meat produced for human consumption.

6. The last criterion details the information that must be listed on the drug dispensed for extra-label use. The label should include the name and address of the veterinarian, the established name of the drug(s), and the specific directions for use including: dosage, routes of administration, frequency of treatment, duration of therapy, cautionary statements, and the withdrawal time for any food that might be derived from the treated animal.

Ten Drug Use Tips

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

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

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

Medications Commonly Used in Goats and Approximate Withdrawal Times

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

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

Herd Health at Different Production Stages

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

Pre-breeding

Breeding does

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

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

Breeding bucks

Bucks are too often neglected and omitted from herd health management practices. Some of the common conditions seen in bucks are urinary calculi (stones), lameness, urine scalding around the prepuce, and front leg injury due to a dominant buck in the pen. In the case of urinary scald, wash the affected area. Application of petroleum jelly can help protect the affected areas. Maintain a 2:1 ratio of dietary calcium to phosphorous and provide a high level of salt (up to 4%) and 1 to 2% ammonium chloride in the diet to prevent urinary calculi. Bucks should be vaccinated at the same time as the does and for the same diseases. Body condition and breeding soundness should be evaluated at least 4 weeks before the breeding season and adjustments made to prevent bucks from becoming overly thin or obese. As breeding season approaches, extremely aggressive and dominant bucks may need to be penned separated to prevent injury. Monitor fecal egg counts in bucks or FAMACHA score and deworm as needed.

Breeding Season

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

Gestation

Pre-parturition

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

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

Parturition (kidding)

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

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

Problems in parturition

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

When assisting birth, it is important to clean the area around the vulva with disinfectant soap and warm water and to have clean hands. Wear gloves. There are certain diseases that can be transmitted to humans during this time period. Pregnant women should not assist with the kidding process. Lubricate the hand prior

to entering the vagina. Feel and identify the parts of the kid. Try to ensure that all body parts felt belong to the same kid and not to two separate bodies. If you feel only one leg or no legs at all, reach further and try to determine the exact position of the fetus. Arrange the legs and/or head gently in a proper position for birth. The fetus may have to be pushed forward towards the doe's head until a leg can be grasped and repositioned. Once the limbs are in a proper position, the kid should be gently pulled out and downwards using only your hands. Clear the mouth and nasal passages of the kid with straw or a towel and ensure it is breathing. Rubbing the body with a piece of cloth can sometimes stimulate breathing. Never pull on any presentation other than a normal presentation of two front legs and a head or a presentation of two hind legs and a tail. Pulling on any other arrangement of limbs and body parts will only make the problem worse.

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

Kid management at birth

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

Another critical practice is the feeding of colostrum as soon after birth as possible. The colostrum, or first milk, contains antibodies, which the doe does not pass to the fetal kid in the womb. Consumption of colostrum must occur as early as possible, ideally within 2-4 hours of birth. At 24 hours after birth there is a rapid reduction in the permeability of the intestinal wall to colostral antibodies. If a newborn kid does not or cannot nurse, the colostrum should be bottle-fed or the kid should be tube fed to insure adequate consumption. Excess colostrum can be frozen for use in orphan or bonus kids. Recent research indicates that disease organisms, especially caprine arthritis encephalitis (CAE), may pass from doe to kid through milk and transmission might be avoided through the use of extra colostrum frozen from does tested and shown to be CAE-free or by feeding pasteurized colostrum. CAE is not considered to be a problem on most meat goat farms.

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

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

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

Artificial raising of kids

Milk is the principal component of the diet of the pre-weaning kid. Most meat goat kids will nurse their dam until weaning. However, for orphaned kids or for kids of does that have lactation problems it may be necessary to use a milk replacer. Goat milk replacers are commercially available. If necessary, a lamb milk

replacer may be used as a substitute for goat milk. Typical lamb milk replacers contain 22 to 24 % protein and 28 to 30% fat (on a dry matter basis). If no other milk replacer is available whole cows milk or calf milk replacers can be used. Maintaining milk replacer quality after mixing is particularly important when kids are fed ad libitum (all they can consume).

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

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

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

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

Feeding schedule and amount for bottle fed kids.

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

Dam raised kids

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

Medications Commonly Used in Goats and Approximate Withdrawal Times

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

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

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

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

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

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

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

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

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

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

NOTE: In the table above PO = oral administration; SQ = subcutaneous injection; IM = intramuscular injection; IV = intravenous injection. DNU = insufficient data available to make WDI estimation, this drug is not approved for lactating goats.

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

Weaning

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

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

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

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

Vaccination Schedule for Meat Goats

Other disease preventive measures

Dam – 1 month prior to kidding

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

Kid – birth to first week

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

Kid – 3 weeks – begin coccidiosis prevention

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

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

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

Herd Health Calendar

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

Planning Calendar for Meat Goat Herd Health

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

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

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

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

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

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

Footnotes:

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

NOTE for Guideline for Anthelmintic Dosages in Goats

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

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

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

Basic Goat Husbandry

Mr. Jerry Hayes
Langston University

Introduction

Every goat producer is confronted with simple management tasks such as:

- telling the age of a goat.
- animal identification.
- hoof trimming.
- castration.
- body condition score.

Ageing Goats

Number and arrangement of teeth

Estimating the age of goats is done by looking at the teeth. The arrangement of teeth on the jaw, from front to back, is incisors, canines, premolars, and molars. Ruminants only have incisors on the bottom jaw. The top jaw has a thick layer of tissue called the "dental pad." Ruminants do not have canine teeth and this open space along the jaw is useful when needing to insert one's fingers to pry open a goat's mouth for drenching, tubing, or other purposes.

Mature goats will have a total of 8 incisors (4 pair), 6 premolars (3 pair), and 6 molars (3 pair). It is customary when ageing goats by looking at their teeth to discuss teeth in terms of "pairs" rather than in total.

Telling the age of goats

Young goats have deciduous or "baby" teeth that are replaced by permanent teeth at a later age. Kids are generally born with the central pair of deciduous incisors (incisors erupt from the center outward) with the second pair erupting at 1 to 2 weeks, third pair at 2 to 3 weeks and the fourth pair erupting at 3 to 4 weeks of age. Kids also will develop 3 pairs of deciduous premolars but no molars.

As kids age, the deciduous incisors are replaced by permanent incisors, again from the center pair outward. The middle pair of deciduous incisors will be replaced sometime around 12 months. The second, third, and fourth pairs are replaced at roughly yearly intervals at 1.5 to 2 years, 2.5 to 3 years, and 3.5 to 4 years of age. Thus, a goat with 1 pair of permanent incisors is roughly 1 year of age, 2 pair of permanent incisors is 2 years of age, and so on. At four years of age when all permanent teeth are in place, the animal may be referred to as having a "full mouth."

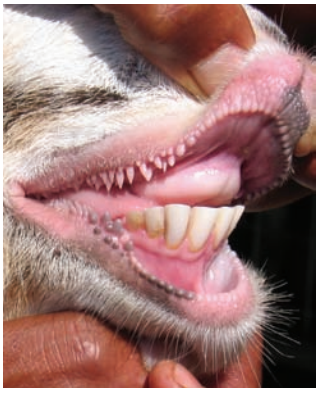
Ageing goats over 4 years of age is more difficult. Over time, the gums recede and teeth appear elongated. Teeth may also become broken or worn down from grazing and foraging. Animals that have broken or lost teeth are often referred to as "broken mouthed." "Undershot" is a condition in which the lower jaw is longer than the upper jaw whereas "overshot" is the opposite. Malformed teeth can affect the ability to graze and consume nutrients.

Animal Identification

The proper identification of animals is essential. Proper identification enables the producer to keep comprehensive records for milk production, reproduction, health problems, and management practices. The efficient maintenance of this information requires a permanent identification system. Several systems of identification may be used. The system selected will depend upon the size of the herd, the environmental

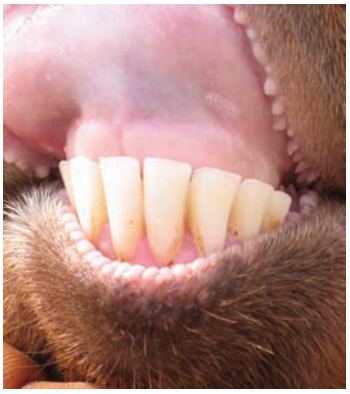
Kid (< 1 year old).

1 year old.

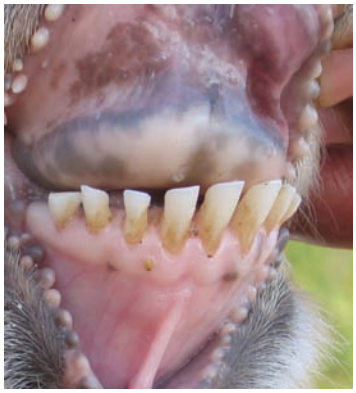


2 year old.

3 year old.



4 year old.



8½ year old.

Broken mouth.

conditions, the primary purpose for identifying individual animals, and regulations of federal government and breed-governing bodies. There are two basic types of identification: permanent and non-permanent. Permanent identification includes tattooing, ear notches or microchips. Non-permanent identification includes paint, chalk and tags.

Tattooing is permanent identification.

Tattooing

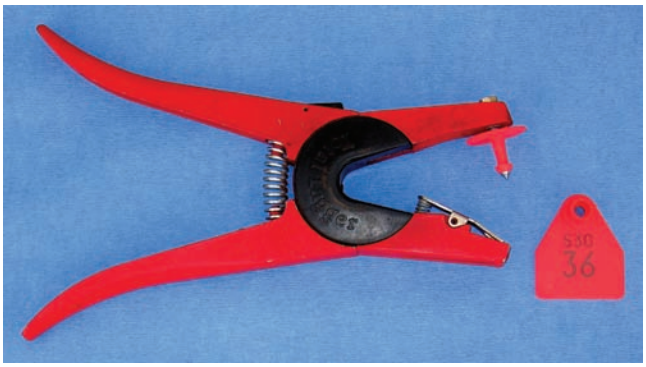
Tattooing is one method of identification that is permanent if properly done. However, it is not easily viewed and may require another complementary method of identification, such as an ear tag, that is visible from short distances. Tattooing involves making needlelike projections in the goat's skin. The tattoo ink is forced into the punctures and remains visible after the puncture wounds heal. It is a good idea to sterilize the equipment and clean the goat's ears to help prevent the spread of some blood-borne diseases. On older animals some tattoos may be difficult to read; holding a bright light source such as a flashlight behind the ear when reading may make the tattoo more legible.

To tattoo an animal, begin by inserting the proper digits into the tattoo pliers. Check for correctness by pressing the pliers onto a piece of paper or cardboard. Secure the goat with a halter or head gate and clean the ear to be tattooed with alcohol. Don't use water for cleaning as it could enter the ear canal and result in infection. Clip or trim any excessive hair present. A generous amount of ink should be applied to the center of the ear between the ribs of cartilage (green ink should be used for dark ears). Position the tattooing pliers between the ribs of cartilage and squeeze firmly forcing the needle-like numbers into the ear tissue. Care should be taken in removing the tattoo pliers from the ear to not scratch the tattooed area. Ink should be reapplied and rubbed into the tattoo. Using an old toothbrush will assist in pushing the ink into the punctures. Afterwards, the equipment and individual tattoo pieces should be cleaned and sprayed with alcohol.

Tattoo pliers and ink.

Ear tags

Ear tags are an easy way to identify each goat in the herd. Unlike tattoos, they can be read without actually having to catch the goat. Unfortunately, unlike tattoos, they can break or be ripped out of the goat's ear. Some producers use two ear tags because of this problem. Goats that are shipped are required to have a scrapie ear tag and these can be used for animal identification. Before putting in the ear tag, it is important to record what ear tag number is assigned to the goat. Ensure the ear tags are inserted between the cartilage ribs on the ears. The producer whose goats have been ear tagged will have an easy-to-read identification number which can be used for herd records.



Ear tag pliers and plastic ear tag.

Microchip

The insertion of a microchip in the base of the ear or tail web of the animal is another form of permanent identification. After insertion, the microchip should be scanned to ensure that it is reading correctly. Care should be taken in recording the microchip number against the tag number of the animal to ensure the integrity of the microchip identification. Exhibitors are required to provide their own reader at many livestock shows.

Ear notching

Ear notching is commonly practiced in identifying goats. It has the advantage of being visible from a distance allowing identification without the necessity of catching the animal and can accommodate numbers up to 9999. Ear notching pliers are used to put "V"-shaped notches in the edges of the ear and a hole punch is used to punch holes in the middle of the ear, if necessary. The animal is restrained and notches and holes may be treated with iodine. As this process results in bleeding, the notching pliers should be disinfected between animals to prevent transmission of any blood-borne diseases. The notching system used is that begun in the Angora industry and adapted for meat goats. However, some producers may use alternate numbering system.

Ear notching pliers.

Example of ear notching.

Generally, notches on the goat's left ear mean: 10 (top), 1 (bottom), 100 (end); and 1,000 (center hole). On the goat's right ear, notch values are: 30 (top), 3 (bottom), 300 (end); and 3,000 (center hole). Thus, a goat with the number 135 would look as follows: 1 notch on end of left ear (100); 1 notch on top of right ear (30), 2 notches on bottom of left ear (2); 1 notch on bottom of right ear (3) with a total value equaling 135.

Hoof Trimming

Hoof trimming goats is a simple task that can be easily learned. The goal of hoof trimming is to allow your goat to walk normally. The lack of trimming, or improper trimming, can lead to foot and leg problems. The amount of time between trimmings depends on many factors, such as type of terrain, the goat's age, level of activity, nutritional level, and genetics. In environmental areas where natural wearing does not occur, producers need to trim hooves on a regular basis. Goats raised in relative confinement and on small acreages may require more frequent trimmings than goats raised in vast pastures. Generally, foot trimming should be done as needed.

Overgrown hoof.

Proper hoof trimming technique.

Each hoof of the goat has two toes. The wall of each toe tends to overgrow and must be trimmed. The heels of the hoof and the dewclaws (especially on an older goat) may also develop extra tissue that needs to be trimmed. Most producers use foot shears or hoof trimmers. Other tools used may include a hoof knife with sharp edges, a pocketknife or a rasp. Pocketknives or a hoof knife can be dangerous to use for both operator and animal as goats may jump. Some people like to use hoof nippers to cut off the tip of the hoof or file it down with rasps.

Initially, use the point of the hoof trimmers to remove any dirt from the outside and the bottom of the hoof. The front of badly overgrown hooves can then be removed. The sides of the hoof should be cut back even with the sole of the foot. Continue to trim the sides around one toe and repeat the process on the other toe. Trim the frog and heel flat until the sole is parallel to the hairline of the pastern. Trim off thin slices. A good rule to follow is to stop when you see pink. If blood appears stop trimming and apply blood stop powder and finish the trimming at a later time.

Castration

All young bucklings that are not to be evaluated as replacement bucks should be castrated. For some producers, this means castrating between the ages of 2 and 4 weeks. Castration of young animals produces less stress in the animals and there is less chance of complications occurring due to the procedure. Young bucks are capable of breeding females as early as 4 to 5 months of age. If a decision is made to not castrate young males, management practices should be in place to prevent unwanted matings.

Three common ways to castrate bucks is through the use of an elastrator that places a rubber ring around the scrotum, a Burdizzo® clamp that crushes the spermatic cord, and the use of a knife to cut the scrotum and remove the testicles.

Elastrator with rubber bands.

Elastrator

Using an elastrator is an inexpensive, quick, and bloodless method of castration. It involves putting a heavy rubber ring around the scrotum near the body. The ring stops blood circulation to the scrotum and testicles and these will dry, shrivel, and slough off in 10 to 14 days. It must be done while the scrotum is still very small, i.e., from three days to three weeks of age depending on breed size, before the scrotal muscles and associated tissues develop.

The rubber ring is first put on the prongs of the elastrator (a pliers-like device that when squeezed will open the ring allowing the scrotum and testes to pass through). The male

kid is restrained and the scrotum is passed through the open ring with the prongs of the elastrator facing the kid's body. The producer must feel the scrotum to ensure that both testicles are in the scrotum below the ring. The rubber ring is positioned close to the body and then slipped off the elastrator prongs. Care must be taken to not apply too close to the body where one runs the risk of trapping the urethra

Body Condition Score

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

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

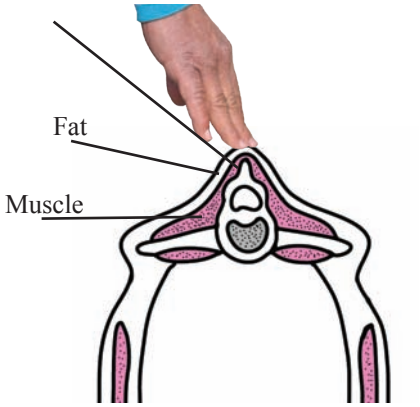
Scoring is performed in goats using a BCS ranging from 1.0 to 5.0, with 0.5 increments. Examples of BCS of 1.0, 2.0, 3.0, 4.0, and 5.0 are given using photographs and written descriptions. Assigning the 0.5 score increment is done when the animal being evaluated is intermediate to the BCS described.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

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

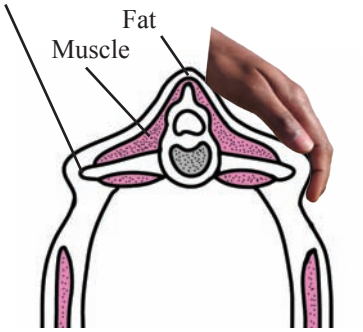
With practice, evaluating the BCS of an animal will only take about 10-15 seconds. By adding BCS as a regular part of your management program, you can more effectively monitor your feeding and herd health program for a healthy and productive herd.

Lumbar Region

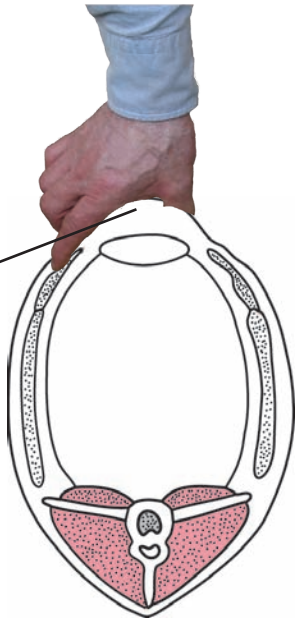
Spinous process



Transverse process



Sternum



Fat

BCS 1.0

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

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

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

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

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

BCS 2.0

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

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

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

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

BCS 3.0

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

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

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

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

BCS 4.0

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

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

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

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

BCS 5.0

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

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

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

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

Meat Goat Nutrition

Dr. Steve Hart
Langston University

Introduction

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

The ruminant stomach

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

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

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

When ruminants are born, the first three compartments of the stomach are underdeveloped and the stomach functions similar to that of a monogastric animal. This enables absorption of antibodies in colostrum and efficient utilization of nutrients in milk. As the young ruminant consumes solid feed, especially high in fiber, and the microbial population is established, the rumen is stimulated to develop. The rumen must have an acceptable degree of development for successful weaning.

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

Nutrients

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

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

Water

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

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

Carbohydrates

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

Cellulose is often referred to as fiber, although the term fiber also pertains to other substances such as hemicellulose and lignin. Fiber in young plants may be highly digestible and provide a high level of energy, but fiber in older, mature plants is often poorly digested and may only provide half the energy of other carbohydrates. Fiber in the diet may be characterized chemically in several ways, such as crude fiber (CF), acid detergent fiber (ADF), and neutral detergent fiber (NDF). These abbreviations are used in hay analysis

and may appear on feed tags. In general, the lower the fiber level, the higher the level of digestible energy. However, a certain minimum fiber level is required for healthy rumen function.

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

Fats

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

Protein

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

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

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

Vitamins

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

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

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

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

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

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

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

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

Minerals

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

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

Macrominerals

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

Calcium (Ca) 0.3 - 0.8%

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

Phosphorus (P) 0.25 - 0.4%

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

Sodium (Na) 0.2%

Potassium (K) 0.8 - 2.0%

Chloride (Cl) 0.2%

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

Sulfur (S) 0.2 - 0.32%

The major biological function of sulfur is as a component of sulfur-containing amino acids. Therefore, sulfur is important in protein synthesis, milk and hair production, enzymes, hormones, hemoglobin, and connective tissue, and is a component of the vitamins biotin and thiamine. The major deficiency symptoms include poor animal performance, hair loss, excessive salivation, tearing of eyes, and weakness. Major source of sulfur is protein which contains sulfur as a component of some of the amino acids. Therefore, sulfur is important in

diets where nonprotein nitrogen (e.g., urea) is used to substitute for some protein. Sulfur-containing mineral blocks are often used for control of external parasites in goats. Excessive sulfur in high concentrate diets can contribute to polioencephalomalacia as discussed for the water soluble vitamin thiamine.

Magnesium (Mg) 0.18 - 0.4%

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

Micro or trace elements

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

Iron (Fe) 35 - 500 ppm

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

Copper (Cu) 10 - 50 ppm

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

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

Cobalt (Co) 0.11 - 25 ppm

The only well accepted biological function of cobalt is as a component of vitamin B_{12}. Rumen microbes utilize cobalt for growth and produce vitamin B_{12}. Cobalt deficiency symptoms include loss of appetite, anemia, decreased production, and weakness. Most natural feedstuffs contain adequate levels of cobalt. There are cobalt-deficient areas in the United States (Figure 1).

Zinc (Zn) 40 - 500 ppm

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

Manganese (Mn) 40 - 1000 ppm

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

Selenium (Se) 0.1 - 20 ppm

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

Molybdenum (Mo) 0.1 - 5 ppm

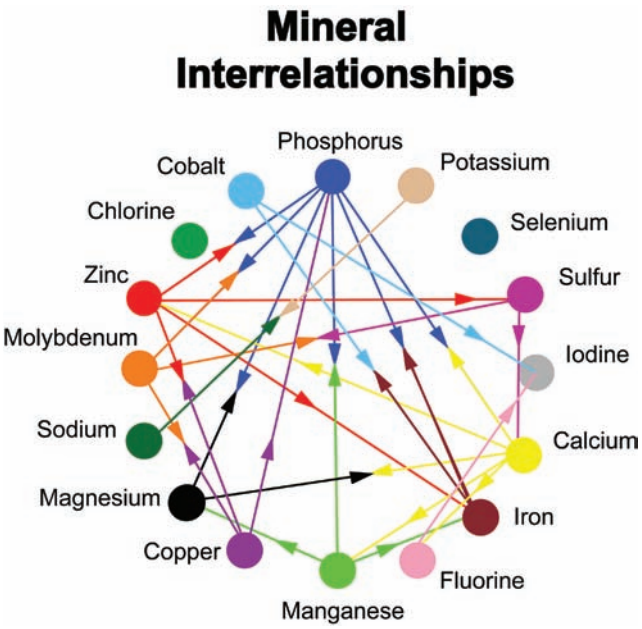
Molybdenum deficiencies are very rare. Toxicity occurs above 3 ppm due to reduced copper absorption, resulting in a copper deficiency. The copper level must be four times the molybdenum level to overcome this effect. High dietary levels of molybdenum are usually related to soil content. Molybdenum (as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

Iodine (I) 0.5 - 50 ppm

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

Mineral nutrition considerations

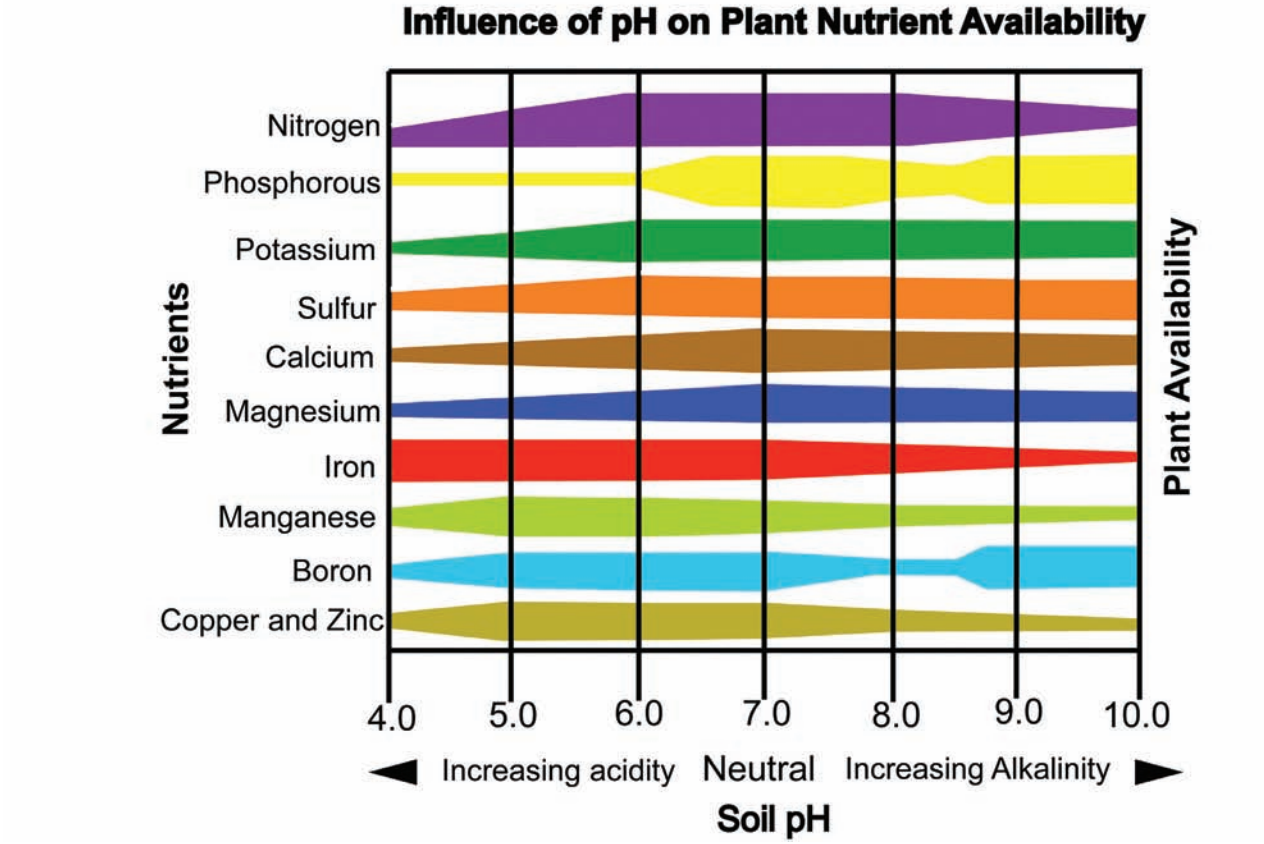
Plants are a major source of minerals for the goat, requiring all minerals that goats require except iodine. However, plant requirements for minerals, such as cobalt and selenium, may be much lower than the level required for animals. Some soils are inherently deficient in some minerals such as iodine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



Drawing by K. Williams.

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

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



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

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

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

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

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

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

Choosing a mineral supplement

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

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

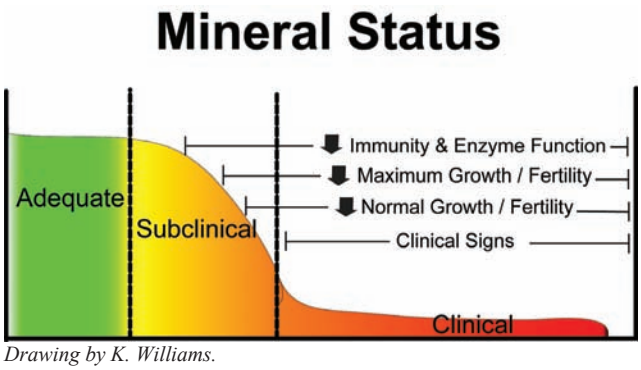
Current approximate wholesale costs for supplying 100% of mineral needs of a 150 lb goat for various minerals in 1 year are as follows:

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

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

Diagnosing mineral deficiencies or toxicities

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



Drawing by K. Williams.

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

Take home lessons on mineral nutrition

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

Body Condition Scoring

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

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

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

Using the Langston Interactive Nutrient Calculator

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

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

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

Getting started

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

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

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

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

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

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

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

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

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

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

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

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

Providing needed nutrients

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

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

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

Feeding Different Classes of Goats

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

Feeding bucks

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

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

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

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

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

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

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

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

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

Feeding replacement bucks and does

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

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

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

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

Feeding does throughout their life cycle

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

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

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

Flushing meat goats

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

Winter feeding of does

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

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

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

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

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

Feeding does in late gestation

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

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

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

Feeding the lactating doe

The lactating doe has very high nutrient requirements. Calculate the requirements for a 4 year old 110 lb Boer cross doe nursing twins in week 4 of lactation. When lactating is selected under question #2 on LINC, a form drops down. Select litter size (twins), week of lactation (4), and age at kidding (4). The program then predicts production of 4.5 lbs of milk per day with 3.6% fat and 3.3% crude protein. Nutrient requirements are 2.65 lbs of TDN, 0.41 lbs of protein, 7.61 g of calcium, and 5.33 grams of phosphorus, with 4.14 lbs of dry matter intake predicted (based on default dietary TDN and CP concentrations). During lactation, the doe can consume nearly enough nutrients if an abundant supply of high quality pasture is available, such as in spring or early summer. If "Range, early summer" is selected and fed at 4.7 lbs, the diet meets protein and calcium requirements, and 90% of energy requirement. However, phosphorus is deficient (3.76 vs. 5.33)

and needs to be supplemented. However, does will likely lose some bodyweight due to the high demands of peak lactation (weeks 3 to 8 of lactation) and an inability to consume an adequate quantity of feed. Kidding should take place when there is an adequate supply of high quality pasture. If there is not adequate pasture, supplemental feed will be required. Inadequate nutrition will decrease body condition, reduce milk production, reduce kid weaning weight, and increase kid mortality.

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

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

Creep feeding

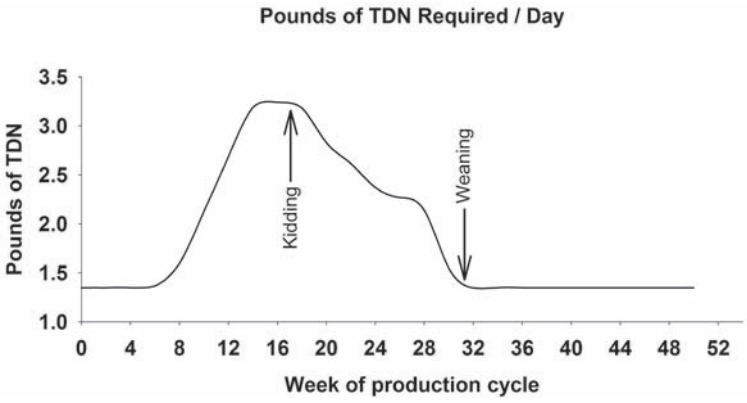
Creep feeding is a method of providing feed for the kids only. This is accomplished by fencing around a feeder and using a creep gate that has holes about 5 inch wide by 1 ft high. These holes are small enough so that kids can enter the feeder, but adults are excluded because they are too big to go through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

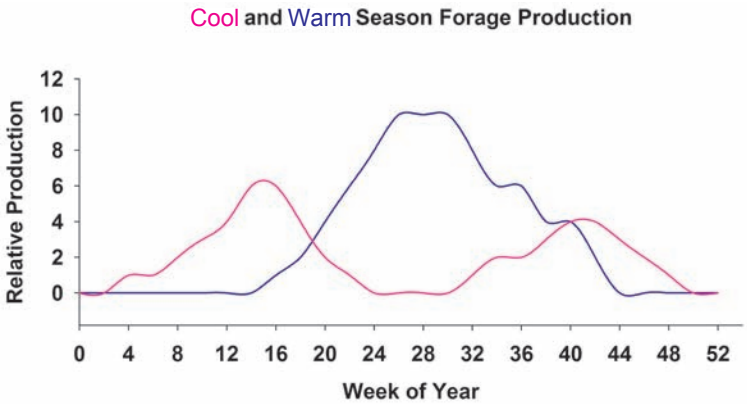
An alternative to grain-based creep feeds that is used in the beef cattle industry is to creep graze calves, using a creep gate that allows calves access to ungrazed high quality pasture. This may have application for goats using high quality pastures (crabgrass or sudangrass that is planted for the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

Effect of Kidding Season on Nutrient Requirements

Nutrient requirements of does change dramatically with stage of production. Requirements increase dramatically the last 6 weeks of gestation due to increasing fetal growth and remain high in early lactation (kidding occurred on week 18 in chart). During the month prior to kidding and for the following 3 months (assuming weaning at 12 weeks of age), the doe will consume nearly as much nutrients as in the remaining 8 months of the production cycle. Thus, during that time it makes sense to supply nutrients from an inexpensive source, typically pasture. The cost of providing the same nutrients as hay is more than twice that of pasture, and supplying through purchased feeds may be four to five times greater than for pasture.

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





season forages for central Oklahoma. Consult a local pasture extension specialist or livestock extension specialist for local forage growth patterns. Rapidly growing pasture is high in protein and energy. A major consideration in determining the date to kid is level of forage production at that time. However, there are other considerations in selecting kidding date, such as parasites and market opportunities. Some markets provide a substantial price premium from kidding at a specific time of the year, such as producing prospect show wethers or registered animals. However, it may take a considerable market premium to cover the cost of purchased feed, so general reliance on pastures and forages is best.

Artificial Raising of Kids

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

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

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

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

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

Considerations in Ration Formulation

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

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

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

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

Feeding Systems

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

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

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

Nutritional Disorders

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

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

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

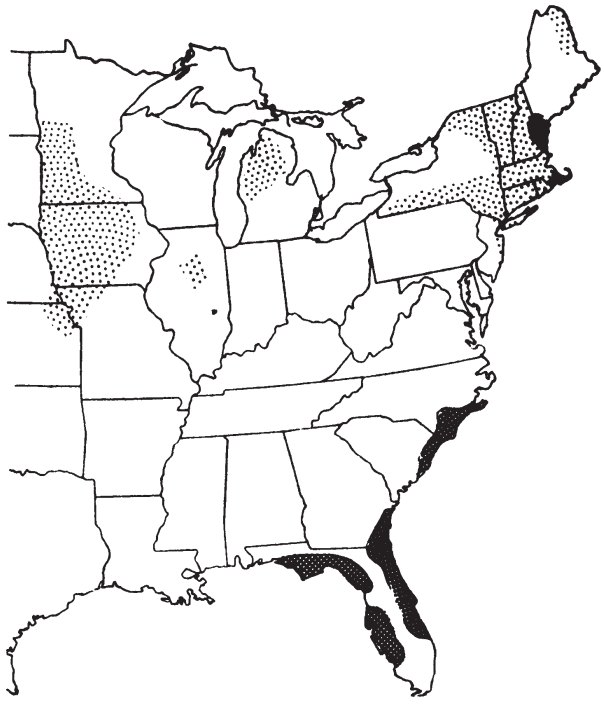
Enterotoxemia is caused by bacteria in the intestine that grow rapidly and produce an endotoxin in response to high levels of starch (grain) in the diet. Animals are in extreme pain from the effect of the endotoxin and often die quickly. Vaccination will help prevent this disease.

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

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

Soil-Related Nutritional Problem Areas for Grazing Animals

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



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

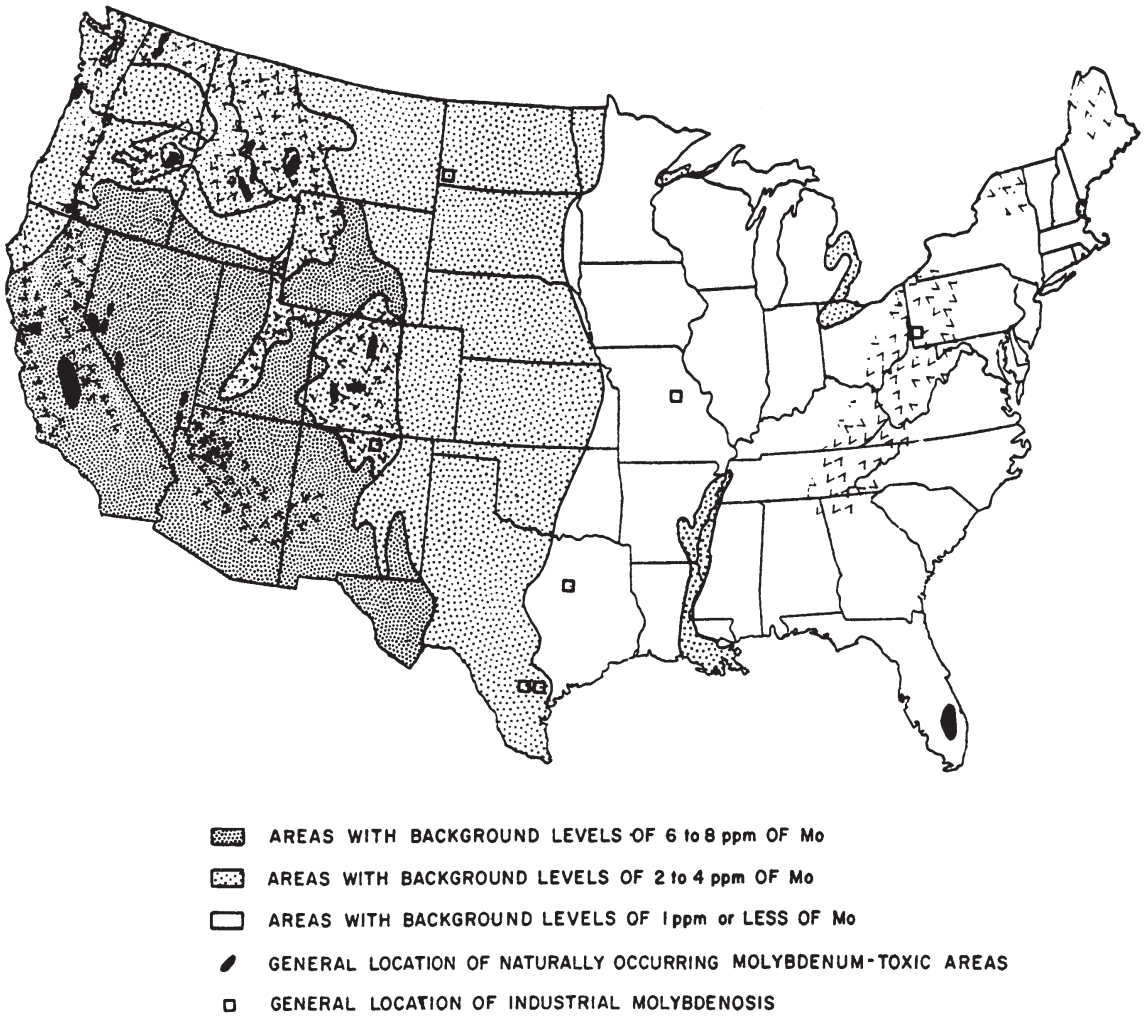


Figure 6. Generalized regional pattern of molybdenum concentration in legumes of the United States (ppm = 1 μg/ g^{-1}). From Kubota, 1977, by courtesy Marcel Dekker, Inc.

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

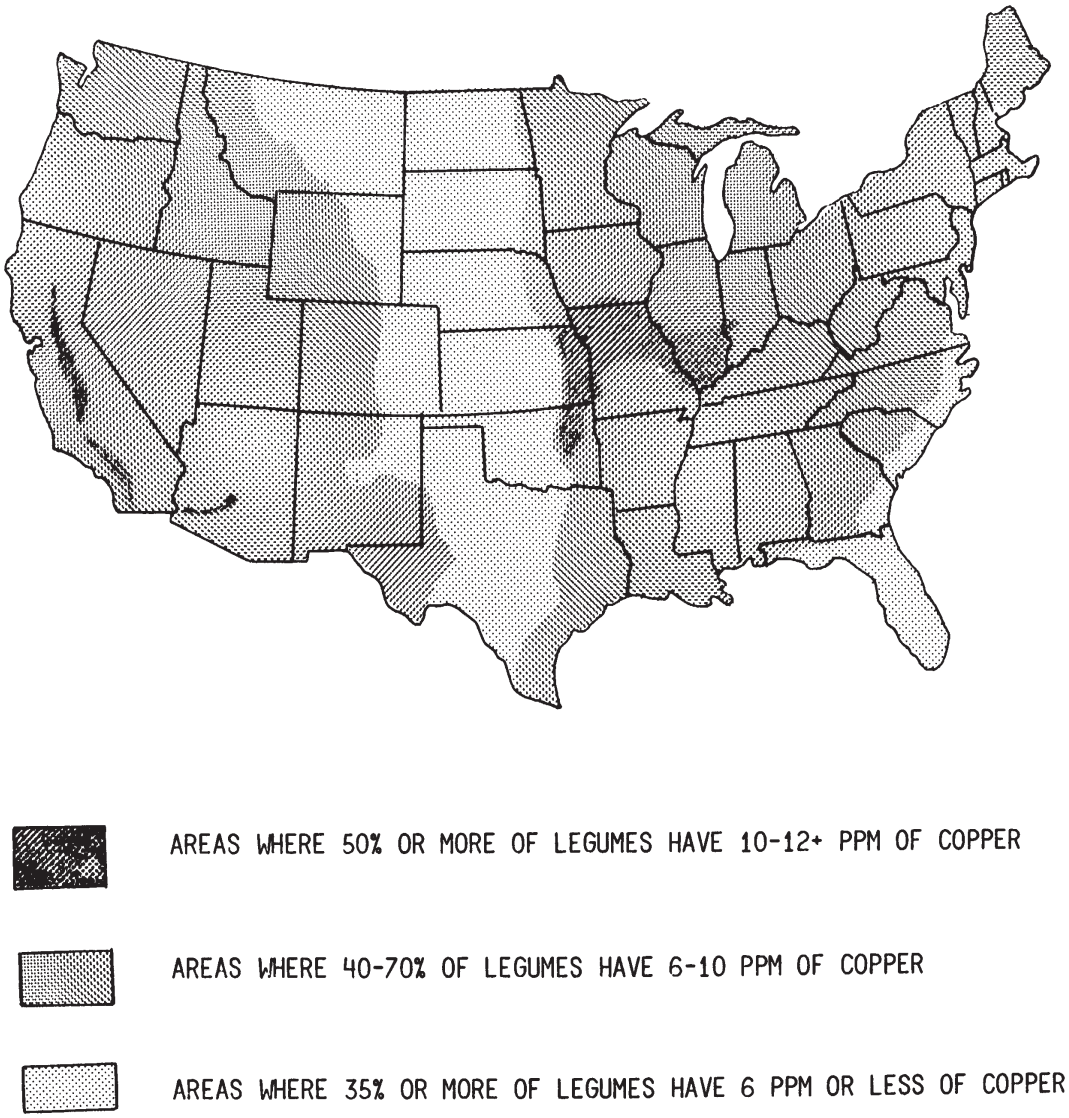


Figure 7. Generalized distribution of copper concentration in legumes of the United States (ppm = 1 μg/ g^{-1}). From Kubota, 1983a, by permission Amer. Society of Agronomy.

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

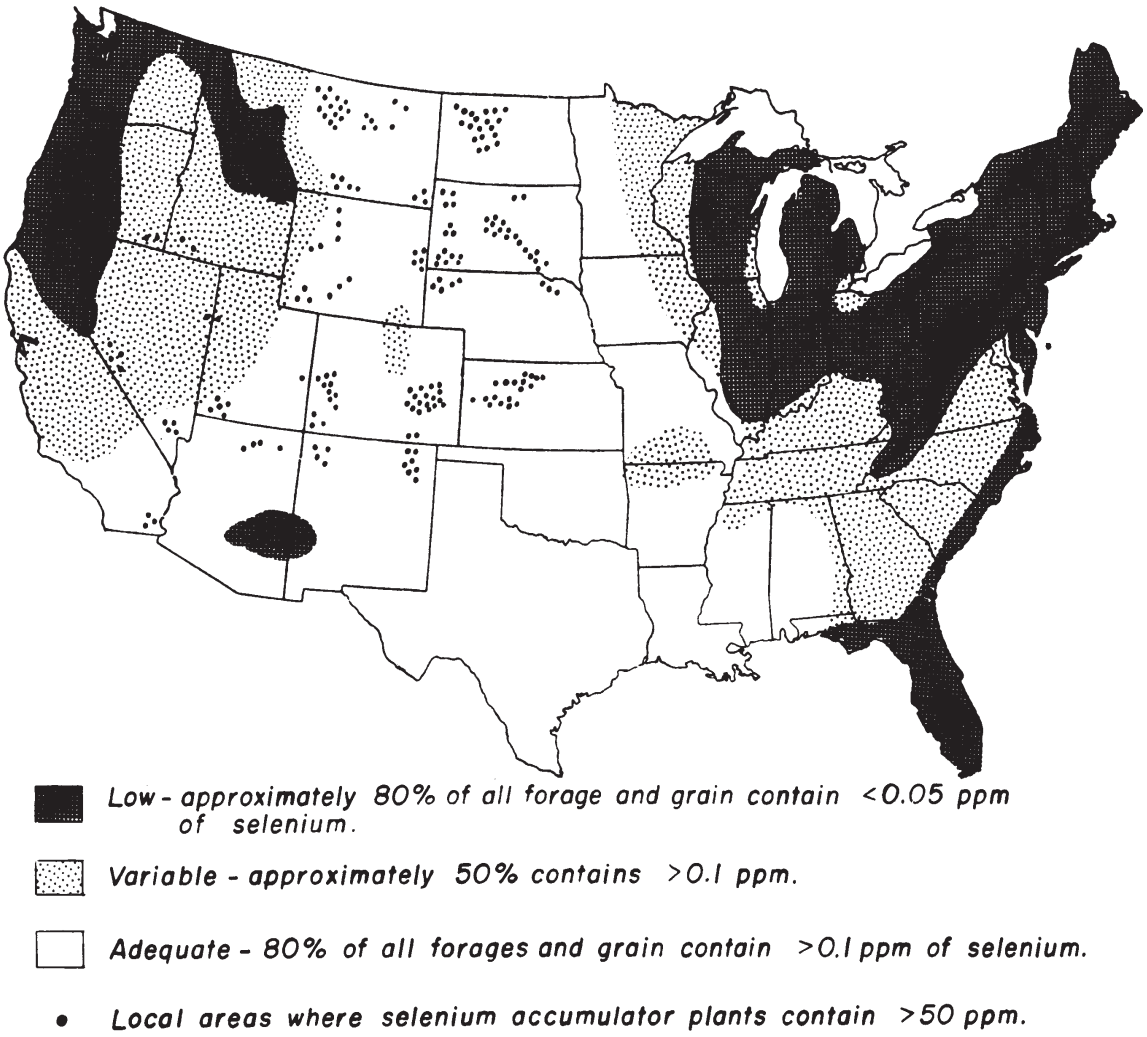


Figure 8. Geographical distribution of low-, variable-, and adequate-Se areas in the United States (ppm = 1 μg/g). From Kubota and Allaway, 1972, by permission Soil Science Society of America.

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

Definitions useful for this section

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Vitamins - Specific organic substances required for various metabolic functions.

FAMACHA for Parasite Control

Dr. Steve Hart
Langston University

There are several sources for information on parasite control and FAMACHA. The best single source is http://www.SCSRPC.org. You can also find information on Langston's web site at http://www2.luresext.edu.

Internal parasites (worms) are the number one health problem of goats in the Southern United States and kill more animals than the total of the next three diseases. Worms function in nature's ecology by preventing populations of animals from overrunning an area when production conditions are good and reduce populations when food is limited.

The most common worm is the Barberpole worm (Haemonchus contortus) which feeds on blood in the abomasum (true stomach) and if there are too many, they cause anemia, poor performance and ultimately death of the animal. The Barberpole worm is responsible for the death of 85% of the animals that die of worms and therefore a very important worm. The red stripe of the Barberpole worm is his gut full of your goat's blood and the white stripe being the worm's uterus full of eggs-essentially a blood-sucking egg-laying machine. The Barberpole worm is about an inch long and as big around as a paperclip wire, so it is easy to see him in the stomach of a freshly dead goat-most are attached sucking blood (looks like a hairy stomach), but a few will be swimming around. Since it is a tropical worm, it is a greater problem during the summer.

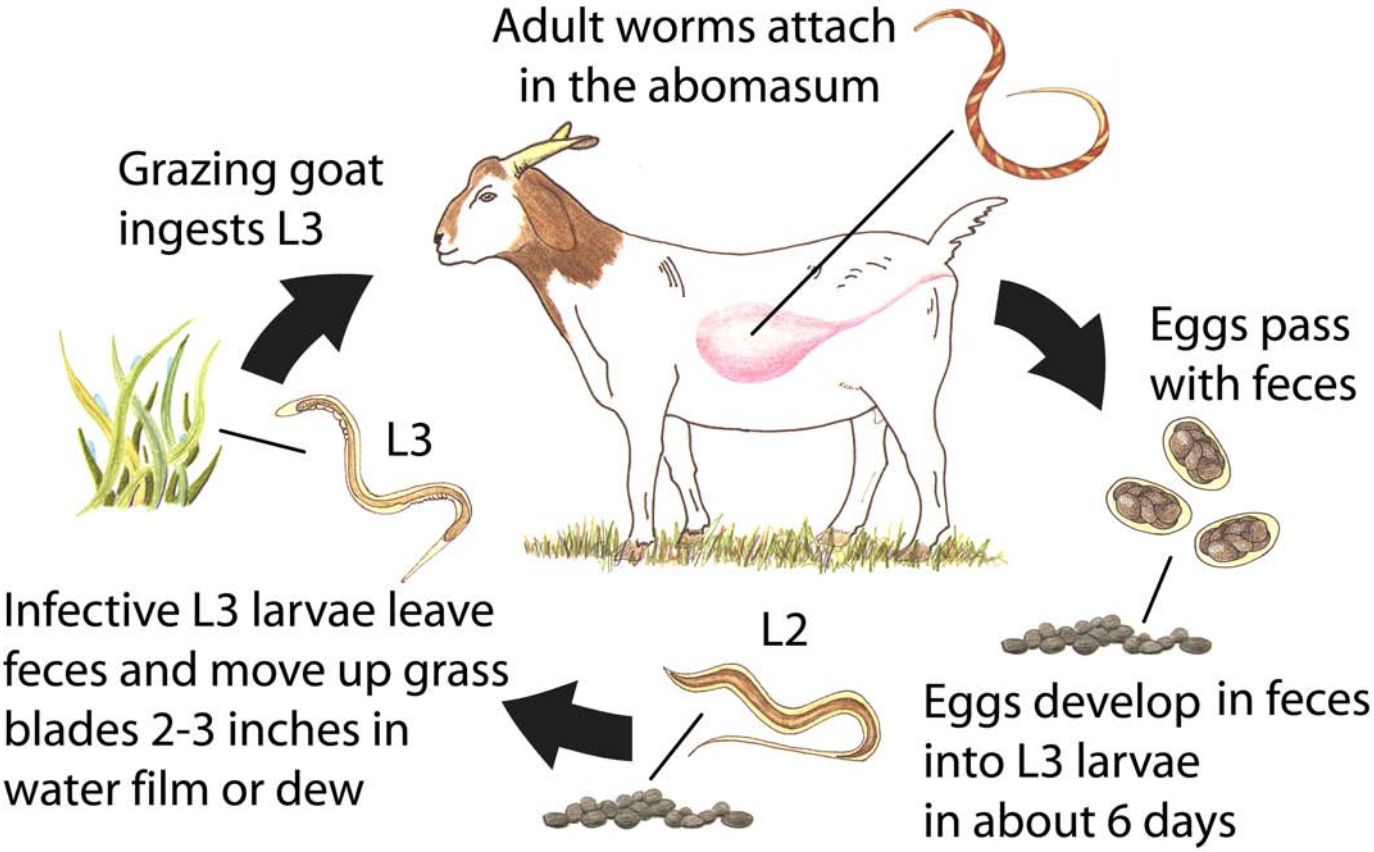
There are two other worms of secondary importance, one is the Black Scour worm (*Trichostrongylus colubriformis*) which feeds on mucous in the small intestine and causes diarrhea, reduced appetite and poor performance. The other worm is the Brown Stomach worm (*Teledorsagia circumcincta*, formerly Ostertagia) which feeds on the secretory cells of the abomasum and causes loss of blood plasma, diarrhea, reduced appetite and poor performance. None of these two worms cause anemia, you only see diarrhea and a poor doing animal. These worms are very small-the size of an eyelash. They are difficult to see, but you can see them wiggling if you put a little digesta on a white card. These worms are temperate species and cause more problems in the spring and fall rather than the summer.

The life cycle of the worm is very important to understand so we know some management steps that we can take to reduce the infection of goats. Worm eggs are in the feces and will hatch when it is over 50ºF, but hatch best at 85°F. This is why worms are less of a problem in the winter. It takes 1-6 days for the eggs to hatch, but they have to go through several developmental stages before they can infect animals. They hatch to the first stage larvae, abbreviated l-1. The l-1 eats bacteria in the feces, grows and molts (sheds skin like a snake) and becomes an l-2. Both the l-1 and l-2 can be killed by drying out when the weather is dry. When we have a dry July and August we have much fewer worm problems because of this.

The l-2 eats bacteria in the fecal pellet and grows and molts to an l-3, but this is an incomplete molt. The old skin slides up and he grows a new skin underneath which is a good news/bad news proposition. He is more resistant to drying out since he has two layers of skin, but also when he partially shed his skin, it covers his mouth so that he can no longer eat and must live off his stored fat. This means that he must get into your goat before he runs out of fat. How long can he live? Since he is cold blooded, his metabolism goes slow when he is cool and he may live 120-240 days. However, when the weather is hot like 95ºF, his metabolism really speeds up and he may only live 35-40 days before he runs out of fat. It takes about 6-14 days for an egg to develop to an l-3, the infective stage of the larvae, depending on how warm temperatures are.

Since goats don't go around eating fecal pellets, the larvae has to escape the fecal pellet and get on grass so that the goat can eat him. Since the outside of the fecal pellet dried into a hard shell and he can't penetrate it, he needs some rain or heavy dews to soften or break the crust so that he can escape. It takes about 2" of rain in a month's time to crack a pellet open. If he runs out of fat before there is enough rain or dew to release him, he dies. Once the pellet is softened or cracked open, the larvae is like a canoe, going wherever the water takes him, hopefully up a leaf of grass so that your goat will eat it along with the 3rd stage infective larvae. The larvae is unable to swim or crawl. Infective larvae are very small, slightly longer than the period at the end of the sentence and about as big around as spider web.

If the larvae is lucky enough to get into your goat, he immediately moults to an l-4. The l-4 has a decision to make-he can decide to grow into an l-5 and go to adulthood and lay eggs or he can decide to enter a state of suspended animation called hypobiosis or arrested form. He nestles down in the stomach gland and the immune system does not know that he is there. He is also harder to kill with the Benzamidole class of drugs. This is a survival mechanism for overwintering since he would die in the cold temperatures over the winter. It may also be used to keep worms alive during a prolonged drought when they would die outside the animal. The hypobiotic worm can be triggered to awaken and develop to an l-5 and onto adulthood by several mechanisms. The act of kidding, the goat eating green grass, kidding, lactating, increasing daylength all may trigger him to awaken and develop to an egg-laying adult.



Life Cycle of Haemonchus contortus, the barber pole worm

The immune system is the first line of defense against worms. Good nutrition supports the immune system in its fight against worms. Some animals have a genetically stronger immune system and goats can be selected for low fecal egg counts. Other diseases which depress the immune system such as coccidiosis, or pneumonia may make an animal more susceptible to worms. When goats are lactating, the immune system is suppressed and does not fight parasites as well. Also, those arrested l-4 larvae that overwintered awaken with kidding in the spring to feed on your goat. This is the reason for the general recommendation to deworm your goats around kidding time.

The Barberpole worm as we said likes a warm climate and it reproduces rapidly, laying as many as 6,000 eggs per day. This enables one resistant worm to produce many resistant worms. An adult Barberpole worm consumes 1-5 drops of blood per day. A thousand worms will consume nearly a pint of blood in a week. This causes your goat to have a low red blood cell number (anemia), low blood protein (hypoprotenemia) which causes edema or bottle jaw and ultimately death when there is not enough blood to sustain your goat's life. Coccidiosis, liver flukes and lice can all cause anemia also and need to be ruled out. Anemia can be determined by looking at the color of the mucous membranes. These are tissues under the lower eyelid, gums and inside the vulva. A normal amount of red blood cells gives them a healthy pink color. A reduced amount of red blood cells makes them more pale (white). You can use a FAMACHA card to determine the degree of anemia (FAMACHA score) and need for deworming.

Our biggest problem with dewormers is that some worms have become resistant to our dewormer. When an animal is dewormed with an effective dewormer, it will kill 100% of the worms. When the dewormer only kills less than 95% of the worms, we can be sure that we have significant dewormer resistance which will increase within a year or two so that the dewormer only kills 40% of the worms and is worthless as a dewormer. Dewormer resistance is measured by taking a fecal egg count, deworming and taking another fecal egg count 7-14 days later. The percent reduction in fecal egg count is called fecal egg count reduction. Figure 2 shows that there is a high level of dewormer resistance to Ivomectrin, Valbazen works on some farms and not others and Levasole was highly effective on all farms. Cydectin was highly effective in 2001, but less so now. When an animal is dewormed and any worms survive in an individual or flock, it is because they are resistant to the dewormer and if the worm(s) mates with another resistant worm, 100% of the eggs will hatch out resistant worms. However, if there are a number of susceptible worms for that worm to mate with, we can reduce the worm's chance of mating with a resistant worm. This is the concept of refugia. Animals that have not been dewormed provide a source of worm eggs (ultimately adult worms) that are genetically susceptible to the dewormer to dilute the eggs of worms that survived deworming (resistant worms) and slow the rate of dewormer development. We increase refugia by only deworming only the animals that need to be dewormed as determined by FAMACHA color score of the eyes. This is different from our old strategy of trying to kill every worm which has gotten us to where dewormer resistance is a bigger problem than having a few worms around. It must be remembered that a few worms are OK and even desirable because they keep the immune system alert against worms. Excessive worms that cause us problems.

Table 1. Oklahoma Farm FECR %

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

Worms are like wealth, not equally distributed to all. 20-30% of the animals produce 70-80% of the eggs. These are predominantly the animals that will need dewormed. Most of the other animals will not need dewormed-they can cope with the worms that they have and the level of eggs in their feces does not cause a high level of pasture contamination. If we get rid of animals that consistently have high fecal egg counts, there will be fewer infective larvae on the pasture for all the other animals.

The Barberpole worm causes anemia and therefore the degree of anemia tells us how much difficulty the worms are causing the animal. The Brown Stomach worm and Black Scour worm do not cause anemia and we have to depend on diarrhea and loss of body condition to detect them. We measure anemia with the FAMACHA card by rolling the lower eyelid down and comparing the color of the inside of the eyelid where it was touching the eyeball to the color chips on the card. A healthy pink color will match chips #1 or 2 whereas a very pale color, white as a sheet will match # 5. If the color match is in between two chips, score it the higher number (more pale) color. Do not hold the eye open for more than a few seconds because the color will change. Check the other eye if necessary. One should remember that pink eye can affect the color of the eye. Also, one should remember that there are other causes of anemia such as coccidiosis, lice and liver flukes and if animals do not respond to deworming, these may need to be investigated as well as determining if the dewormer is working.

Treat all animals with a FAMACHA score of 4 or 5 with an effective dewormer and check again two weeks later if it is during the summer worm season. At deworming, many producers give the animal a blood building supplement such as Red Cell to support producing replacement red blood cells. If >10% of the animals have FAMACHA scores of 4 or 5, then consider deworming animals that score 3, especially ewes around lambing/kidding or nursing kids, young animals, does nursing kids and thin, poorly conditioned animals. Try to rotate animals to another pasture. Be sure to check animals which lag behind the herd. Also if an animal gets "bottle jaw", deworm them regardless of their FAMACHA score. Score animals using the card, not from memory and replace the card every 12 months because the colors fade. Record animal numbers as they are dewormed. If you add up the number of times that animals are dewormed across the summer, those requiring the most deworming are also those producing the most eggs and causing pasture contamination for others. Their offspring are also likely to be like them, so those animals that were dewormed the most are good candidates for culling.

FAMACHA is not a parasite control program, but a tool in a parasite control program. Your parasite management program should include monitoring of fecal egg counts periodically as well as FAMACHA eye scores. When you have a parasite problem, determine why and change the parts of management that

you can. Only use a dewormer when necessary to reduce the rate of development of dewormer resistance. Cull wormy animals because they cause worm problems for everyone else and it is often passed onto their offspring. Deworm new animals coming onto your place with at least two classes of dewormer and check a week later to make sure their feces are free of eggs to prevent importing resistant worms. Notice animals with pale color around the eyes when you check animals and deworm them promptly. Good nutrition (not only protein and energy, but also vitamins and minerals) is necessary to fuel the immune system in its fight against worms.

Some management steps that you can use to reduce parasite problems are grazing cattle or horses with goats. Avoid forcing goats to graze close to the ground since most infective larvae are within 3 inches of the ground. Making hay or tilling the ground can clean parasites off of a pasture. If you can rest a pasture 6 weeks, especially during warm weather, it will reduce contamination level greatly. If animals are browsing or eating high off the ground, they pick up much fewer infective larvae. As stocking rate increases above two head per acre, parasite problems also increase. There are certain conditions that increase the risk for worms such as: warm weather, two or more inches of rain in a month, grazing pastures close to the ground (such as during a drought), high stocking rates, long residence time on pastures, thin animals or animals nursing young. The more risk factors that you have, the greater the parasite challenge and the more attention to parasite management will be needed.

Dewormers are classified into action families. All members of an action family use the same mode of action to kill worms, but some members of that family may be more potent than others. The benzamidoles are one of the first marketed class of dewormers and because of that there is more dewormer resistance to

this class. The Benzamidoles not only kill worms, but also worm eggs, lungworms and tapeworms. They are especially useful for these latter two worms. Members of this group include fenbendazole (Panacur, Safeguard), oxfenbendazole (Synanthic) and albendazole (Valbazen), the most potent member of the family which also kills liver flukes. The cell depolarizers includes levamisole (Tramisole, Levasole and Prohibit) are basically only effective against roundworms and is generally the dewormer used after worms develop resistance to Cydectin. Morantel or Pyrantel tartrate (Rumatel or Positive Pellet Dewormer) is a form of the dewormer that is in the feed. It is not as potent as Levasole. The Avermectin/Milbermyucin class has been very effective in the past, but there is an accumulation of dewormer resistance to this class. It includes ivermectin (Ivomec), dormectrin (Dectomax), eprinomectin (Eprinex) and moxydextin (Cydectin) which is the most potent member of this class, but has a long withdrawal time.

Selection of a dewormer depends on what works in your herd as well as the withdrawal time. If you are milking animals or animals are going to market, you want a drug that has a shorter withdrawal, but also works. Every year, you should check to make sure your dewormer is working by taking some stool samples collected from animals that were dewormed 7-14 days previously to your vet (or do it yourself) to make sure that they have no fecal eggs in them. When you develop resistance to a dewormer, you may be able to use it at a higher dose, but generally it is better to use another drug. When you have resistance to all common dewormers, you will have to resort to combinations of dewormers or alternative dewormers such as copper oxide wire capsules or sericea lespedeza. With good parasite management, we can reduce the development of dewormer resistance, but it involves the use of FAMACHA, pasture rotation and having a good parasite management program in place. In conclusion, if you fail to manage your parasites, they will manage to put you out of the goat business.

Reproduction and the Bottom Line

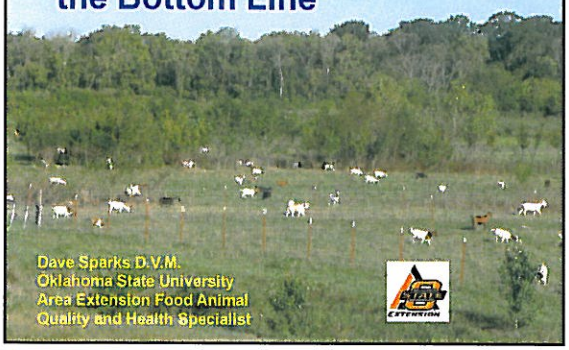
Dr. Dave Sparks
Oklahoma State University

Introduction

Reproductive efficiency probably affects the profitability of meat goat operations more than any other factor. It seems like reproduction should be the simple part of the goat management plan. After all we only have to let nature take its course, right? Remember that in nature all that is required is to reproduce efficiently enough to maintain the population, not show a profit. A better understanding of the reproductive physiology and some simple management tips can help producers manage to have more product to offset the expenses, and maybe even have a little black ink left over.

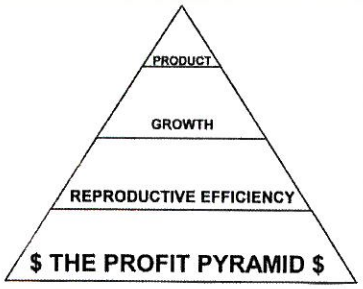
As I give talks on meat goat health and productivity I find that most of us are in this industry because we enjoy working with our goats. Most of the folks I visit with, however, tell me that they would enjoy it a lot more if they were taking some profits to the bank. Many producers don't realize that although carcass quality and growth rate are important, it is reproduction performance that spells the difference between profit and loss. Today in Oklahoma, there is about a $5/cwt difference in the sale price of a number 1 or number 2 kid. On a 60 Ib. kid, this translates to about $3.00 per goat. Obviously kids that reach market weight faster are more profitable. If however, your doe can wean twice as many kids, then the income is doubled, while the expense of maintaining the does is unchanged. This is important for commercial producers, but it is even more important for purebred breeders who are depreciating large investments for their breeding herd. The easiest and fastest way to increase profits is simply to have more kids to hop in the trailer when it is time to go!

Reproduction and the Bottom Line



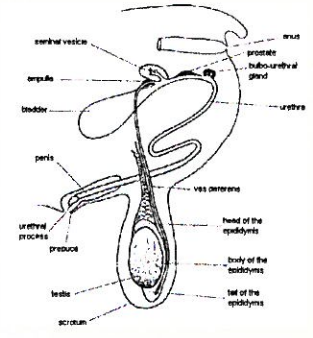
Dave Sparks D.V.M.
Oklahoma State University
Area Extension Food Animal
Quality and Health Specialist

Relative Economic Value of Traits



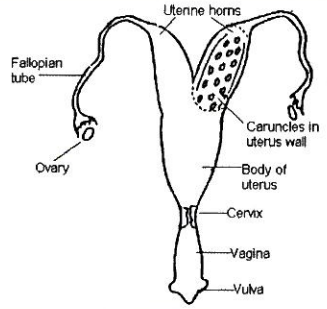
Male Reproductive System

The male continues to manufacture haploid cells, the sperm, throughout his life.



Female Reproductive Tract

The female is born with a predetermined number of haploid cells, the ova or egg cells, in her ovary and will never make any more.



Goat Estrous Cycle

- Anestrous
  - The time between breeding seasons when the doe is not coming into heat
- Estrus
  - The time the doe is "in heat"
- Metestrus
  - The time between heat periods when the doe is trying to become pregnant

Anestrus

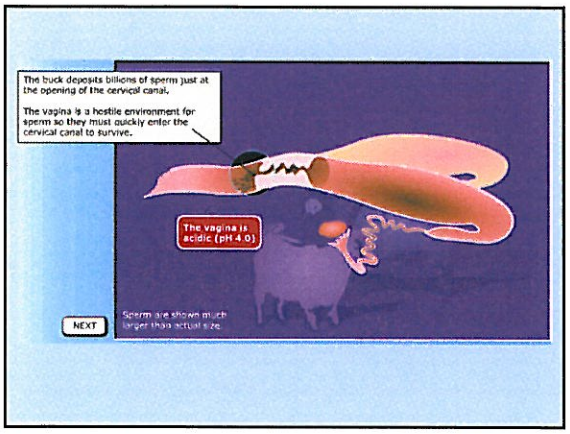
- Goats are seasonal breeders. Anestrous is the part of the year when does are not cycling.
- All reproductive hormone levels are low.
- The onset and decline of the breeding season are controlled by day length and buck activities.
- Poorly influenced by drugs, but can be influenced by artificial lights and teaser bucks.

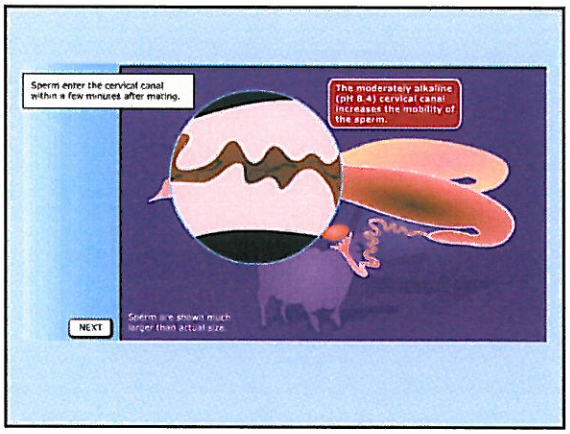
Estrus

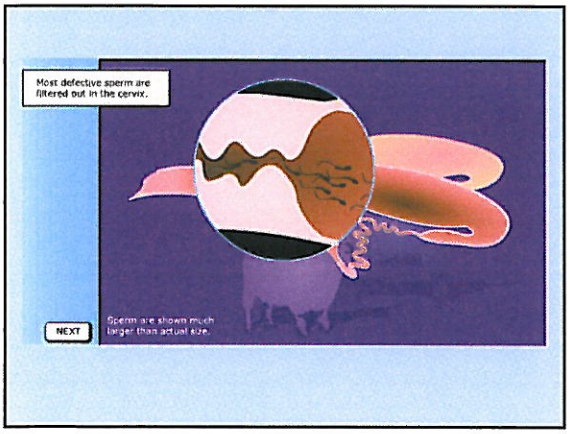
- This is the period just before, during and just after the egg is released in the ovary.
- The dominant structure on the ovary is the follicle which releases estrogen as the dominant hormone in the system.
- The estrogen causes the doe to be receptive to the male.

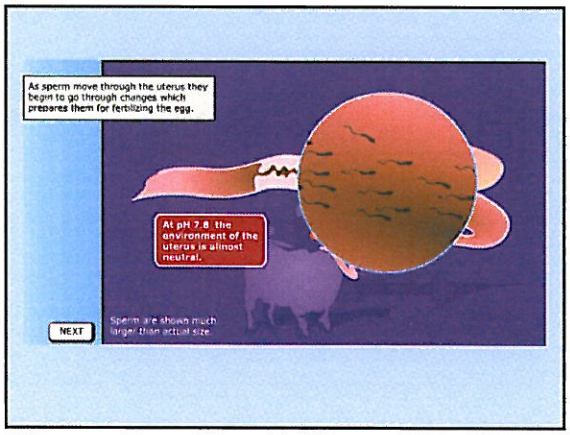
Metestrus

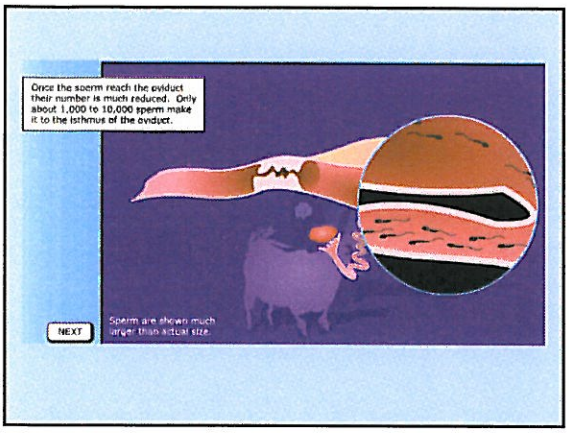
- The part of the cycle between heat periods.
- The dominant structure on the ovary is the Corpus Luteum and the dominant hormone is progesterone.
- Under the influence of progesterone the doe rejects the buck and the reproductive tract undergoes changes to allow for attachment of the embryo and support of the pregnancy.

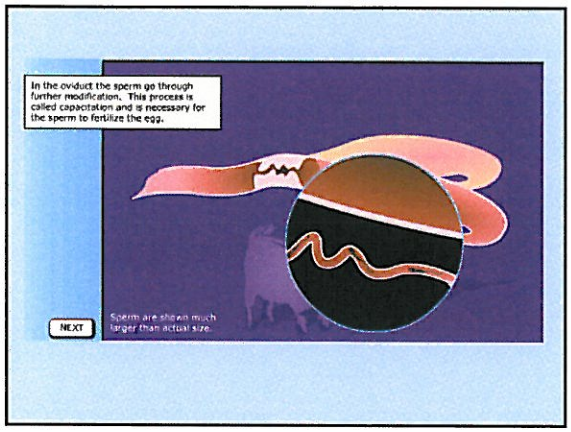


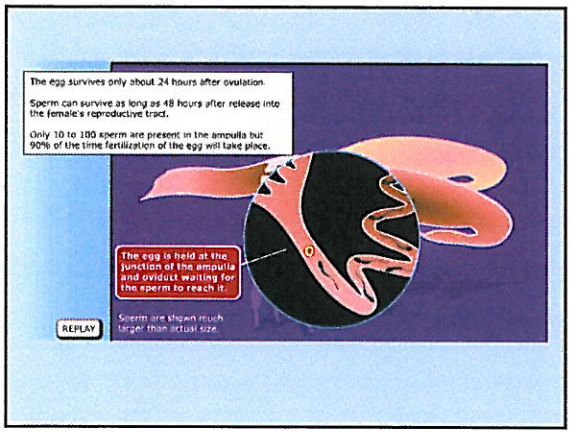












How Big is Big Enough?

Kid doe body weight at mating (lb)	First kidding%	Average lifetime kidding%
Below 40	2	48
40 – 44	21	70
44 – 51	32	72
51 – 55	55	79
55 – 60	78	82
60 – 70	81	86
Above 70	88	89

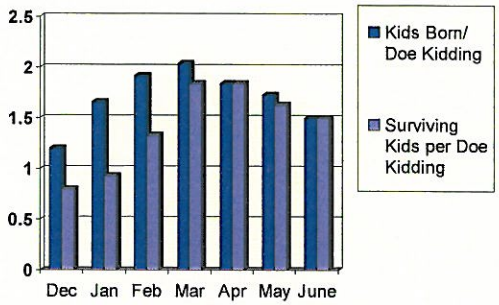
Weaning Traits of Boer Does (3 Matings)

Dam ID	Litter Size, n	Litter Wt, lbs
220	2.33	100.27
217	2.00	90.93
Herd Avg	*1.48*	*58.00*
Boer Avg	*1.19*	*47.57*
247	1.00	35.48
207	1.00	34.20

You Can't Afford Singles

- The average meat goat doe eats about 1 ton of "something" per year!!
- First time does have a higher percentage of singles.
- Second pregnancies tend to be singles if first time was twins.
- Higher percentage of singles in mature does following triplets in prior year.
- Does above the age of 6 years have a higher percentage of singles.

Does Bred Early or Late Have More Singles



Teaser Bucks Can Help!

- Teasers are intact vasectomized males used to stimulate the does.
- Teasers stimulate does to cycle but cannot cause a pregnancy.
- When herd sires are introduced the doe is more fertile than on her first cycle of the season.
- Quality or size is not a concern but teasers should be tough, vigorous and trouble free.

Nutrition and Reproduction

- **Flushing – Increasing nutritional plane by adding .5 lbs of corn or protein supplement for 2 weeks before and 2 weeks after breeding increases pregnancy rate and litter size at birth.**
- **Does in good body condition at breeding deliver more kids and have better kid survival rates.**
- **Pregnancy toxemia**

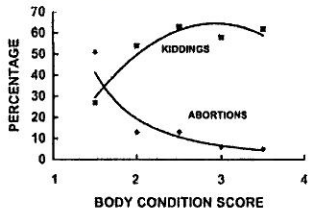


Fig. 1. Relationship between body condition score of goats at mating and abortion and kidding rates.

Pregnancy Toxemia

- **Inadequate carbohydrates in diet in last trimester causes mother to metabolize her body fat.**
- **By product is ketones which build up to toxic levels.**
- **Doe carrying twins, carbo requirement increases to 180%, with triplets 240%.**
- **Doe should gain ½ lb. day last trimester.**

Pregnancy Diagnosis

- **Can reduce costs, increase income, and maximize returns on available inputs.**
- **Several possibilities, each with advantages and disadvantages.**
  - Doppler Ultrasound
  - "A Mode" Ultrasound
  - Blood Hormone Assay

Doppler Ultrasound

- Expensive to purchase.
- Delicate and only somewhat portable.
- Requires extensive training and practice to use accurately.

•Accurate and early results.

•Use with multiple species and multiple functions.

•May show number of fetuses.

•Slower to operate accurately.

Ultrasound of 55 day Pregnancy

"A Mode" Ultrasound

•Inexpensive to purchase and operate

•Purchase preset for one type of animal.

•Quickly operate successfully.

•Accurate at 30 to 40 days.

•Audio tones. Can not tell how many kids are present.

•Tough and easily portable.

Blood Chemical Assay

- BioPRYN – Measures the amount of a very specific protein, released from the plancenta, present in the maternal blood.

•Accurate at 26 days
•95% accurate
•Samples received in lab by Wednesday are reported Friday
•Cost is $7.50/test + supplies and shipping

•www.biotracking.com
•208-882-9736

Assisted Reproduction

•**Artificial Insemination**

•**Embryo Transfer**

Valuable tools for increasing the impact of outstanding genetics, but also require increased management, cost, and risk.

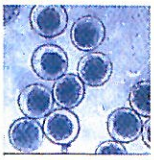
Artificial Insemination

•**Bucks are collected via;**
  •**Artificial Vagina and estrus doe**
  •**Electro-ejaculator**
•**Semen is examined, extended, and frozen.**

•**Semen is placed inside the cervix by means of a glass speculum and pipette.**
•**Typical conception rates are 30-50% for one insemination or 60-80% with 2 or three inseminations.**
  •**May get 2 or 3 straws with one certificate.**
•**Laparoscopic AI increases the success rate but also the danger to doe and the cost.**

Embryo Transfer

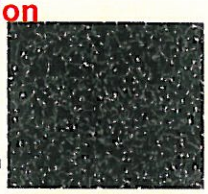
High value doe is synchronized with lower value does, super-ovulated, and bred to high value buck. At about 1 week of pregnancy the fertile embryos are flushed from the donor doe and introduced surgically into heat synchronized recipient does.



- Typically harvest from 0 to 20 fertile embryos from donor.
- Very expensive and management intensive, must have strong market for high value kids.
- Difficult to do legally in goats due to restrictions on drugs used in the procedure.

Buck Breeding Soundness Examination

- Not so much to identify sterile males as to identify marginally fertile males.
- Late kidding, low conception rates and small litter sizes cost big dollars. (Especially since goats are seasonal breeders and goat markets are seasonal)



Breeding Soundness Exam

- Evaluation of semen sample
  - Semen volume and concentration
  - Correct morphology
  - Motility
- Physical examination for ability to breed
  - Reproductive system
  - Musculoskeletal system
- Libido determination must be made from observations over time.

Your local veterinarian can help you identify problems before they are problems.

Oklahoma Veterinary Medical Association
www.okvma.org

American Association of Small Ruminant Practitioners
www.aasrp.org

Goat Farm Budgeting

Mr. Roger Sahs
Oklahoma State University

Introduction

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

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

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

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

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

Enterprise Budgets

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

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

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

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

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

Production

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

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

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

	Weight	Unit	Price/Cwt	Quantity	Total	$/Head
PRODUCTION						
Male Kids	70.0	Lbs.	$91.47	40.50	$2,593	$51.86
Female Kids	70.0	Lbs.	$91.47	30.50	$1,953	$39.06
Cull Does	85.0	Lbs.	$55.00	7.00	$327	$6.55
Cull Replacement Doe Kids	70.0	Lbs.	$125.00	0.00	$0	$0
Cull Bucks	135.0	Lbs.	$79.94	0.00	$0	$0
Total Receipts					**$4,873**	**$97.47**
OPERATING INPUTS		**Unit**	**Price**	**Quantity**	**Total**	**$/Head**
Pasture		Head	$1.60	1	$80	$1.60
Hay		Head	$9.24	1	$462	$9.24
Grain		Head	$0.00	1	$0	$0.00
Protein Supplement		Head	$34.48	1	$1,724	$34.48
Salt/Minerals		Head	$2.85	1	$143	$2.85
Vet Services/Medicine		Head	$2.09	1	$105	$2.09
Vet Supplies		Head	$3.25	1	$163	$3.25
Marketing		Head	$8.50	1	$425	$8.50
Mach/Equip Fuel, Lube, Repairs		Head	$6.33	1	$317	$6.33
Machinery/Equipment Labor		Hours	$10.00	0.90	$450	$9.00
Other Labor		Hours	$10.00	2.00	$1,000	$20.00
Annual Operating Capital		Dollars	7.00%	45.19	$158	$3.16
Total Operating Costs					**$5,025**	**$100.50**
Returns Above Total Operating Costs					**$(152)**	**$(3.03)**
FIXED COSTS		**Unit**	**Rate**		**Total**	**$/Head**
Machinery/Equipment						
Interest at		Dollars	7.25%		$79	$1.57
Taxes at		Dollars	1.00%		$18	$0.36
Insurance		Dollars	0.60%		$7	$0.13
Depreciation		Dollars			$163	$3.25
Livestock						
Interest at		Dollars	7.25%		$341	$6.82
Taxes at		Dollars	1.00%		$69	$1.37
Insurance		Dollars	0.60%		$28	$0.56
Depreciation		Dollars			$77	$1.53
Land			$0			
Interest at		Dollars	0.00%		$0	$0
Taxes at		Dollars	0.00%		$0	$0
Total Fixed Costs					**$780**	**$15.59**
Total Costs (Operating +Fixed)					**$5,805**	**$116.09**
Returns Above all Specified Costs					**$(931)**	**$(18.62)**

Source: OSU Enterprise Budget Software.

Production Costs

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

services. Overhead expenses are included in whole-farm budgets, but are generally excluded in enterprise budgets.

Variable Costs

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

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

Fixed Costs

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

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

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

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

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

Returns Above Total Operating Costs

The return to fixed costs, risk, and management (that is, the returns above total operating costs) is computed by subtracting total operating costs from total receipts. When returns above operating costs are positive, production is economically rational for an established enterprise. Positive returns above total operating costs indicate that the enterprise generates enough revenue to cover all variable costs and some portion of fixed costs. If returns above total operating costs are negative, the enterprise is not generating enough

revenue to cover even variable costs. Unless the producer is willing to subsidize the operation (for instance, by contributing off-farm income), eliminating this enterprise will increase profits or decrease losses on the overall farm business. The return above total operating costs is also known as gross margin.

Returns Above All Specified Costs

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

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

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

One of the most important keys to successful goat operations is to be as cost effective as possible. As mentioned previously, one needs to periodically evaluate the contributions of all resources used in the operation. Look at possibilities for improving cost control through new technologies or cultural practices. Identify key leverage points that can generate the "most bang for the buck". Are there ways to reduce the number of trips to the feed store while still meeting nutritional requirements? Try to minimize harvested or supplemental feedstuffs with improved grazing management. A goat is a forage harvesting machine and grazing will always be cheaper than providing harvested forages. There is no single management practice that affects livestock profitability more than stocking rate. Can you do a better job of taking care of the herd instead of regular visits from the veterinarian? Benchmark what other producers are doing. Spending dollars wisely given the appropriate management practice can generate major dividends that impact the bottom line. After all possibilities to improve the budget have been exhausted and long-run earnings still appear unsatisfactory, the best decision may be to exit the enterprise and employ resources in a different enterprise or investment.

OSU software is available to develop a customized budget for an individual operation (http://www.agecon.okstate.edu/budgets). The Microsoft Excel-based software provides users access to important agricultural references during an "interactive" budget building process. Through a series of links and pop-up menus, users may override defaults with their own values to customize the budget if their experience and farm records indicate different values and production practices. Where possible, web-links are built into the spreadsheets to provide users important economic and agricultural science information on the Internet. Link

examples include OSU Extension publications, Oklahoma Agricultural Statistics Service data, and Langston University goat information.

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

Other Aids to the Process

Education

The producer needs to know what they are doing or raising goats will be a painful lesson in the pocketbook. You will need to have an eye for detail, be able to follow set procedures, and understand the risks involved. Use the best information available and include all decision makers in the business planning process. Talk to local growers and Extension personnel. Other sources of information are books/periodicals on meat goat production and industry, commodity organizations, and meat goat websites such as Langston University (http://www2.luresext.edu). The National Ag Risk Education Library provides risk management education on a variety of topics including goats. Focus on financial management as much as production performance. Realize that alternatives that appear profitable for one producer may not work for another. Everyone's experience levels, managerial abilities, and willingness to assume risk is different. Do your homework!

Financial Records

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

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

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

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

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

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

Budget Limitations

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

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

Conclusion

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

Business management requires that producers focus on financial management as much as production performance. In an enterprise with seasonal and cyclical price changes, sensitivity to variable grain and hay prices, and vulnerability to drought, successful managers discover that life is a whole lot easier saving money through budget planning. Goat producers interested in being profitable should expect to do no less.

References

Doye, D. (2009) Budgets: Their Use in Farm Management. *OSU Extension Facts AGEC-139*, Cooperative Extension Service, Oklahoma State University. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1682/AGEC-139web.pdf

Doye, D. (2009) From Cash Records to Cost of Production, *OSU Extension Facts AGEC-242*, Cooperative Extension Service, Oklahoma State University. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1663/AGEC-242web.pdf

Doye, D. (2009) Information Systems for Oklahoma Farmers, *OSU Extension Facts AGEC-302*, Cooperative Extension Service, Oklahoma State University. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2483/AGEC-302web.pdf

Doye, D. (2008) Quicken for Farm Financial Records. *OSU Extension Current Report CR-324*, Cooperative Extension Service, Oklahoma State University. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1799/CR-324.pdf

Doye, D. and R. Sahs (2009) Using Enterprise Budgets in Farm Financial Planning. *OSU Extension Facts AGEC-243*, Cooperative Extension Service, Oklahoma State University. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1658/AGEC-243web.pdf

OSU Enterprise Budget Software. http://www.agecon.okstate.edu/budgets/.

Pack Goats

Mr. Dwite and Mrs. Mary Sharp
Paradise Ranch

Introduction

Introduction to Dwite and Mary Sharp

Dwite and Mary Sharp have raised and trained pack goats for over 11 years. They own and operate Paradise Ranch in the Flint Hills near the historical town of Council Grove, Kansas. Their family has lived in Morris County for eight generations. Although they grew up in southern California they have returned to the Flint Hills several times to live. The last time they moved to the Flint Hills was in 1997 when they moved from Charlotte, North Carolina; this time to stay.

In 2000 Dwite retired from auto racing where he had been a Design and Fabrication Engineer for over 30 years. Involved with NASCAR's Winston Cup Division he designed and built cars for Felix Sabotos, Rick Hendricks, Richard Childress and many others.

Mary had been in restaurant management for many years before returning to Kansas and after returning to the Flint Hills she opened her own café. After a year she called it quits and decided to stay home and raise pack goats. Since 1999 Mary has been the working force at Paradise Ranch tending to the chores on a daily basis.

In 2001 Dwite took a job with BNSF Railway in the engineering department, but his true passion now is the creatures of Paradise Ranch. There they raise pack goats, high end Boer goats, Mammoth Donkeys, guineas, and Doberman Pinschers.

Introduction to Goat Packing

Goat packing was first invented in 1972 out of necessity by John Mionczynski, a scientific researcher for the U.S. Forrest Service.

His job was to follow and stay close to a band of Rocky Mountain big horn sheep and to observe and record their food habits and behavior in the wild. The sheep had been fitted with radio collars.

John was on his own and at first he used horses to carry his equipment and supplies. The horses didn't work very well, they did a good job getting to base camp, but they couldn't get near the terrain where the sheep lived. There wasn't enough grass in that country to leave them picketed out for more than a day. He would have to come back once a day to move and water them. This was not going to work.

So the horses went and he started backpacking. Carrying a backpack in that terrain was dangerous enough but after weighing his pack it weighed over one hundred pounds.

He was at a high level of desperation, after a particularly difficult day in the mountains, he imagined a goat packed up like a horse. At first he laughed at the idea, but he was desperate. Several days later he returned home for a few days off. He had several goats, he liked goat milk. One was an eleven year old wether named Wethervane that he harnessed and used to haul water on a travois from a creek to a cabin. He knew Wethervane could haul a couple hundred pounds on a travois using an old upside down horse halter for a harness. He had no idea how he would react to carrying a load on his back. He started slowly using a saddle bag, adding a little weight at a time, leading him around. Wethervane acted as though he was carrying nothing. So John got some bigger bags and loaded them with his gear. He slung them over Wethervane's back, using a horse saddle pad for padding. It worked, this was becoming exciting. After a day of walking Wethervane around and increasing the weight, it became evident that with a few refinements he could prob-

ably take Wethervane back to the mountains with him. He made the first pack goat saddle out of some 1"x6" boards and cross bucks from a sawed up shovel handle. It became clear that with the saddle to help distribute the load more evenly, Wethervane could easily carry even more weight.

Back in the mountains Wethervane followed faithfully and silently. He was so quiet he let him stay at camp and even at the observation posts. Wethervane's true test came the day the sheep decided to migrate. Could he keep up? It started before daybreak. The radio signals were clear; they were on the move. Wild sheep can go thirty miles in one move and you have no idea where they will end up. John and Wethervane hiked for several days along escarpments and over mountains. Although Wethervane had a few new things to learn, he performed beautifully. John was ecstatic. You can teach and old goat new tricks!

Each day Wethervane worked and became stronger and could carry more weight. John could see Wethervane's muscles growing and firming up.

In time John was packing Wethervane, a doe named Jessie (a milk goat), and several kids as trainees.

John's greatest pleasure came from seeing how healthy, alert, and handsome a goat can look when it's being worked. Also how much like a wild animal it can act; testing the air for scents, twitching the ears, looking around ,curious about every new sound, scent, and movement. They were a different animal entirely from the sloth like, pot bellied barn potatoes.

Several years later Wethervane, the first pack goat, was killed by a hunter in the opening day of deer season.

John went on to run his own goat-centered outfitting/guide service, building and selling custom pack saddles, and raising pack goats. John Mionczynski is known as the father of goat packing.

Facts about Goats

1. Goats are quite picky about what they eat.
2. Goat's eyesight is seven times better than a human.
3. Goats can smell with their mouth (called the Flehman response), using an organ in the roof of their mouth called the Jacobsens organ. When they curl up their upper lip with their mouth slightly open, they are smelling.
4. Goats can be very social animals making them wonderful companions.
5. Goats will follow with out being led.
6. Goats are the most surefooted animal on the planet.
7. Goats are one of the most intelligent creatures on the planet.
8. Goats are thought to have been domesticated more than 10.000 years ago. 5,000 years before the horse and probably the first wild animal to be domesticated.
9. Goat's primary diet consists of weeds and brush.
10. Goats are browsers not grazers.
11. Goats can go 3 or 4 days without water. The only animal better is a camel.
12. While in the desert a large wether can carry enough water for you and itself to last a week.
13. Goats can adjust their metabolism as the need arises.
14. An exercising goat has up to 12% heat loss through their horns. (They are like radiators)
15. Generally there is no need to carry feed for goats on a pack trip.
16. Goats are herd animals and should be kept with at least one other goat.
17. Goats have the ability to regain all their natural instincts when taken into the wilderness.
18. Goats have the widest variety of food preferences.
19. When danger approaches pack goats will surround you and face the danger. They will not flee.
20. Horned goats are capable of killing predators, and will if forced to do so.

21. Wildlife has been known to follow and get extremely close to pack goats in the wild. This makes for great photo opportunities.
22. When given a large selection of plants in a pasture a goat is capable of eating the correct amount of the right plants to be at optimum health. A nutritionist can not compete with this ability.

Preparing the Facilities for Pack Goats

So as not to get the cart in front of the goat, we must get the facilities in order before bringing the goats home. Packgoats are no different than other goats as far as their needs.

Their needs are:

1. Goats need housing that will protect them from rain and wind, but is not so tight as to be unventilated. Goats are susceptible to respiratory problems, because they will urinate and defecate in their living quarters. Their housing should be well ventilated. A three sided structure will work just fine. Face the opening so the wind doesn't blow in. You can even build a wall in front of the opening 3'-4' out. Leave the eaves under the roof open so the air can circulate. Use your imagination. There is no set rule as to what the goathouse should look like, so lots of different buildings will work. If you have one goat that is aggressive you might want to have an escape door on each end. The size of the house will depend on the number of goats to be housed. A minimum of 15 square feet per goat is needed and more if you have horned goats.

2. Pens and Pastures; the goat house should have a pen or corral on the side or sides that are open, so you can contain the goats as needed. I recommend using 2"x4" woven wire or even 2"x4" horse panels. These two are five feet tall. My reasoning for this is to protect the goats inside the pens from predators. The 2"x4" openings will not allow the small kids to get their heads through the fence and be grabbed by something on the other side. This is a very common way for goats to be killed. We have had very bad luck using cattle panels and woven field wire (sometimes called hog wire) which have 6"x6" openings. Newborns have been known to crawl through these fences and as they get older and have horns they get their heads stuck in the fence and then they are at the mercy of what ever is on the outside. The wire with the 6"x6" opening is cheaper but don't take the chance! Spend the money at the beginning before you loose something precious to you! Also don't use welded wire. The welds will eventually break loose and your fence will come apart. We use T posts everywhere we use panels. With the woven wire you must have braced, hedge corner posts. The reason for this is because the wire must be stretched and if they are not cemented and braced the tension of the wire will pull the posts over. We use 4'-12' round tubular gates and cover the side the goats are on with 4' chain link. You could also use chain link gates. All the materials can be bought at a farm and ranch store. Remember to put the fence on the side of the post that will be pushed on most. For example, if you have cows on one side and goats on the other, then the fence should be on the side the cows are on. If you have nothing on the other side the fence should be on the goat side. Let the post support the fence not the wire that is holding the fence to the post. When putting the T posts in the ground do not forget to face the T post the correct way for the side the fence will be on.

Pasture fence can be a real challenge for keeping goats in. No other animal will point out your fence building short comings faster than a goat. It is said that if you build a 10' high solid wood wall all the way around the pasture and then go 3' inside that wall and build another one just like it. Now fill the 3' space between the walls full of cement. After it dries fill the pasture with water all the way to the top of the walls. If it holds water it might hold a goat!

My experience with goat fencing is vast. I've made every mistake I think I could have. I think I finally have it under control. Goats are brilliant escape artists and eating machines. These two attributes make them tough to fence. You might think you've beat them but you'll only know for sure when the eating looks better on the other side of the fence. That is why they will show you your deficiencies in fence building. I have had

way more Boer goats over the years than pack goats but it seems to be the trained pack goats that instigate the major break outs. These very large goats have escaped through the places I would not have believed if I had not seen it with my own eyes. They have shorted out electric fences and led one hundred goats into the neighbor's bean field. They have done this more than once.

If you have no pasture fencing at all and must start from scratch I recommend not using electric fences. If you have existing fences and can't afford to replace all of them electric fences are usually the cheapest option.

If you are putting up a completely new fence I would use goat and sheep woven wire. There are two kinds of this wire. The best is the one with 4"x4" openings. The other has 6"x12" openings. The 4"x4" wire will actually keep the goats heads on your side of the fence. The 6"x12" wire will allow the goats to put there heads through the fence but the opening is large enough to allow them to remove their heads easily. The 4'x4' wire is my first choice but because it has so much more wire, it is also more expensive. I use the 48" width. Both of these products are manufactured by Oklahoma Wire and Steel and come in 330' rolls.

I space the T post 10' to 15' apart and use cemented braced hedge posts on the corners. If the fence goes down into a low spot and then back up, you will probably need to cement a hedge post on both sides of the low areas to keep the tension of the fence from pulling the T post out of the ground (specially when it rains).

If you have an existing fence and you need to goat proof it you have several options. If it is barbed wire you can add more wires to the fence. Goats almost always go under the fence so adding wires to the bottom will help. Then stretch a wire (it can be the barbless wire) about 3" to 4" off the ground. Space it so they are closer together at the bottom and a little wider as they go up. If the wires are stretched tightly and spaced correctly, seven wires will work.

The next option is to install an electric fence on the inside of the existing fence. I've had a lot of experience with this. The first thing to do is select the fence charger. I highly recommend using a low impedance charger. Although the testers for electric fences test in volts, it is not the voltage that shocks. It is the amps that shock. A low impedance charger turns up the amperage (makes it hotter) as the fence is contacted by vegetation or wet grass. If you tested it with a tester it would show the voltage has dropped but, actually the fence is very hot. With the non low impedance fence charger the fence would have been colder. Low impedance chargers use joules to measure the power. I suggest at least 6 joules for goats. To get this you will need a charger that is rated for about 100 miles of fence. Battery operated fence chargers will not be hot enough. The lesser ones will work for a while and then the pack goats will figure it out and they will escape. I use a 100 mile low impedance Zareba fence charger. Orschlins and Tractor Supply sell them. My pastures are only about 25 acres total.

We attempted to place insulators on the same T posts that the existing barbed wire was on. This failed miserably. The pack goats went between the fence posts. They seemed to be able to tell when the fence surged. In between the surges they used their horns to push the hot wire over and hooked it on the barbwire. This shorts the fence out. They then kneel down and push their nose under the bottom wire of the barbed wire fence, which is about 6" off the ground, and they escaped. Once again there were one hundred goats in the bean field! All of this took about 30 seconds. I counter attacked! I bought ½" rebar and cut it into 4' lengths. I placed the rebar 20' to 25' apart and 1' inside the barbed wire fence. I then placed one 14 gage galvanized steel wire about 8" to 10" above the ground and another one 16" above the first. I stretched the wire as tight as a banjo string. I then released the goats from the corral. They slowly walked out of the corral and headed to the scene of the crime. Remembering the taste of the bean field, they broke into a full run. As they approached the new electric fence they skidded to a halt, looked up and down the new fence, and then turned and walked away. That was about six years ago and I haven't had a goat out since.

The bad part about electric fences is that they need constant attention. You must walk the fence to make sure that the insulators haven't broken and fallen off, or moved up or down the rebar. We have learned to use ceramic corner insulators. The plastic ones pull through and short out in time, killing the fence. Tree branches fall on the hot wires and push the fence to the ground stretching the wire. We have had our Anatolian Shepherd chase coyotes through the fence, damaging it. So if you can fence your goats with less maintenance you will make it easier on yourself.

Choosing Your Pack Goats

Not everyone who would like the benefits of a pack goat should actually own one. If your short on patience and aren't a big fan of Mother Nature, then goat packing will not be for you. To find out how you feel about pack goats you might want to rent one for a small outing and see how it goes.

If you decide you would like to own a pack goat you need to get at least two. Goats are herd animals and need at least one other goat in their life to be emotionally healthy.

You can buy an experienced pack goat from a breeder/ outfitter. If you do you will miss out on all the fun and experiences of seeing these wonderful creatures mature and blossom with your interaction.

The majority of our pack goats started bonding with us at birth or within the first week. A few of our pack goats were actually purchased and restructured into pack goats at a much older age. Four of them were actually two years old before becoming pack goats. I would not recommend this for the beginner. Two of these four were completely wild animals and quite dangerous. These two have turned out quite well but the amount of time required was immense. I would be willing to say that we will probably not do that again.

If you don't have a lot of experience caring for baby goats you may opt to purchase you pack goat pre-trained at about six months of age. This way he has a head start in the right direction (That is if you purchase him from a good pack goat breeder; they are not all equal). You can continue his training and learn together.

You need to learn about good pack goat conformation. This will be beneficial in selecting a goat with good potential. Don't think that all Dairy goat breeders know about good pack goat conformation, because this is not likely. They breed for milk production, utter attachment, etc. They do not breed for pack goat conformation. If you are going to spend all the time, effort, and money on a quality pack goat let a reputable pack goat breeder help you get started.

It is possible to get good pack goat kids from outside the pack goat industry but without the knowledge it's difficult to make an accurate choice.

We do sell pack goat kids, but only in advance. Meaning we discuss what you want and then we breed the kid, to be delivered a few days after birth or at six months. We take our responsibility seriously.

Training

Training is something that is best if it begins shortly after birth. It's best for the bonding with humans aspect if the human becomes mom right away. That is not to say a good pack goat can't be achieved later. Removing the kid immediately after birth has a negative impact on the mental well being of the doe. Also the kids seem to learn about eating hay, grain, and minerals better with their mother. Mom really does know best. The sooner the kids start eating hay, grain, etc., the better they will grow. When you remove the kids from the doe you become their mother; you have to teach them the most important thing in a goats life, EATING! Sometimes it can be a real struggle to get them to eat enough. We have had bottle babies that at three months were eating very little grain. We feared they would starve if we weaned them. You must spend a lot of time with the kids and teach them by placing the grain in their mouth over and over again. You must do this before giving them their bottle. This seems sometimes like they aren't going to figure it out and then

one day they finally get it. When you cut back the number of times a day they get a bottle they will think a little bit more about eating grain, hay, etc…

So why don't you just let the doe raise the kid? After all letting the doe raise the kid would be much easier. You would not have to get up in the middle of the night, get dressed, heat up the milk, go out in the cold, and feed the kids. When the doe does the work the kids tend to become wild goats and are not dependent on you. You want your pack goats to be completely dependent on you for food, water, and emotional support. Oh yes you have to become a goat!

You should spend a lot of time with the kids besides the feeding time. Go in to the pen, sit on a milk crate, talk to them, call them by name, pick them up, and hold them as long as you can. Soon they will be too large for this so do it while you can. For the first few weeks it is okay to let them jump on you. After a few weeks do not allow the goats to even put their front feet on the fence. Now start teaching them that it is not okay to jump on you, the gate, the fence, the car, or anything else. The word "down" should be taught at a young age.

Goats don't tolerate violence. Don't make the mistake of loosing your patience and yelling at or striking them. You will go from the top of the hill to the bottom, in their eyes. It could take weeks to regain their trust. Goats have a good memory and will get even. It may not be today or even tomorrow, but it will happen.

After a couple weeks you can put a small collar and leash on them. Let them get used to this slowly. Do not try to lead them until they are comfortable being tied (held by you). NEVER, NEVER, leave the collar on unless you are right there. Goats can strangle quickly. In time the goat and you will learn to deal with the safety issues of collars and horned goats.

1st Hour

1. "All Wether Marching Band" arrives.
2. Paradise Ranch introduction.
3. Introduction to the "Boys".
4. How goatpacking began.
5. Packgoat confirmation.
6. Horns: yes or no?

2nd Hour

1. Choosing a Packgoat.
2. Packgoat facilities, housing, fencing, and pens.
3. Training.
4. How to tie goats out safely.
5. Vaccinations.
6. Parasite.

3rd Hour

1. Hoof trimming.
2. Nutrition and wavy teeth.
3. Saddles, pannier bags, and how to pack them.
4. Questions and answers.

This would not be possible without the members of the "All Wether Marching Band". (The Horn Section)

Alpine	Boer	LaMancha	Nubian	Nubor (Nubian/ Boer cross)	Oberhasli	Saanen	Sabor (Saanen/ Boer cross)	Toggenburg
Louis	Dynamite	Snow	Chief	Micah	Mud Pie	Rock Slide	Clark	Poncho
Geronimo	Brock	Axel	Jake	Rio	Satchel	Avalanche	Luke	Lefty
Cochese	Valentino				Cargo	Glacier	Noah	
Forrest						Cliff	Gabriel	
Badger						Rocky	Tarzan	
Ridge								

Books

"The Pack Goat"
by John Mionczynski
Published by Pruett Publishing Co., Boulder, Colorado

"Goat Medicine"
by Mary C. Smith & David M. Sherman
Published by Lea & Febiger

"Meat Goat Production Handbook"
Available from Langston University
www.luresext.edu/GOATS/mgph.html

"Practical Goat Packing"
by Carolyn Eddy for $17.95
"Diet for Wethers" by Carolyn Eddy for $14.95
Shipping for one or both for $3.50
Order from: Eagle Creek Pack Goats
PO BOX 755
Estacada, Oregon, 93023

"Field First Aid for Goats" $24.95
by Carolyn Eddy & Alice Beberness
"Packable Guide for First Aid for Goats" $16.95 by Carolyn Eddy & Alice Beberness
Order from: Alice Beberness
PO BOX 4
Alvadore, Oregon 97409
Check, money order, or pay pal ID # Carolyn@goattracks.com

Magazine

"Goat Tracks Journal of the Working Goat"
558 Park Ave
Logan, Utah 84321
E-mail Shannon @ www.GoatTracksMagazine.com

To become a member of the "North American Pack Goat Association"
Log on to www.napga.org

Small Stock Mortality Composting

Dr. Roger Merkel[1], Dr. Terry Gipson[1], Ms. Janelle Malone[2] and Dr. Kefyalew Girma Desta[2]
[1]Langston University
[2]Oklahoma State University

Why Compost Sheep and Goat Mortality?

All livestock producers encounter mortality. Goat and sheep operations may experience annual mortality losses of up to 10% of young before weaning and 5% of adult breeding animals. For a producer with 30 breeding females, two-thirds of whom have twins, this would mean a loss of about 5 young and 2 adults. Severe disease or internal parasite outbreaks may add to this loss. Finding appropriate carcass disposal methods can be challenging.

The State of Oklahoma Department of Agriculture, Food and Forestry lists five acceptable options for animal carcass disposal: 1) rendering, 2) burial, 3) incineration, 4) landfills, and 5) composting. Finding a rendering service for sheep and goats is difficult. Since July 1, 2006 there has been no rendering facility in Oklahoma that accepts goat carcasses or offal (Dan Parrish, Director, Agric. Env. Mgt. Serv. Div., Oklahoma Dept. of Agric., personal communication). Burial may be expensive if proper equipment must be rented. Further, there are rules on burial that must be followed. Carcasses may not be buried less than 1 foot above flood plains or within 2 feet of the water table or bedrock. Burial cannot take place within 300 feet of water sources, houses, public areas or property lines and carcasses must be covered with a minimum of 2.5 feet of soil. The cost to purchase and operate an incinerator is not economical for most producers. Not all landfills accept carcasses, and those that do charge disposal fees.

Composting is an inexpensive, environmentally friendly method of disposing of animal mortality that is commonly used in the poultry and swine industries. In the same way that microorganisms degrade vegetative waste and turn it into a rich soil amendment, animal carcasses can be turned into an organic matter-rich material that can be spread on pastures and other agricultural land. When properly done, animal composting generates no odor and temperatures generated during composting are high enough to kill most pathogens. However, animals suspected to have died from severe zoonotic diseases, i.e., diseases that can be passed to humans, such as anthrax, should not be composted. Sheep and goats that die from scrapie should never be composted as the agent responsible for this neurological disease is not killed at common compost pile temperatures. However, for most cases of mortality, composting is a safe, low-cost alternative to other carcass disposal options.

Mortality Composting Basics

To successfully compost animal mortality requires attention to the basics of a good compost pile: proper carbon to nitrogen ratio (C:N), moisture content, available oxygen, and pore size of material. Proper composting is done by aerobic microorganisms, meaning that they need oxygen to survive, in a temperature range of 130 – 150°F. These microorganisms require nutrients in the form of carbon and nitrogen in a C:N ratio of roughly 30:1 or 30 parts carbon for each part nitrogen. Animal carcasses are high in nitrogen and the surrounding compost material should be high in carbon to create the proper C:N ratio. There are many suitable carbon sources for mortality composting. One commonly used material is sawdust. Wood shavings and old hay or straw can be used when mixed with other material, such as manure or finished compost, in a 50:50 mixture. Mixtures of animal bedding and manure, such as that from horse stalls, are an acceptable carbon source. Used bedding after a livestock show at a local fairgrounds or horse arena can be a source of carbon material. Poultry litter has been used in mortality composting as a source of nutrients and microor-

ganisms but it is very high in phosphorus. Because of environmental concerns, the Oklahoma Department of Agriculture, Food and Forestry (ODA) requires mortality composting piles using poultry litter to be covered and runoff prevented.

Optimum moisture content for a compost pile is around 50%. If the material is too dry, the bacteria have insufficient moisture and composting will be very slow. If the material is too wet, water fills the pore spaces in the compost pile resulting in aerobic bacteria being replaced by anaerobic bacteria that do not require oxygen. Decomposition by anaerobic bacteria is very slow, generates odors, and does not produce sufficient heat. Squeeze a handful of the compost material. If water drips out, it is too wet. If none sticks to your hand, it is too dry. For a more accurate moisture level reading, use a portable moisture probe.

If the particle size of material making up the carbon source is too small, there is inadequate pore space to trap oxygen. If the material is too large, such as chopped hay or straw, there can be too much air transfer and heat, odors and moisture can escape the pile. Sawdust, mixtures of shavings and manure, or bedding and manure all have good sized particles providing adequate pore space.

Site Selection

After deciding to compost mortality, the next decision is where to construct the compost pile. Use ODA guidelines for animal burial to properly situate your mortality compost piles away from streams, wells, roads and property lines. Do not compost in areas with poor drainage or excessively sandy soil. A firm surface near the pile is needed for equipment and vehicle access and for storage of the carbon source. It is best to place compost piles away from public view. Mortality compost piles can be made with no surrounding structure; however, curious animals may dig into the pile so some type of surrounding wall or fence is beneficial.

Mortality Composting Bins

Depending upon the level of mortality expected, the amount of funds available and the permanence desired, different types of bins can be constructed.

Permanent bins

Permanent bins are constructed on a concrete pad of sufficient strength for the equipment to be used in building and turning compost piles, usually a tractor or skid steer with a bucket. The concrete pad helps prevent runoff and liquid seepage into the ground and provides a good working surface. A graveled area surrounding the pad helps when working in wet weather. The structure should be large enough to accommodate expected annual mortality and house a minimum of three bins, two working bins plus a third that can be used to store additional carbon source or where material is transferred as piles are turned. Permanent bins usually have a roof sheltering the pile from the weather allowing for better control of composting conditions.

Bins should be constructed from pressure treated wood with a minimum depth and height of five feet. Bin width should be a minimum of six feet wide or 1.5 times the width of tractor or skid steer buckets used in constructing and turning compost piles. When constructing the walls of the bins, spaces should be left between boards to allow for air exchange. The front of the bin should be removable or hinged and could be wooden or a type of gate made with mesh wire to enhance air exchange. Should a roof not be constructed, covering bins with a tarp helps protect the pile from rainfall that could make the compost too wet resulting in poor decomposition and odor generation.

Permanent bins are the most expensive to construct but provide the most control over the composting process and, once built, can be used for many years. An alternative to building a structure for permanent bins would be to utilize an unused storage or equipment shed.

Figure 1. A set of two wooden bins, with a third bin separately built to the side (not shown).

Low-cost alternatives

There are many low-cost alternatives to wooden bins. Two wire stock panels can serve as a bin by shaping them in a circle to enclose a mortality compost pile. Eight wooden pallets on edge can be held in place by t-posts or wired together to make an easy, low cost bin. Wire with small openings or unused chain link fence held in place by t-posts or wired to stock panels will help hold compost material in piles and prevent disturbance from wildlife and dogs. Bins should be made so they can be easily opened to build and turn compost piles, as well as for removing completed compost.

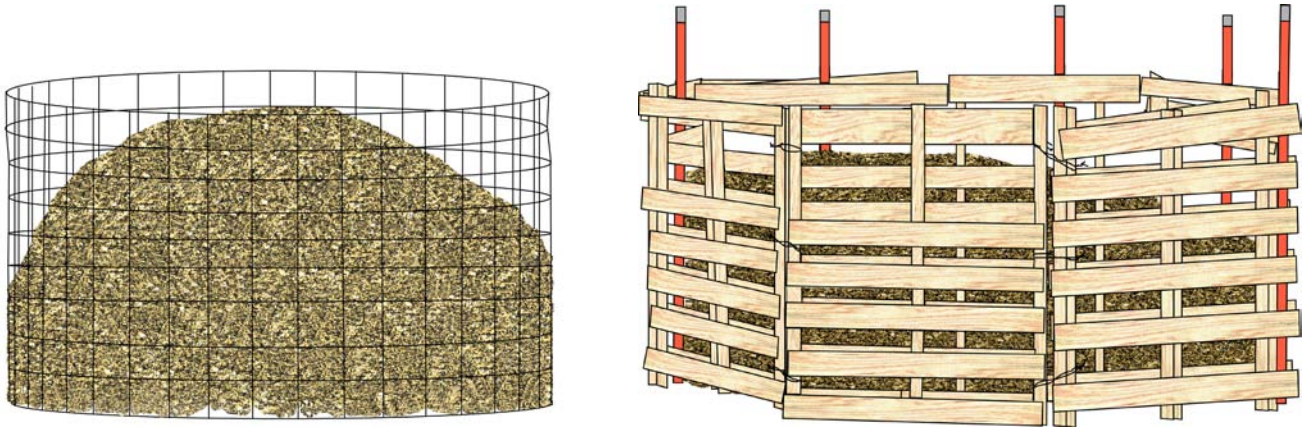


Figure 2. Bins can be made from wire panels or wooden pallets at minimal cost (All illustrations by K. Williams, Langston University).

Table 1. Estimated construction cost of different types of composting bins.

Bin type	Estimated cost[a], $
Permanent composting structure with 5" thick concrete pad, gravel work area, 3 – 6' x 6' bins with 5' side walls, pressure treated lumber, metal roofing	>5,000
Permanent simple structure with 3" thick concrete pad, 2 – 5' x 6' bins with 5' walls, pressure treated lumber, tarp covering	500 - 700
Non-permanent stock panel and wire	25 – 30
Non-permanent pallets and 8 t-posts (pallets assumed free)	25 – 30
Non-permanent woven wire and t-posts	25 – 30

[a]*All costs are estimates and can vary depending on several factors such as materials used, labor, etc.*

Windrow systems

Farms with large numbers of animals may wish to consider a windrow system for mortality composting. In this system, successive mortalities are added to the end of the pile made for the previous mortality. Usually, a portion of the covering carbon source material is removed and the carcass placed and covered. This continues until the row is considered complete.

Mortality Composting Process

Ensure you have plenty of carbon source material before beginning mortality composting. Approximately 100 ft^3 (3.5 yd^3) or 4 to 5 tractor buckets of the carbon source mixture are needed for each 100 lbs of mortality. If two or three carcasses are layered in a bin, the total will be somewhat less on a per animal basis as the base layer will be used for more than one carcass. However, too thin a base or covering layer of carbon source will lead to poor decomposition, excessive leachate or odors.

Building the pile:

1. Cover the base of the bin with 18 inches of carbon source material as an absorbent layer to trap liquid leached from the carcass during composting.
2. Place the carcass in the middle of the base a minimum of 12 inches from bin walls or sides.
3. Use a knife to lance the rumen and thorax. This provides access by microbes to the inside of the carcass and prevents the rumen from bursting due to gas build up from ruminal microbes.
4. If the bin is of sufficient size, add another carcass to the layer. Place adult carcasses back to back 8 to 10 inches apart and lamb or kid carcasses 6 inches apart with feet pointing to the pile's edge.
5. Cover the carcass layer with 6 to 12 inches of carbon source material.
6. Add enough water to create a suitable moisture content of roughly 50%. Two to three five-gallon buckets of water can be added per 100 lbs mortality. Adjust the amount depending on the dryness of the carbon source.
7. A second layer of carcasses can be added as described.
8. After all carcasses have been added, top off the pile with 18 inches of carbon source material creating a cone shape to shed rainwater if no roof or tarp covering will be used.

After a couple weeks, the pile will have shrunk and additional carbon source may be added to the covering layer. Check the pile occasionally to ensure animals have not disturbed it, that no portions of the carcass are visible, for noticeable odors, and pile temperature.

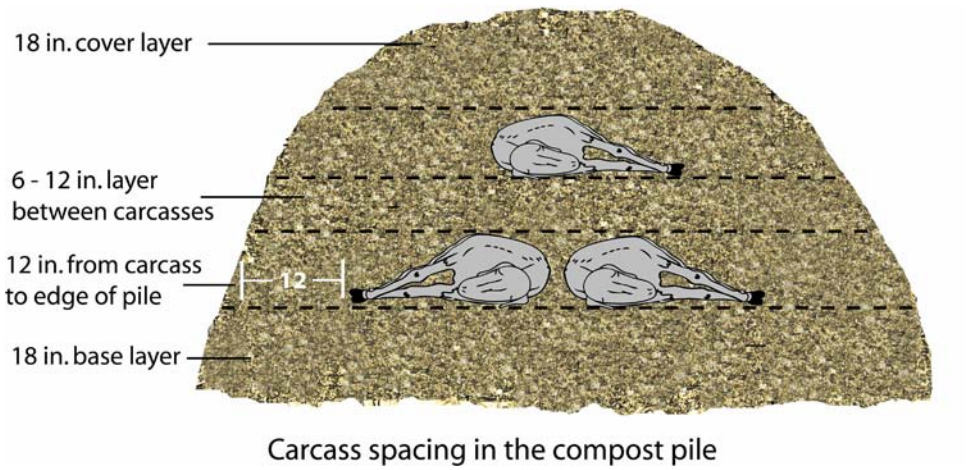


Figure 3. Use these minimum depth recommendations to ensure proper spacing and thickness of carbon source layers when layering carcasses.

Pile Temperature

After building the pile, bacteria will be working and generating heat. After three or four days, pile temperature should reach over 130°F and remain at that temperature for up to two weeks before beginning a gradual decline. A compost pile temperature above 131°F for a minimum of 3 days reduces pathogens below detectable levels and is needed to fulfill the requirements of a Class A biosolid allowing the completed compost to be used on public and private land. Requirements for Class B biosolids are less stringent and require a temperature in excess of 104°F for 5 consecutive days with a temperature of 131°F or greater for at least 4 hours during that period. Class B biosolids can be applied to agricultural land. For further information see http://www.epa.gov/owm/mtb/biosolids/503pe/index.htm. Temperature in excess of 145°F kills most weed seeds. A pile temperature that is too high, greater than 160°F, can affect bacterial survival. It is best to monitor temperature using a 36" or 48" compost thermometer thrust into the pile's core. Compost thermometers range in cost from $115 - $150. Two sources of long-stem compost thermometers are REOTEMP Instrument Corporation[1], Heavy Duty Windrow Thermometers, http://www.reotemp.com/ and Omega Engineering Corp., Compost Thermometers, http://omega.com/. If a thermometer won't be used, insert a long piece of metal rod, such as a piece of rebar, into the pile withdrawing it occasionally to feel if the pile is heating. At temperatures above 130°F, the tip of the rod can be held in one's hand for only one or two seconds.

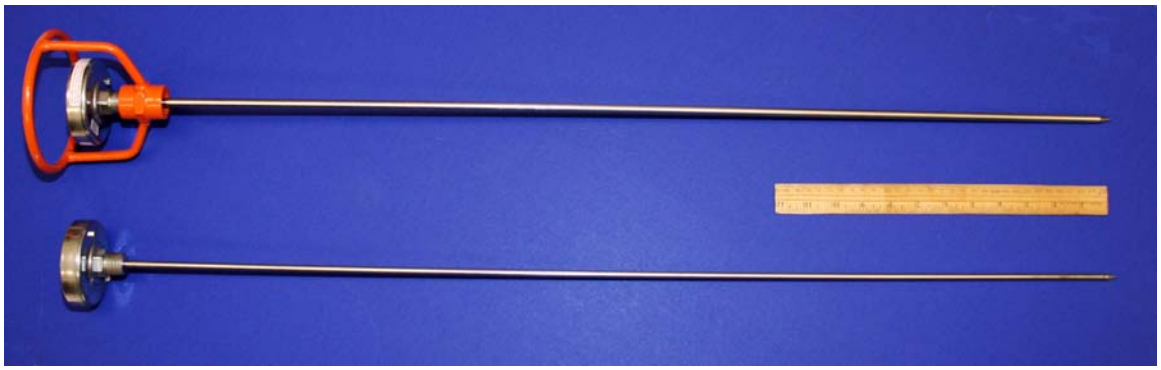


Figure 4. Compost thermometers are 3 to 4 feet long.

[1]Listing of trade names, proprietary products, or vendors does not imply endorsement by Langston University of the products or vendors named or criticism of similar products or vendors not mentioned.

Figure 5. Compost thermometers should measure core temperature. Temperatures over 131° F kill most pathogens.

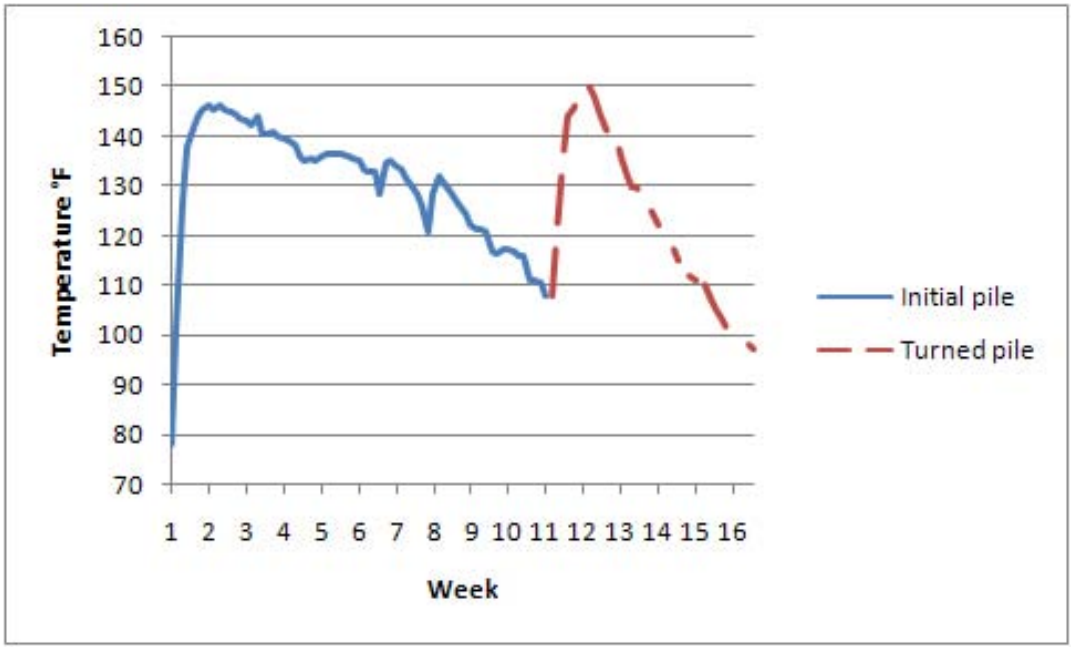


Figure 6. Temperature of a goat carcass compost pile made with a mixture of horse bedding and wood shavings.

Turning Compost Piles

When the temperature of the pile decreases to environmental temperature, or below 110°F, the pile should be turned to mix contents and aerate the pile. By this time, all flesh and soft tissues will have been decomposed and mainly bones are left. For carcasses of adult animals, this occurs two to three months after the pile is built. Lamb and kid carcasses may take only a few weeks. Use a tractor bucket to pick up material and either dump it back on the pile or move it to a new bin. Make sure enough covering layer is put on the turned pile. Moisture can be added if the pile is too dry or the pile can be allowed to dry if it is too wet, from trapped rainfall, for example. After turning, the pile should heat again and continue composting. After another two month period, the compost could be turned again and left to cure for several weeks before use.

Figure 7. Bones of goats after 10 weeks of composting.

Troubleshooting Mortality Compost

Low temperature

Low temperatures are usually the result of either too little or too much pile moisture or an improper C:N ratio. Remove some of the covering layer and check pile moisture using the handful squeeze method. If nothing sticks to your palm, add water. If water drips out, turn the pile and allow it to dry. Check the temperature a few days later to see if the pile has begun heating. A pile will also not heat sufficiently if the carbon source material does not pack tightly enough. For example, chopped cornstalks and long-stem hay or straw allows too much air movement to the extent that heat is lost and composting is poor. These materials should be mixed with manure or finished compost before using.

Pile odor

Odors can arise from compost that is too wet. Turn the compost and add additional carbon source. Wooden bins may trap rainwater if not covered and composting material on the sides and bottom can become too wet. Too low a C:N ratio and too thin a covering layer also contribute to odor. Make sure there is a good C:N ratio, the covering layer is at least 18 inches thick, and carcasses are a minimum of 12 inches from the pile's edge. The covering layer not only acts to shed rainwater, it also serves as a biofilter trapping gasses and odors generated by the composting process.

Failure to decompose

Failure to decompose is due to improper C:N ratio or carcasses that were laid too thickly or too close to the edge of the pile. Ensure that the pile is properly constructed and use fewer carcasses per layer.

Insect/fly larvae

Seeing insects or fly larvae is due to insufficient covering layer over carcass or liquids leaching from the pile creating odors. Build the pile with a thick absorbent base, ensure an adequate cover throughout the decomposition process and maintain a clean area surrounding the pile.

Compost Use

About one-half of the material from a mortality compost pile can be reused in a new pile and mixed with additional carbon source material. This reduces the amount of carbon source that needs to be on hand and also provides a source of bacteria for the new pile. The remaining composted material is a nutrient-rich medium that can be applied to pasture and other agricultural land. It is not recommended to use small stock compost on vegetables or areas where food is produced for direct human consumption.

Summary

Mortality composting is an easy, lawful, low-cost alternative for producers to dispose of livestock losses. Select sites away from water sources and the public. Producers may wish to construct permanent wooden bins on a concrete pad or use simple wire or pallet enclosures in which to compost. A carbon source such as sawdust, wood shavings mixed with manure, stable bedding or other carbon-rich material is needed to combine with the carcass to obtain a C:N ratio of 30:1. Temperatures in a properly made pile will be high enough to kill most pathogens. A portion of the resulting compost can be reused and the remainder spread on pasture land.

Acknowledgment

The authors wish to acknowledge the Sustainable Agriculture Research & Education (SARE) Program supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture for providing funding for this project.

References

Auvermann, B., S. Mukhtar and K. Heflin. 2006. Composting Large Animal Carcasses. Publication E-422. Texas Cooperative Extension. http://tammi.tamu.edu/largecarcassE-422.pdf.

Bonhotal, J., L. Telega and J. Petzen. 2002. Natural Rendering: Composting Livestock Mortality and Butcher Waste. Cornell Waste Management Institute. Cornell Cooperative Extension. http://compost.css.cornell.edu/naturalrenderingFS.pdf.

EPA. 1994. A Plain English Guide to the EPA Part 503 Biosolids Rule. U.S. Environmental Protection Agency. Office of Wastewater Management. Washingtion, D.C. http://www.epa.gov/owm/mtb/biosolids/503pe/index.htm.

Estienne, M.J. n.d. Disposing of Dead Goats. Maryland Cooperative Extension. http://www.sheepandgoat.com/articles/compost.html.

Higgins, S., S. Guinn and A.A. Guinee. 2008. On-Farm Composting of Animal Mortalities. Publication ID-166. Univ. Kentucky Cooperative Extension Service. http://www.ca.uky.edu/agc/pubs/id/id166/id166.pdf.

Looper, M. 2002. Whole Animal Composting of Dairy Cattle. Guide D-108. New Mexico State Univ. Cooperative Extension Service. http://aces.nmsu.edu/pubs/_d/D-108.pdf.

Payne, J. 2009. Proper Disposal of Routine and Catastrophic Livestock and Poultry Mortality. BAE – 1748. Oklahoma State Univ. Cooperative Extension Service. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-6301/BAE1748web.pdf.

DHI Training

Ms. Eva Vasquez
Langston University

STANDARD OPERATING PROCEDURES FOR DAIRY GOAT PRODUCTION TESTING

Effective January 1, 2004

CONTENTS

STANDARD OPERATING PROCEDURES

1.0 SCOPE & APPLICATION

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

2.0 SUMMARY OF PROGRAM

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

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

3.0 AUTHORITY

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

4.0 RESPONSIBILITY

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

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

5.0 DEFINITIONS

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

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

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

6.0 PERSONNEL QUALIFICATIONS

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

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

7.0 MINIMUM PERSONNEL TRAINING REQUIREMENTS

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

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

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

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

8.0 EQUIPMENT AND SUPPLIES

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

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

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

9.0 SAMPLE COLLECTION – PREPARATION

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

9.2 Obtain necessary sampling and/or weighing equipment.

9.3 Coordinate with herdowner and partner agencies, if appropriate.

10.0 SAMPLE COLLECTION - METHOD OPTIONS

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

GOAT METERS

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

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

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

10.3 All scales must be checked for calibration by a certified meter technician or an individual approved by the DHIA prior to being placed in active service. The field technician or the herdowner may own Scales. Approved individuals must calibrate scales using certified weights.

10.4 Scales should be identified with a unique identification number.

10.5 All scales must be submitted for an approved routine calibration check by a certified meter technician or an individual approved by the local DHIA on an annual basis.

10.6 All scales receiving repairs that may have affected accuracy must be checked for calibration by a certified meter technician or an individual approved by the local DHIA before returning to active service.

10.7 Each scale must be identified with a tag, sticker, engraving, or other marking indicating the last calibration year and meter center used.

10.8 Documentation of scales must include (1) the make and unique identification number of the scale, (2) the meter technician's or approved individual's name, (3) the meter center used, (4) the date of calibration check, and (5) the final calibration check readings.

10.9 Dip Sampling must be done in a manner that assures a representative sample from the entire milk volume collected.

11.0 SAMPLE HANDLING AND PRESERVATION

11.1 Use pre-preserved sample vials.

11.2 Samples should be kept at room temperature and out of direct sunlight.

11.3 Keep samples in control of the tester – ***EXCEPTION*** – for group tests, samples may also be in control of the group leader, or person designated to ship the samples/data to the laboratory.

11.4 Record all pertinent data on a field data sheet.

11.5 Samples should be shipped so that they arrive at the lab no later than 6 days after the test is performed.

12.0 DATA COLLECTION AND RECORDS MANAGEMENT

12.1 When a breeding date is available, and a doe freshens less than 10 days prior to the expected kidding date, it will be considered a normal kidding and the record initiated will be used for buck and doe evaluations. Does freshening 10 days or more prior to the expected kidding date, whether in milk or dry, will be coded as abnormal and the record initiated will not be used for buck and doe evaluations.

12.2 If a doe aborts while in milk and has carried a kid less than 80 days, her current record will continue without interruption. If a breeding date is not available, and the doe aborts while in milk for less than 240 days, her current record shall continue without interruption. Except for specific situations stated above, the current record shall end and a new lactation will begin.

12.3 Verification tests may be a required condition of test type plan or registry recognition level. It is the herdowner's and/or test supervisor's responsibility to arrange for such tests dependent on registry or regional requirements. Verification testing should be done in accordance with registry policies.

12.4 All data and information must be documented on field data sheets

12.5 Minimum Suggested Record Retention

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

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

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

14.0 REFERENCES

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

2010 Langston DHI Supervisor Test

(Must return by Jan. 31, 2010 if you want a certificate)

Where you previously certified by Langston to be a Supervisor? _____ _____
Yes No

Name: _____

Address: _____

City: _____ State:_____ Zip: _____

Telephone: _____

Who do you test for: _____

1. When a sample is spoiled or spilled, the year to date pounds of fat on the DMS 210 for that Doe will…
   ____increase ____decrease ____remain the same ____be zero

2. The $.08 charge on the invoice is for each sample submitted.
   ____True ____False

3. A Verification Test consists of ____ milkings?
   ____1 ____2 ____3 ____4

4. A new scale does not need the calibration checked.
   ____ True ____False

5. If the pill falls out of the vial, I should …
   ____pick it up and put back in vial.
   ____wash it off and put back in vial.
   ____ throw it in trash and get a new vial.

6. I can use a vial without a pill.
   ____True ____False

7. When I dry off all my Does, I do not need to send anything to Lab.
   ____True ____False

8. When a doe dries, it is not necessary to indicate it on the paperwork.
   ____True ____False

9. The best way to correct a problem is to …
   ____ Wait until the end of the year
   ____ Wait until another test to see if the problem was corrected.
   ____ Call as soon as you see a problem
   ____ Make a note of the error and highlight it.

10. The best way to label the vial is to …
    ____ Use a unique numbering system with a secret code.
    ____ Put the index number of the Doe on the vial.
    ____ Put the order in which the Does were milked (1, 2, 3, 4…ect.).
    ____ Put the Doe's name on the vial.

11. Explain the difference between a transfer Doe and a new Doe entering the herd.

12. Can Langston calibrate your scales?
    ____Yes ____No

13. Before sending the paperwork, I always ensure that I have put down fresh dates for Does that have freshened, dry dates for Does that have dried that have dried, sold dates for Does sold, and death dates for Does that have died since last test.
    ____True ____False

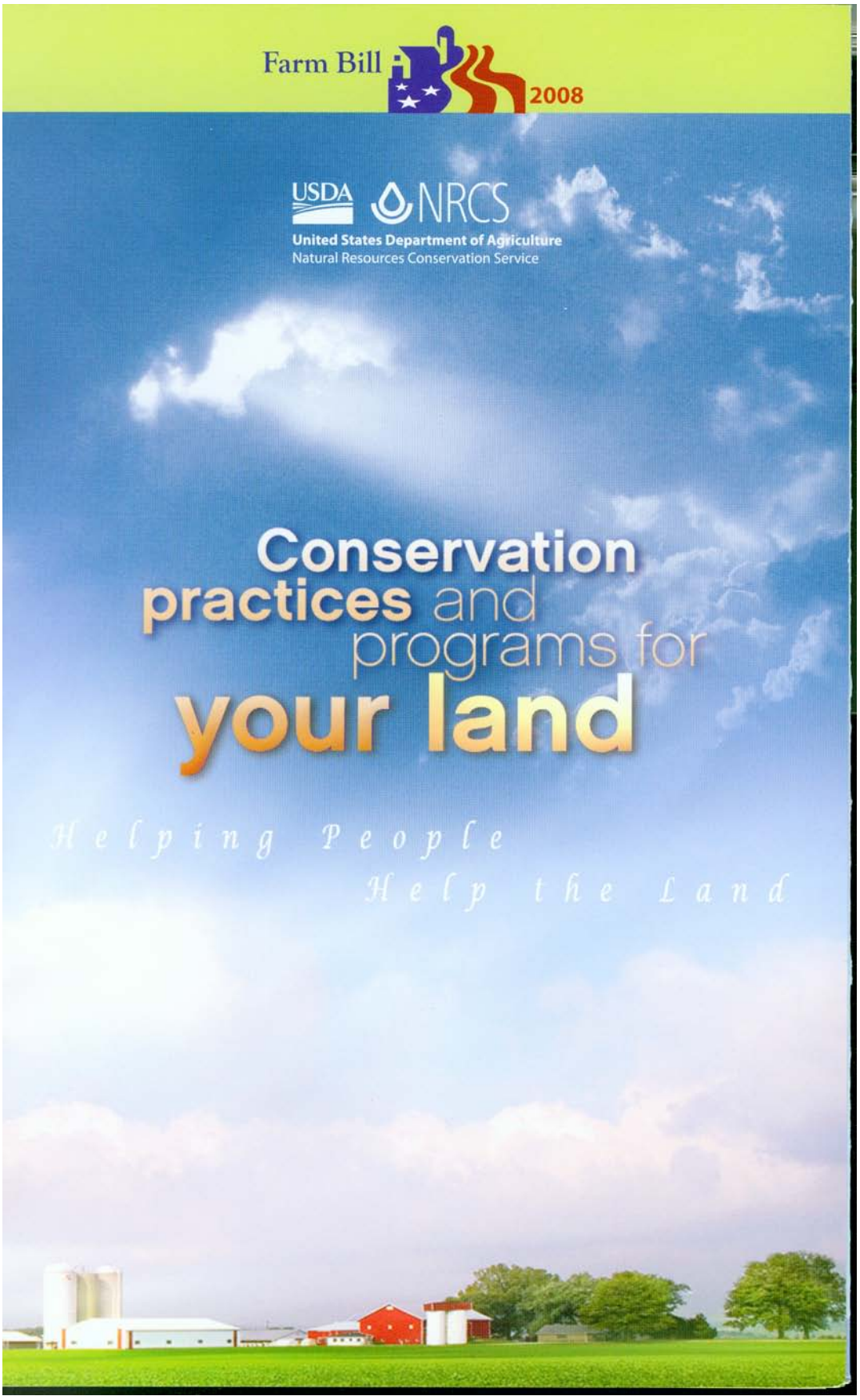
14. What is the best way to take a good milk sample?

15. To enter a Doe in the DHI program, You need :
    A. Registration Number
    B. Name
    C. Date Of Birth
    D. Fresh Date
    E. All The Above

16. If you have any question or comments, you may write it here.

Benefits of USDA Programs

Mr. Dwight Guy, Mr. Phil Estes, Mr. Kenneth Hitch, and Mr. Wil Hundl
USDA


Farm Bill 2008
USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service
Conservation practices and programs for your land
Helping People Help the Land

FAQ

frequentlyasked**questions**

How do I improve the chances of my conservation program application being accepted?

Most program applications are selected according to ranking processes specific to your area. Working with your local NRCS representative, you can develop a conservation plan for your land that provides alternatives for various levels of resource treatment relevant to application ranking considerations in your area. You can select the level of treatment that best meets your individual needs while improving your chances of being accepted for funding.

If I enroll my land in a conservation program, do I maintain ownership? Am I required to allow public access to my land?

If you enroll land in any of our conservation programs, you retain ownership of the land. Although participation in conservation easement programs limits certain uses of the land during the term of the agreement or easement, you still maintain control of public access.

Will I be responsible for maintaining practices that I install under a conservation program?

All programs require practice operation and maintenance as stated in the agreement.

What types of wildlife will I attract if I enroll in conservation programs?

The practices you implement and the plants you establish will affect the types of wildlife you attract to your land. Practices can be designed and managed to attract particular species, such as turkey, quail, deer, songbirds, and other wildlife species.

PA - 2037 November 2009

What USDA Offers

	Program	What Land is Eligible?	Length of Agreement	Contract Payments	Easements	Program Payments	Producer Responsibilities
Financial Assistance Programs	Agricultural Management Assistance (AMA) Program	Private or Tribal land in agricultural production including cropland, hayland, pastureland, rangeland, grassland, and non-industrial private forest land.	1-10 years			Payments support practice implementation based on incurred cost and income foregone*	Develop and follow an AMA plan that describes the conservation and environmental objectives. Contribute to installation costs.
	Agricultural Water Enhancement Program (AWEP)	Private, public, and Tribal land in agricultural production including cropland, grassland, and non-industrial private forest land. Does not include land enrolled in CRP, WRP, or GRP.	Up to 5 years for AWEP partnership agreements; 1-10 years for producer EQIP contracts			Payments support practice implementation based on incurred cost and income foregone*	Develop and follow an AWEP EQIP plan that addresses water conservation and water quality and describes the environmental objectives. Incur installation costs.
	Conservation Stewardship Program (CSP)	Private or Tribal agricultural land and non-industrial private forest land. Does not include land enrolled in CRP, WRP, GRP, or Conservation Security Program.	5 years; 5-year renewal option, subject to funding availability	Annual payment based on level of conservation stewardship; supplemental payment available for participants who adopt a resource-conserving crop rotation			Implement a conservation stewardship plan that addresses resource concerns in a comprehensive manner by installing and adopting additional conservation activities and improving, maintaining, and managing existing activities.
	Environmental Quality Incentives Program (EQIP)	Private, public, and Tribal land in agricultural production including cropland, grassland, and non-industrial private forest land. Does not include land enrolled in CRP, WRP, or GRP.	1-10 years			Payments support practice implementation based on incurred cost and income foregone*	Develop and follow EQIP plan of operations that describes the conservation and environmental objectives. Incur installation costs.
	Wildlife Habitat Incentive Program (WHIP)	Private or Tribal agricultural land. Does not include land enrolled in CRP, WRP, HFRP, or a similar program.	1-10 years, or minimum of 15 years for long-term agreements for critical habitat			Payments support practice implementation based on incurred cost*	Prepare and follow WHIP plan of operations that describes the wildlife habitat objectives to be achieved. Contribute to installation costs.
Easement Programs	Farm and Ranch Lands Protection Program (FRPP)	Private land that contains at least 50% prime, State, or locally important farmland; contains historic or archeological resources; or supports the policies of a State, local farm, or ranch protection program. Includes cropland, rangeland, grassland, pastureland, and forest land.	Cooperative agreements obligate funds annually to entities that acquire permanent easements		One-time, up-front payment or up to five annual payments		Continue to use the land for agricultural purposes. Comply with conservation plan for highly erodible land and terms of conservation easement deed.
	Grassland Reserve Program (GRP)	Private or Tribal grassland, shrubland, land containing forbs (including improved rangeland and pastureland) for which grazing is the predominant use, and land in an area that historically contained those features.	10-, 15-, and 20-year rental contracts or permanent easements	Annual rental payment based on county rate determined by FSA	One-time, up-front payment or up to 10 annual payments	50% of actual cost	Develop and comply with a grazing management plan for the easement, rental contract, or restoration agreement. Contribute to installation costs and maintain practices.
	Healthy Forests Reserve Program (HFRP)	Non-industrial private or Tribal forest land capable of supporting habitat for a selected wildlife species.	10-year cost-share agreements, 30-year contracts, and 30-year or permanent easements		One-time, up-front payment or up to 10 annual payments	Up to 75% for cost-share agreements, 30-year contracts, and 30-year easements; up to 100% for permanent easements	Develop and implement HFRP restoration plan that promotes restoration, protection, enhancement and maintenance of forest land functions and values. Contribute to installation costs.
	Wetlands Reserve Program (WRP)	Private or Tribal farmed wetlands or wetlands converted prior to December 23, 1985, and adjacent lands that maximize wildlife benefits.	30-year or permanent easements, 30-year contracts, or cost-share restoration agreements		One-time, up-front payment or up to 30 annual payments for either easement option or 30-year contract	Up to 75% for restoration cost-share agreements, 30-year contracts, and 30-year easements; 100% for permanent easements	Develop and implement WRP plan of operations for the restoration and maintenance of the wetland. Contribute to restoration costs.

All programs are subject to final USDA regulations. ***Historically underserved participants may be eligible for increased payment rates up to 90%; EQIP offers up to 30%.**

2008 FARM BILL: WHAT'S IN IT FOR YOU?

Conservation practices & programs for your land

What's in it for you?

The 2008 Farm Bill offers America's agricultural producers and non-industrial private forest landowners more assistance than ever before to voluntarily conserve natural resources on our Nation's privately owned farm and ranch lands. Its provisions provide technical and financial assistance to help producers implement conservation practices that reduce erosion, protect our waters, improve fish and wildlife habitat, improve air quality, and conserve energy. This guide introduces the assistance available.

What's New?

- Increased focus on energy conservation, organic and specialty crop production, forestry, air quality, and climate change.
- New programs and initiatives that include the Agricultural Water Enhancement Program (AWEP), Cooperative Conservation Partnership Initiative (CCPI), Chesapeake Bay Watershed Initiative (CBWI), the Environmental Quality Incentives Program (EQIP) Air Quality Initiative, and the Conservation Stewardship Program (CSP).
- Set-aside funding for beginning and socially disadvantaged farmers and ranchers.

Financial & Economic Incentives

The Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA) offers a variety of programs to producers and landowners interested in conservation. Some programs offer annual conservation payments for long-term contracts and conservation easements. Whether through an agreement or easement purchase, all programs include Federal funds to assist with or offset costs of conservation practices and activities.

Technical Assistance

NRCS helps customers plan and implement conservation practices on private lands through technical assistance of the highest quality and standards. Technical assistance is also available through certified Technical Service Providers (TSPs).

Partnerships Enhance Assistance to NRCS Private Land Programs

NRCS works with many partners to deliver conservation services and programs. Partners such as local conservation districts, Resource Conservation and Development (RC&D) Councils, Cooperative Extension, State natural resource agencies, and nongovernmental conservation organizations all play important roles. Professionals in each organization provide technical help. Additional educational and financial assistance for establishing conservation practices on farms and ranches may be available.

For More Information

Contact your local NRCS Office, USDA Service Center, or local conservation district,

Water Erosion

Curbing water erosion

To reduce soil movement and nutrient runoff consider these or similar practices:
- Grassed waterways
- Residue management
- Grassed riparian buffers
- Grade stabilization structures
- Contour buffer strips

Begin with a look at these programs:
EQIP, AMA, WHIP, CSP

Wind Erosion

Curbing wind damage

To mitigate the effects of wind on farm and ranch lands, consider these or similar practices:
- Residue management
- Shelterbelts
- Windbreaks
- Field stripcropping

Begin with a look at these programs:
EQIP, WHIP, CSP

Soil

Conserving soil and water resources

To improve soil and water quality, consider these or similar practices:
- Nutrient management
- Pest management
- Crop rotation
- Filter strips
- Riparian buffers
- Surface water management

Begin with a look at these programs:
EQIP, AWEP, AMA, WHIP, CSP

Waterways

Protecting waterways from erosion and degradation

Consider these or similar practices:
- Riparian buffers
- Filter strips
- Stream crossings
- Stream bank stabilization/Shoreline protection

Begin with a look at these programs:
EQIP, WHIP, AMA, CSP, CRP

Manure

Managing manure

To prevent nutrient loss and protect air, soil, water, fish, and wildlife resources, consider these or similar practices:
- Waste storage structures and lagoons
- Nutrient management
- Compost facilities
- Waste utilization

Begin with a look at these programs:
EQIP, CBWI

Grasslands

Managing grasslands

To improve forage quality, control invasive species, and conserve fish and wildlife habitat, consider these or similar practices:
- Prescribed grazing
- Pest management
- Prescribed burning
- Watering facilities
- Brush management

Begin with a look at these programs:
EQIP, GRP, WHIP, WRP, CSP, CRP

Wildlife

Establishing wildlife habitat

To enhance, restore, manage and protect fish and wildlife habitat, consider these or similar practices:
- Upland/Wetland habitat management
- Wetland restoration
- Forest stand improvement
- Stream habitat improvement
- Prescribed burning
- Tree/Shrub establishment

Begin with a look at these programs:
WHIP, WRP, GRP, EQIP, HFRP, CSP

Forest Lands

Managing forest lands

To restore and protect forest resources and improve fish and wildlife habitat, consider these or similar practices:
- Tree planting
- Forest stand improvement, thinning
- Prescribed burning
- Controlling invasive plants

Begin with a look at these programs:
HFRP, WHIP, EQIP, CSP

Air, Energy & Climate Change

Improving air quality, conserving energy, and mitigating climate change

Consider these or similar practices:
- Residue management
- Dust abatement
- Cover crops
- Conservation buffers
- Windbreak/ Shelterbelt plantings
- Tree planting
- Conversion of cropland to grassland

Begin with a look at these programs:
EQIP, AMA, HFRP, GRP, CSP

USDA-NASS
OKLAHOMA
FIELD OFFICE

ANNUAL SHEEP AND GOAT REVIEW

VOLUME 1, ISSUE 1 JANUARY 2010

WELCOME to the first issue of the *Annual Sheep and Goat Review*! First, I thank all participants from the sheep and goat industries for their continued support and cooperation – especially the producers who provide data for the annual *Sheep and Goats* surveys. Without their commitment and participation, this report would not be possible.

This publication is a compilation of related reports issued by USDA's National Agricultural Statistics Service (NASS) in an effort to provide a complete source of statistics relevant to the sheep and goat industry.

Though many of the statistics in this publication can be accessed through our website on a monthly basis (www.nass.usda.gov/Publications), this Oklahoma Field Office summary will be issued each January following the release of the USDA-NASS annual *Sheep and Goats* report.

Please feel free to contact our office with any comments or questions you may have. I hope you find this information useful!

Wilbert Hundl, Jr.
Director
Oklahoma Field Office

OKLAHOMA AND U.S. INVENTORY

Oklahoma's sheep producers had 75,000 head of **all sheep and lambs** on hand January 1, 2010, down 6 percent from last year. The 2009 **lamb crop** was 45,000 head, down 8 percent from 2008. **Wool production** in 2009 was 150,000 pounds, down 32 percent from last year.

Sheep and Lambs: Number by Class, Oklahoma and United States, January 1, 2009-2010

Date	Oklahoma			United States		
	2009	2010	2010 as Percent of 2009	2009	2010	2010 as Percent of 2009
	1,000 Head	*1,000 Head*	*Percent*	*1,000 Head*	*1,000 Head*	*Percent*
All Sheep and Lambs	80	75	94	5,747	5,630	98
Breeding Sheep	63	59	94	4,247	4,190	99
Ewes 1 Year +	46	43	93	3,405	3,340	98
Rams 1 Year +	5	5	100	195	195	100
Replacement Lambs	12	11	92	646	655	101
Market Sheep and Lambs	17	16	94	1,500	1,440	96
Market Sheep 1 Year +	1	1	100	81	85	105
Market Lambs	16	15	94	1,419	1,355	95
Lambs Under 65 pounds	8	6	75	350	360	103
Lambs 65-84 pounds	3	4	133	170	172	101
Lambs 85-105 pounds	2	2	100	314	275	88
Lambs over 105 pounds	3	3	100	585	548	94

Lamb Crop, Oklahoma and United States 2008-2009

Date	Oklahoma			United States		
	2008	2009	2009 as Percent of 2008	2008	2009	2009 as Percent of 2008
	1,000 Head	*1,000 Head*	*Percent*	*1,000 Head*	*1,000 Head*	*Percent*
Lamb Crop[1]	80	75	94	5,747	5,630	98

[1] Lamb crop is defined as lambs born in the Eastern States and lambs docked or branded in the Western States.

The majority of Oklahoma's goats are meat-type. Initial goat estimates, which began in 2005, showed 73,000 meat goats. They peaked in 2008 when the meat-type inventory was measured at 115,000 head. The current level of 90,000 matches the 2005 level and is down 14 percent from a year ago.

Milk goats make up the bulk of the remaining total goats. In 2005, there were 9,000 head estimated with the high inventory of 10,000 reached in 2006. The 2010 inventory of 8,300 is up 300 head from the level maintained since 2007.

Goats: Number by Class, Oklahoma and United States, 2009-2010

Date	Oklahoma			United States		
	2009	2010	2010 as Percent of 2009	2009	2010	2010 as Percent of 2009
	1,000 Head	*1,000 Head*	*Percent*	*1,000 Head*	*1,000 Head*	*Percent*
Angora	1.0	(1)		185	150	81
Milk	8.0	8.3	104	335	355	106
Meat	105.0	90.0	86	2,549	2,538	100

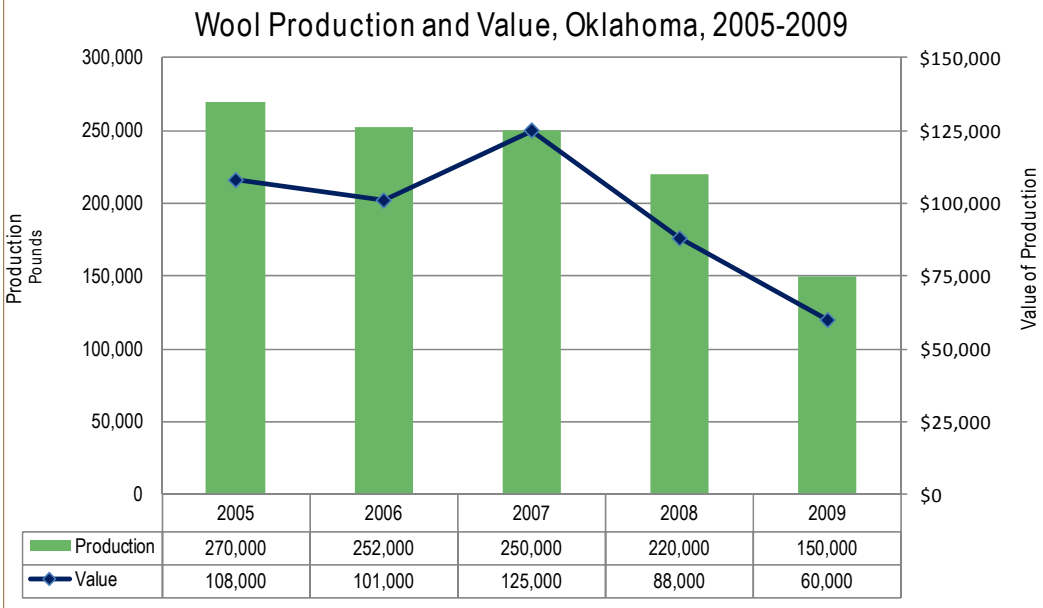
[1] Oklahoma is included in Other States for 2010.

Source: USDA-NASS January *Sheep and Goat* report

WOOL PRODUCTION AND VALUE

As of July 1, 2009, all sheep and lambs in the U.S. and Canada combined totaled 8.11 million head.

December 2009 wool production for Oklahoma numbered 150,000 pounds, down 31 percent from the previous year.



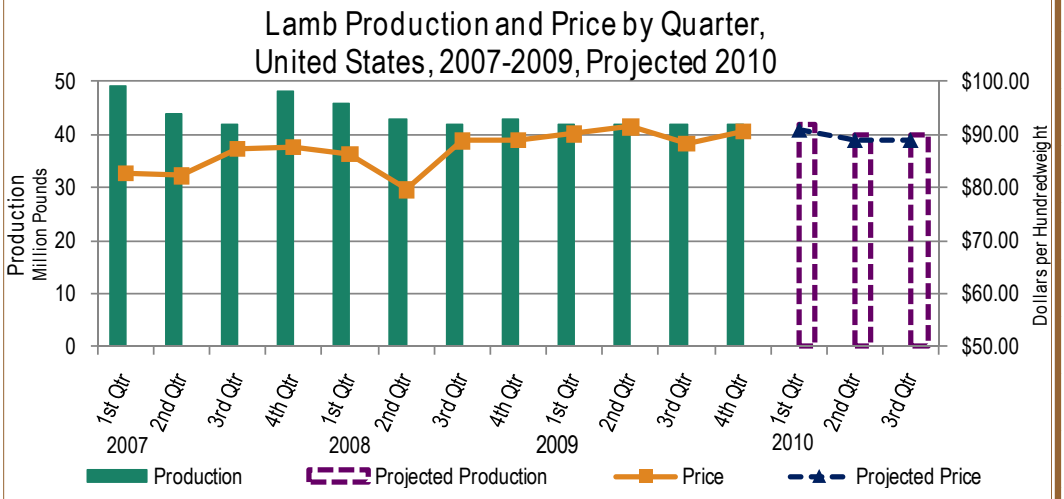
Data Source: USDA-WAOB monthly *World Agriculture Supply and Demand Estimates* report

The U.S. peak sheep inventory of 51.1 million head was reached in 1884. The 2009 count was 4.2 million head.

LAMB PRODUCTION AND PRICE OUTLOOK

Lower than normal demand for lamb has affected lamb prices and as a result, producers are making decisions to liquidate their lamb operations.

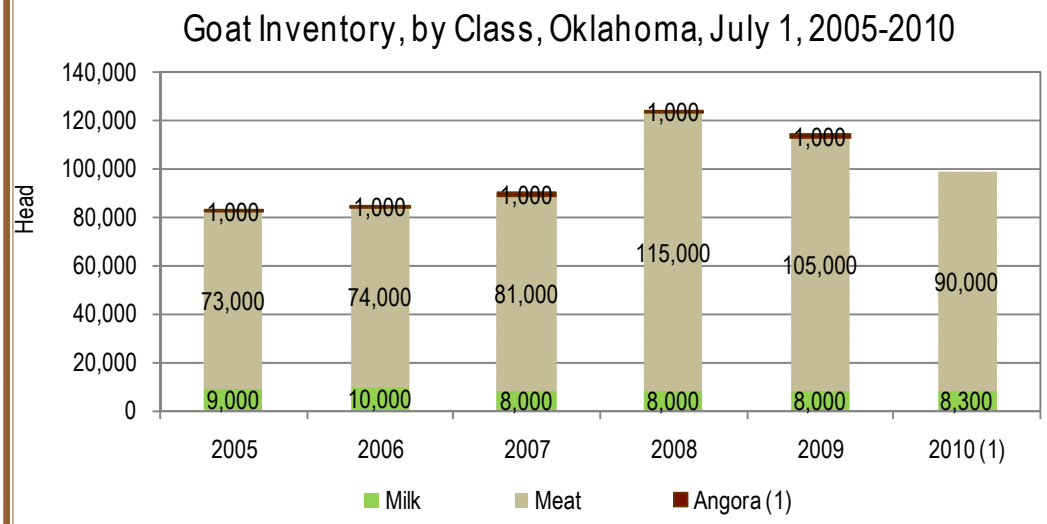
Producers can use the information to determine production and marketing strategies and to plan purchases and capital investments.



Data Source: USDA-WAOB monthly *World Agriculture Supply and Demand Estimates* report

INVENTORY

In 2008, meat-goat inventory peaked and reached 115,000 head. Current inventory matches inventory measured in 2005, however, is down 14 percent from the previous year.

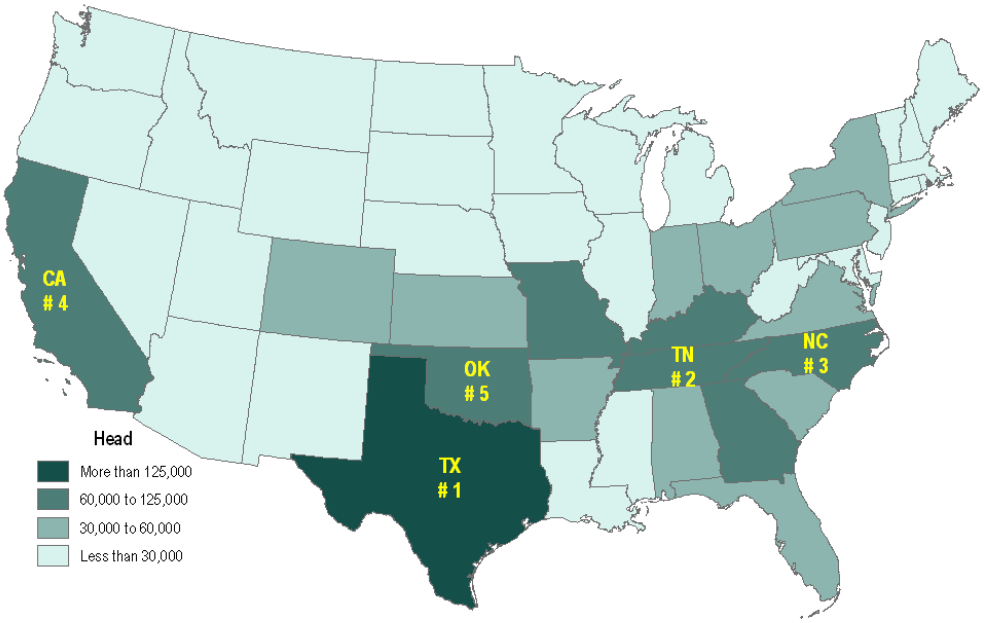


[1] For 2010, the Oklahoma estimate for Angora not published individually, but included in Other States on National release.

Data Source: January *Sheep and Goats* report

In Oklahoma, the January 1, 2010 goat inventory showed 90,000 Meat-type, and 8,300 Milk-type goats.

US RANK



Data Source: January *Sheep and Goats* report

Oklahoma ranked 5th in goat inventory for the United States in 2010.

Timely estimates of sheep and goat inventory allow input suppliers, packers and government to evaluate the expected slaughter volume for future months and to determine potential supplies for export.

TO OKLAHOMA SHEEP AND GOAT PRODUCERS: ***This report contains results collected from the January Sheep and Goat survey. Your operation, large or small, represents Oklahoma agriculture. We appreciate your assistance in providing timely and accurate data. Thank you for your support.***

~Wilbert C Hundl, Jr., Director
USDA-NASS Oklahoma Field Office

USDA-NASS
OKLAHOMA FIELD OFFICE

PHONE:
405-522-6190

FAX:
405-528-2296

E-MAIL:
nass-ok@nass.usda.gov

Wilbert C. Hundl, Jr., Director
Dave Ranek, Deputy Director

INFORMATION IS POWER

Some of the resources for farmers and ranchers available on our Oklahoma website:

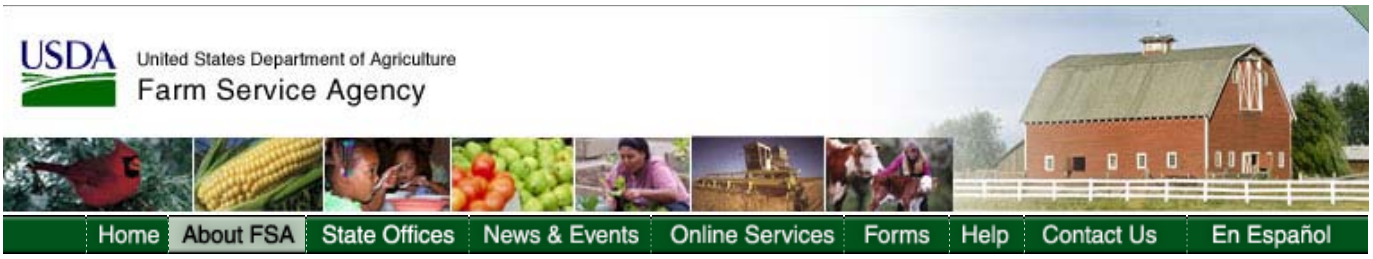
- **Oklahoma Annual Statistics Bulletin**
- **Crop Progress and Conditions**
- **Livestock Reports**
- **Crop Reports**

Find us on the web at: www.nass.usda.gov/ok

All reports referred to in this special sheep and goat issue can be found at the USDA NASS national website. You can subscribe to electronic delivery of new reports by following the links at: www.nass.usda.gov/Publications

OUR CONFIDENTIALITY PLEDGE

● **Names, addresses, and personal identifiers are fully protected by NASS with the** *force of law*. Title 7, U.S. Code, Section 2276 and the Confidential Information Protection and Statistical Efficiency Act ***prohibit*** **public disclosure** of individual information. ● **Only authorized** persons working for NASS as employees or sworn agents, who are subject to fines and imprisonment for unauthorized disclosure, can access individual record data and only for approved official purposes. ● **Data security** is a top priority during preparation of NASS reports. ● Published statistics from NASS surveys and censuses ***will not*** disclose reported data from an individual.



Search FSA

Go

All FSA

- Advanced Search
- Search Tips

Browse by Audience

Information For...

Browse by Subject

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

You are here: FSA Home / About FSA

About FSA

Office of the Administrator

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

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

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

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

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

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

Structure & Organization

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

FSA Biographies

Includes biographies of the Farm Service Agency leadership.

History & Mission

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

Budget & Performance

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

Related Topics

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

Media Help

To view PDF files you must have Adobe Acrobat Reader installed on your computer.

To view Flash files you must have Macromedia Flash Player installed on your computer.

Questions? Ask FSA

Search FSA

Go

All FSA

- Advanced Search
- Search Tips

Browse by Audience

Information For...

Browse by Subject

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

You are here: FSA Home / Farm Loan Programs

Farm Loan Programs

Background

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

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

Our Customers

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

Last Modified: 10/09/2007

Related Topics

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

I Want To...

- **Find Farm Loan Program Notices**
- **Find Real Estate for Sale**

Media Help

To view PDF files you must have Adobe Acrobat Reader installed on your computer.

To view Flash files you must have Macromedia Flash Player installed on your computer.

Questions? Ask FSA

Goat Cookery

Dr. Terry Gipson
Langston University

Introduction

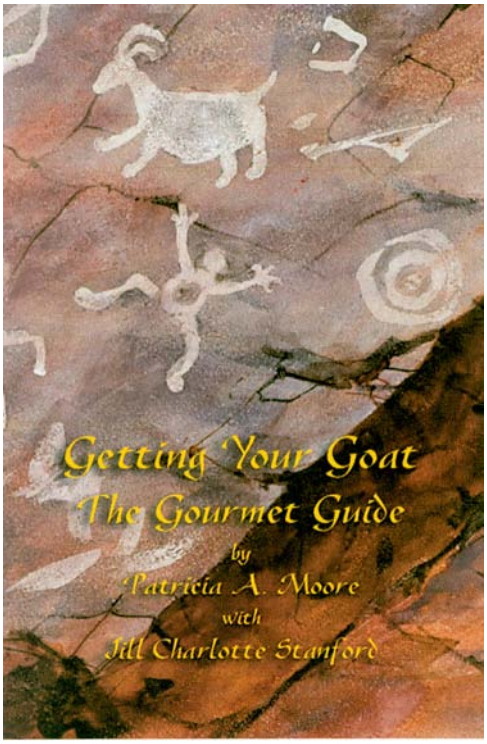
Often, we receive calls about goat cookery and the best way to prepare goat meat. Many of the recipes that one can find, either in print publications or on the Internet, has been about barbecued goat. Indeed, our barbecued chopped goat is always a popular lunch item for our annual Goat Field Days. Recently, I came across a new goat cookbook, *Getting Your Goat: The Gourmet Guide* (Evertype 2009) by Patricia A. Moore and Jill Charlotte Stanford. This cookbook covers a wide array of dishes and I think that the section headers reveals the breadth of the cookbook. They include 1) appetizers, 2) roasts, 3) shanks and chops, 4) soups, stews, and casseroles, 4) ground goat, 5) on the side, 6) desserts, and 7) miscellaneous. I recently contacted Patricia Moore and asked her if she would please share her favorite recipes from the cookbook with our Goat Field Day participants. She recommended Chevon Osso Buco (page 34 of the cookbook), Chevon Moroccan (page 51 of the cookbook), African Goat Soup (page 52 of the cookbook), and Pat's Goat-Loaf Muffins (page 85 of the cookbook) and those four recipes have been included in the proceedings. For those of you seeking new ways to prepare goat, I highly recommend this cookbook. I don't think that you will be disappointed.

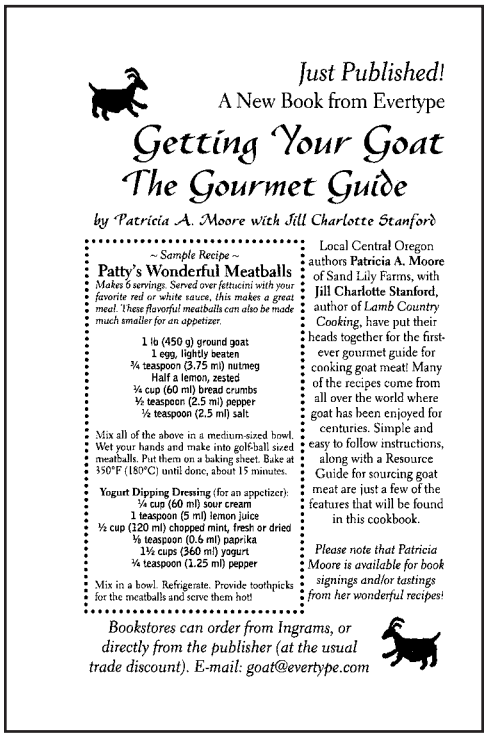
About the authors:

Patricia A. Moore spent 25 years in horticulture, running a landscape maintenance business in the San Francisco Bay area before moving to Central Oregon in 1988. She raises Boer goats, serves on the State Board of the Oregon Meat Goat Producers and is involved with her local chapter of the OMGP. Cooking is Patricia's passion. This book contains many wonderful recipes from her own kitchen, as well as recipes from other goat gourmets.

Jill Charlotte Stanford has been a writer, editor, and author since 1978. She is the author of Lamb Country Cooking (Culinary Arts 1994), The Cowgirl's Cookbook (Globe Pequot 2008), and Going It Alone (Evertype 2008). As a Restaurant Reviewer as well as a Lamb Cook-Off Judge, she has a highly developed sense of good food. Jill lives and writes in Sisters, Oregon, with her faithful Australian Shepherd Elsa.

Susan Koch (illustrator) studied life drawing and watercolor at the American Academy of Art in Chicago, Illinois. Over the past thirty-five years her paintings have won many awards, including "Best of Show" and "Peoples' Choice" several years running in the Watercolor Society of Oregon annual shows.





Getting Your Goat: The Gourmet Guide is also available at Amazon.com

Chevon Osso Buco

4 servings

Osso Buco is a northern Italian tradition. The slow cooker is the ideal way to cook this dish flavored with rosemary. Try spooning the sauce over mashed potatoes or polenta.

- 4 goat shanks
- 2 tablespoons (30 ml) flour
- ¾ teaspoon (3.75 ml) black pepper
- 1 tablespoon (15 ml) olive oil
- 1 cup (240 ml) chopped carrot
- 1 cup (240 ml) chopped celery
- 1 cup (240 ml) chopped white onion
- 1 large garlic clove, minced
- ½ cup (120 ml) red wine
- One 14.5 oz (430 ml) can diced tomatoes, drained
- 1 tablespoon (15 ml) chopped rosemary
- ½ teaspoon (2.5 ml) salt
- 1 bay leaf

Combine the flour and pepper in a shallow pan. Wash and dredge the shanks in the flour, coating them evenly.

Heat the oil in a large skillet. Add the goat shanks and braise for 2 minutes each side or until evenly browned. Place the shanks in a slow cooker.

Put all the vegetables in the pan and sauté for 5 minutes. Add the wine. Scrape the pan to loosen any browned bits. Cook over medium low heat for 1 minute.

Pour the vegetable mix over the shanks in the cooker. Add the tomatoes, rosemary, salt and bay leaf. Stir well.

Cover and cook on Low 8-9 hours.

Discard the bay leaf before serving.

African Goat Soup

6 servings

Goats are a symbol of a family's wealth in Africa. The more goats they have, the wealthier they are. Too many goats? They serve them up in this tasty soup which is more like a stew. Serve it with a good loaf of crusty bread and a bottle of hearty red wine.

- 2 lbs (900 g) lean goat meat, cut into 1" (2.5 cm) cubes
- ¼ cup (60 ml) of flour
- 3 tablespoons (45 ml) olive oil
- 1 large yellow onion, sliced
- 1 cup (240 ml) celery/ cut into pieces
- 1½ cups (360 ml) carrots, cut into pieces
- 2 cups (480 ml) sweet potatoes (or yams) washed, skinned, and cubed
- 3 cups (710 ml) vegetable broth
- 1 cup (240 ml) water
- ¼ cup (60 ml) white wine (optional) salt and pepper to taste
- 1 clove garlic, mashed
- 1 teaspoon (5 ml) cinnamon
- 1 tablespoon (15 ml) cumin

Trim any excess fat from the meat. Dredge the meat in the flour that has the salt and pepper added to it. Coat it well.

In a heavy skillet, put 1 tablespoon of the olive oil and sauté the meat until browned on all sides. Remove from the pan.

Add the remaining olive oil and sauté the vegetables until the onions are clear.

Put the meat back into the pan and add the vegetable broth, white wine, water and spices.

You may also put everything into a Slow Cooker. Simmer, covered, for 5 or 6 hours on Low, stirring occasionally.

Chevon Moroccan

6 servings

Cat Addison is a go-get 'em kind of gal. She loves new adventures and especially new recipes. She says, "Chevon Moroccan was my first taste of goat meat. It is now one of my favorite dishes and I have prepared it for others to get them to see how wonderful goat meat is too."

- 3 tablespoons (45 ml) olive oil
- 2 lb (900 g) goat meat, cubed in 1" (2.5 cm) pieces
- ½ lb (225 kg) fresh, sliced mushrooms
- ½ onions/ chopped
- 1 garlic clove, minced
- 1 lb (450 g) fresh tomatoes, peeled and quartered
- ½ cup (120 ml) raisins
- ½ cup (120 ml) toasted almond slices
- 2 tablespoons (30 ml) sugar
- 1 teaspoon (5 ml) cinnamon
- 1 teaspoon (5 ml) salt
- ¼ teaspoon (1.25 ml) allspice
- ¼ cup (60 ml) chicken broth

Heat the oil in a large skillet. Add the goat meat and sauté until browned. Add the mushrooms, onions and garlic. Sauté for 2 more minutes.

Add the tomatoes, raisins, almonds, sugar, cinnamon, salt and allspice.

Add the broth and simmer for one hour, stirring occasionally, until the meat is tender. Add more broth if needed as it simmers.

Serve the stew over couscous for a truly authentic dish.

Pat's Goat-Loaf Muffins

6 servings

A simple and fast way to cook and serve "diner-style" meat loaf.

- 1 teaspoon (5 ml) olive oil
- 1 cup (240 ml) sweet onion, chopped very fine
- ½ cup (120 ml) carrot, chopped fine
- 1 teaspoon (5 ml) oregano
- 2 cloves of garlic, minced
- 1 cup (240 ml) tomato ketchup, divided
- 1½ lb (680 g) ground goat
- 1 cup (240 ml) (about 20) saltine crackers, crushed very fine
- 2 tablespoons (30 ml) prepared yellow mustard
- 1 teaspoon (5 ml) Worcestershire sauce
- ¼ teaspoon (1.25 ml) black pepper
- 2 large eggs

Preheat the oven to 350°F/180°C/Gas 4

Grease 12 muffin cups (you can use cooking spray).

Heat the olive oil in a large skillet. Add the vegetables and herbs and spices. Sauté for about 2 minutes and then allow to cool.

In a large bowl, combine the vegetable mixture with half the ketchup and the remaining ingredients. Mix well.

Spoon the mixture into the muffin cups and top each with 2 teaspoons of the remaining ketchup.

Bake at 350°F/180°C/Gas 4 for 25 minutes, or until the tops are browned.

Let them stand for 5 minutes before removing.

CURRENT PROGRAM SUMMARY

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

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

[This page intentionally left blank.]

Extension Overview

Dr. Terry A. Gipson
Goat Extension Leader

The year 2009 was a busy year for the Langston Goat Extension program. The goat extension specialists have answered innumerable producer requests for goat production and product information via the telephone, letters and e-mail, have given numerous presentations at several state, regional, national and international goat conferences for potential, novice and veteran goat producers, and have produced a quarterly newsletter. They have also been busy with several major extension activities. These activities include the annual Goat Field Day, Langston Goat Dairy Herd Improvement (DHI) Program, grazing demonstrations, the eighth annual meat buck performance test and various goat workshops on artificial insemination and on internal parasite control.

Goat Field Day

Our annual Goat Field Day was held on Saturday, April 25, 2009 at the Langston University Goat Farm with registration beginning at 8:00 a.m. This year's theme was Breeding for the Future in the Dairy and Meat Goat Industries. Last year our featured speakers were Ms. Lisa Shepard who spoke on Performance Programs - Your "Genetic Toolbox", and Dr. Richard Browning, Jr., who spoke on Breed Evaluation for Commercial Meat Goat Herds: A Research Update. Ms. Lisa Shepard currently works for the American Dairy Goat Association under contract as the Performance Programs Coordinator. This involves efforts with the DHI Production Testing, Linear Appraisal, Sire Development, DNA Typing, Artificial Insemination, and Type programs. Prior to this, she was employed in the laboratory genetics field for 30 years which evolved into the areas of quality assurance and regulatory affairs. Ms. Shepard is also a representative to the California Dairy Goat Advisory committee, officer in the National Saanen Breeders Association, and on the Board of New Mexico's caprine DHIA. Lisa and her husband raise a small seedstock herd of Saanens in Northern New Mexico. Dr. Richard Browning, Jr. is a faculty member in the Department of Agricultural Sciences at Tennessee State University (TSU) in Nashville. Dr. Browning earned a B.Sc. (1989) from Prairie View A & M University and M.Sc. (1992) and Ph.D. (1994) from Texas A & M University. Dr. Browning initiated meat goat breed evaluation research at TSU in 2001. The main focus of the research has been to study fitness and performance traits among Boer, Kiko, and Spanish does raising straightbred and F1 kids raised under commercial, pasture management conditions. The work has also included postweaning performance and carcass merit of the offspring. In the afternoon session, participants broke into small-group workshops. Last year's sub-theme was "Globalization/Internationalization of Goat Production". Collaborators on the International Collaboration in Goat Research and Production Web-Based Decision Support Aids project were at the 2009 Goat Field Day to discuss goat production in their respective countries. The Web-based Goat Nutrient Requirement Calculators are currently being translated into Chinese, Spanish, Arabic, and French versions and installed on servers in China, Mexico, Jordan, and Rwanda. Dr. Jun Luo of the Northwest Agriculture and Forestry University in Yangling, China is the collaborator for the Chinese version and presented on dairy goat production in China. Dr. Ignacio Tovar-Luna of the Universidad Autónoma Chapingo in Bermajillo, Mexico is the collaborator for the Spanish version and presented on dairy goat production in Mexico. Dr. Laith al Rousan of the Jordan University of Science and Technology in Irbid, Jordan is the collaborator for the Arabic version and presented on goat production in Jordan, with emphasis on meat goats. Mr. Juvenal Kanani of the National University of Rwanda in Butare, Rwanda is the collaborator for the French version and presented on meat goat production in Central Africa.

The afternoon workshops included:

- Using your Genetic Resources with Ms. Lisa Shepard.
- Using On-farm Performance Recording to Enhance the Meat Goat Herd Enterprise with Dr. Richard Browning, Jr.
- Dairy Goat Production in China - overview of the Chinese dairy goat industry and its production practices with Dr. Jun Luo.
- Dairy Goat Production in Mexico - overview of the Mexican dairy goat industry and its production practices with Dr. Ignacio Tovar-Luna.
- Goat Production in Jordan - overview of the Middle Eastern goat industry and its production practices with Dr. Laith al Rousan.
- Goat Production in Central Africa - overview of the Central African meat goat industry and its production practices with Mr. Juvenal Kanani.
- Basic Goat Husbandry - hoof trimming, injection sites, farm management calendar, disbudding, etc. with Mr. Jerry Hayes.
- Basic Herd Health - herd health program including vaccinations and other approved drugs with Dr. Lionel Dawson.
- Nutrition for Health and Production - calculation of energy, protein and feed intake requirements with Dr. Steve Hart.
- Internal Parasite Control - sustainable internal parasite control program with Dr. Dave Sparks.
- Pack Goats - basic goat training as a pack animal and equipment needs with Mr. Dwite Sharp.
- Managing External Pests - control of external parasites and pests on goats with Dr. Justin Talley.
- Goats from a Professional Buyer's Viewpoint - learn to look at your goats as a buyer sees them with Mr. Mike and Ms. Katie Pershbacher.
- DHI Training - supervisor/tester training for dairy goat producers including scale certification with Ms. Eva Vasquez.
- Tanning Goat Hides - basic tanning and leather treatment of goat skins with Dr. Roger Merkel.
- USDA Government Programs - overview of USDA Natural Resource Conservation Service's work with goats and its cost-sharing program with Mr. Dwight Guy.
- Fitting and Showing for Youth and Adults - tips and pointers on fitting and show ring etiquette with Ms. Kay Garrett (this is a full day workshop).
- Fun Tent Youth Activity: Ms. Sheila Stevenson hosted a full day of activities for youth ages 5-12 in the Fun Tent. This allowed the parents and older teens to enjoy the workshops knowing that their little ones are having fun in a safe environment.
- Fitting and Showing Youth Activity: Youth and interested adults were able to participate in a full-day clipping, fitting, and showing workshop conducted by Ms. Kay Garrett of the Oklahoma Meat Goat Association and a Vo-Ag teacher in Prague, OK. Participants had the opportunity to have hands-on practice of clipping, fitting, and showing a goat.

Goat DHI Laboratory

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

of years. However, until 1996 DHIA catered only to cow dairies. The Langston DHI program has been very popular with dairy goat producers and has grown significantly since its establishment in 1996. Goat producers are now able to get records for their animals that reflect accurate information with the correct language. Currently we are serving a 29 state area that includes a majority of the eastern states. Currently, we have 81 producer herds in these 29 states enrolled in the Langston Goat Dairy DHI Program. In 2009, the DHI laboratory processed more than 8,000 samples. Langston University continues to serve the very small-scale dairy goat producer. The average herds size on test with Langston University is 10 animals. This is significantly smaller than the herd size average for the five other processing centers.

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

Goat Newsletter

To date, the Goat Extension program published four issues of the 8-page Goat Newsletter in 2009. Interest in the newsletter has grown and we currently have over 2400 subscribers to our free quarterly Goat Newsletter and the subscription list continues to increase every year. The Goat Newsletter is mailed to every state in the nation and to 10 countries overseas. Ninety-seven percent of the mailings go to American households. At least one newsletter is mailed to a household in every state in the nation. Fifty percent of the newsletters are mailed to Oklahoma households. An additional thirty percent of the newsletters are mailed to households to state adjacent to Oklahoma.

Artificial Insemination Workshop

The use of superior sires is imperative in improving the genetic composition of breeding stock. Artificial insemination has long been used in the dairy cattle industry and is a simple technology that goat producers can acquire. However, opportunities for goat producers to the necessary skills via formal and practical instruction are not widespread. Langston University has instituted a practical workshop for instruction in artificial insemination in goats. Producers are instructed in the anatomy and physiology of the female goat, estrus detection and handling and storage of semen. Producers participate in a hands-on insemination exercise. An understanding of the anatomy and physiology enable the producer to devise seasonal breeding plans and to troubleshoot problem breeders. An understanding of estrus detection enables the producer to effective time inseminations for favorable conditions for conception and to effectively utilize semen. An understanding of semen handling and storage enables the producer to safeguard semen supplies, which can be scarce and costly. The experience of actually inseminating a female goat enables the producer to practice the knowledge that they have gained. The acquisition of these inseminating skill will allow producers the use of genetically superior sires in their herds that they normally would not have access to. It also allows producers to save money by conducting the inseminating themselves instead of hiring an inseminator. In 2009, AI workshops were held in September at the Langston University campus and in October at the county fairgrounds in Antlers.

Meat Goat Production Handbook

The Meat Goat Production Handbook, which is a companion to the Web-based Training and Certification Program, both of which were funded through an USDA/FSIS grant. The 400-plus page Meat Goat Production Handbook is an answer to the paucity of information, especially on the aspect of quality assurance, which will be a key production element as the meat goat industry grows and evolves. A quality assurance program ensures the production of a safe, healthy product that satisfies consumers and increases profit for the

production industry. Conventional topics such as herd health, nutrition, herd management, and many others are covered comprehensively, yet remain clear and easy-to-read. Additional topics generally not covered in conventional handbooks are also included, topics such as disaster preparedness, legal issues, and organic meat goat production. Even though Langston University has taken the lead in this project, this handbook is not the product of one person nor of a single university. Our collaborating project institutions/organizations, which include Alcorn State University, American Boer Goat Association, American Meat Goat Association, Florida A&M University, Fort Valley State University, Kentucky State University, Langston University, Prairie View A&M University, Southern University, Tennessee Goat Producers Association, Tennessee State University, Tuskegee University, United States Boer Goat Association, University of Arkansas Pine Bluff, and Virginia State University. Handbook contributing institutions/organizations include Allen Veterinary Clinic, American Boer Goat Association, American Meat Goat Association, BIO-Genics, Ltd., Bountiful Farm, Cornell University, Fort Valley State University, Kentucky State University, Langston University, Law Office of Wheeler and Mueller, Louisiana State University, Louisiana State University AgCenter, NCAT / ATTRA National Sustainable Agriculture Information Service, North Carolina State University, Oklahoma State University, Texas A & M University, United States Boer Goat Association, and Virginia State University.

Controlling Internal Parasites Workshop

Internal parasites (Barberpole worm, *Haemonchus contortus*) is the leading cause of death in goats in the Southern US, accounting for as many deaths as the total of the next three leading causes of death in goats. Several factors contribute to the high mortality caused by internal parasites.

Goats which originated in dry areas where there was no internal parasite challenge have been brought to the humid South where there is great parasite challenge. Only a few animals have good genetic resistance against internal parasites. In addition, goats are forced to graze rather than browse which provides greater opportunity to consume infective larvae and especially so when animals overgraze. Producers are not familiar with monitoring animals for signs of parasitism and do not understand how animals get infected. In addition internal parasites have developed a high level of resistance to dewormers from the overuse of dewormers in goats. To address these concerns, Langston developed a parasite workshop to educate producers about internal parasites. It includes 3 hours of lecture on biology of the parasite, pasture management to avoid worms and monitoring parasite infection using the FAMACHA chart which assesses the degree of anemia. This is a cooperative effort with OSU Extension Veterinarian who addresses dewormer resistance and correct use of dewormers. Producers get hands'on instruction in use of the FAMACHA card, taking fecal samples and running fecal egg counts.

Nutrient Requirements of Goats

Under a research project which developed equations for energy and protein requirements for goats, as well as prediction of feed intake, an extension sub-project developed a website calculation system for "Nutrient Requirements of Goats" (http://www2.luresext.edu/goats/research/nutreqgoats.html). Most calculators were based on studies of the project reported in a Special Issue of the journal Small Ruminant Research. For calculators with score inputs (i.e., grazing and body conditions), pictures are available to aid in determining most appropriate entries. Realistic examples are given, as well as discussion of appropriate and inappropriate usage. However, for the experienced user there is an option to hide text and examples and to view only inputs and outputs.

In 2005, a calculator for calcium and phosphorus requirements was added to the existing calculators for metabolizable energy, metabolizable protein, and feed intake for suckling, growing, mature, lactating, gestating, and Angora goats. Also in 2005, the interface of the calculators was unified into a single calculator with the English measurement system used. This will encourage the use of the calculators by American producers. The least-cost ration balancer was modified so that it incorporates the least-cost feed percentage

into the diet. Also, calculators are equipped with printable version commands to obtain inputs and outputs in hard copy format. In 2007, the calculators were continued to be updated.

In summary, for nutrient requirement expressions to be of value, they must be readily accessible and reasonably simple. Therefore, a web-based goat nutrient requirement system was developed based on findings of a recent project. It is hoped that this system will enjoy widespread usage and enhance feeding practices for goats.

Internet Website

http://www2.luresext.edu

The Agricultural Research and Cooperative Extension program of Langston University recently unveiled a new and improved Internet web site. The Internet address (URL) of the new web site is http://www2.luresext.edu.

Capabilities of the new web site include a document library with the complete proceedings of the annual Goat Field Day for the past three years and the quarterly newsletter for the past several years. Both the proceedings and newsletters are also available in portable document format (pdf), which allows for the viewing and printing of documents across platform and printer without loss of formatting.

Information, recent abstracts and scientific articles of completed and current research activities in dairy, fiber and meat production are available for online viewing and reading. Visitors will be able to take a Virtual Tour of the research farm and laboratories, complete with digital photos and narrative. Visitors will also be able to browse a digital Photo Album. Visitors will also be able to subscribe to our free quarterly newsletter online. Visitors will be able to test their knowledge of goats with the interactive goat quiz which covers nearly all aspects of dairy, fiber and meat goat production. For those questions that are lacking in the interactive quiz database, visitors will be able to submit a question to be included in the database. Visitors will be able to read about research interests of faculty and will be able to contact faculty & staff via email.

Rehabilitation of Under-Utilized Forest Land by Goats for Economic Benefits

In 2009 and for a second year, Langston University collaborated with the Oklahoma State University Forest Resources Center located in Idabel, OK to demonstrate that goats can be used to remove woody vegetation and underbrush so that forest land can be constructively and sustainably maintained. Moreover, meat goat production itself is profitable and an enterprise appropriate for smallholders. Besides this, goats can improve soil fertility by release of nutrients sequestered in woody plants. Nonetheless, although use of goats for vegetation management is gaining in popularity, it still is not widely prevalent; in part because of incomplete knowledge and probably more importantly a lack of familiarity with the method. Control of invasive species in forest and rangelands is costly for landowners. Recently, goats have been used as a biological means to control invasive and/or undesirable plant species on rangelands. However, their effectiveness in a forested environment is unknown. Twenty-five mature wether goats were fitted with a GPS collar and released upon the 9-acres study.

Web-based Training for Meat Goat Producers

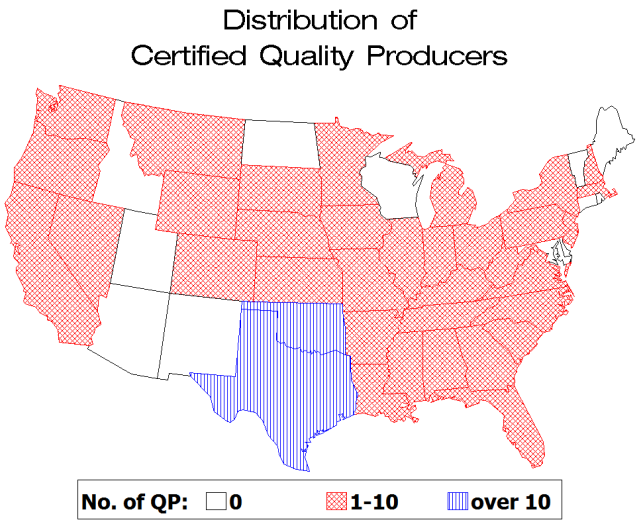
Meat goat production is one of the fastest growing sectors of the livestock industry in the United States. New producers, as well as some established ones, have an expressed need for current, correct information on how to raise goats and produce safe, wholesome products in demand by the public. As the meat goat industry grows and evolves, a quality assurance program is essential. Such a QA program ensures the production of a wholesome product that satisfies consumers and increases profit for the meat goat industry.

Langston University was awarded funding by the Food Safety and Inspection Service of USDA to develop training and certification for meat goat producers. Langston University organized and led a consortium of 1890 universities and producer associations in this project. The consortium identified the subject topics most pertinent and pressing for the instructional modules. The consortium then identified experts on the selected subject topics and pursued these experts as module authors. These authors represent the most qualified persons in their field in academia as well as in the industry. Langston University translated the sixteen instructional modules into web pages with accompanying images, and pre- and post tests for those producers wishing to pursue certification. All modules are also available in pdf for easy printing and the introductory module is available as a podchapter for downloading and listening on your favorite mp3 player. The web-site (http://www2.luresext.edu/goats/training/qa.html) was unveiled in late 2005.

Even though this web-site (http://www2.luresext.edu/goats/training/qa.html) was only unveiled in 2007, more than 1,000 producers have enrolled for certification and 157 have completed the certification process. These instructional materials will best serve meat goat producers in assisting them to produce a safe, wholesome, healthy product for the American consumer. Funding source for this project was USDA/FSIS/OPHS project #FSIS-C-10-2004 entitled "Development of a Web-based Training and Certification Program for Meat Goat Producers."

Breed Association	**Number of Members Certified**
Alberta Goat Breeder's Association	2
American Boer Goat Association	52
American Kiko Goat Association	9
American Meat Goat Association	18
Empire State Meat Goat Producers Association	1
International Boer Goat Association	5
International Goat Association	2
International Kiko Goat Association	6
Spanish Goat Association	1
United States Boer Goat Association	21
None	66

The table above shows the association affiliations for the 157 certified producers. Please note that certified producers may be a member of more than one association.



Meat Buck Performance Test

The eleventh annual meat buck performance test started June 6, 2009 with 93 bucks enrolled from 16 different breeders (51 bucks from private producers and 42 from Langston University). Geographical distribution is given in the table below.

State	Bucks
KS	7
NE	9
OK	18 (42)
TX	17
Total	51 (93)

Breed distribution is 77 Boer (42 Boer from Langston University); 1 Boer Cross; 9 Kiko; 3 Ranger; and 3 Spanish. Bucks were given a physical examination by Dr. Lionel Dawson, dewormed with Cydectin (moxidectin), deloused with Atroban De-Lice, given a preemptive injection of long-acting antibiotic for upper respiratory infections, and those bucks that needed booster or initial vaccinations for enterotoxemia and caseous lymphandinitis. Half of the bucks were randomly assigned within breeder to either Calan feeders or Feed Intake Recording Equipment (FIRE) system.

Average age in days and entry weight are detailed in the table below.

Data	Total
Average of Entry Weight (lbs)	42
Average of Entry Age (days)	84

Adjustment Period

All bucks underwent an adjustment period of two weeks immediately after check-in and the test officially started on June 24, 2009. During the adjustment period, bucks were acclimated to the test ration and to the Calan feeders or to the FIRE system. For the Calan feeders, each buck wears a collar with an electronic "key" encased in hard plastic. The key unlocks the door to only one Calan feeder, thus enabling the buck to eat out of his individual feeder. Each morning, yesterday's feed that remains in the Calan feeder is weighed and removed from the Calan feeder. Fresh feed is weighted and placed into the Calan feeder. The difference in weights between the fresh feed place in the Calan feeder one morning and the remaining feed the next morning is the amount consumed. Because only one goat is capable of opening the Calan door and eating, it is possible to calculate the feed intake of the individual bucks. For the FIRE system, feed intake is automatically recorded every time a buck enters into the FIRE system to eat.

This year we were fortunate to hire a Langston University undergraduate, Ms. Amanda Manley, to help with the bucks. Amanda did a wonderful job with the bucks.

Ration

Nutritionists at Langston University formulated the test ration. The ration was fed free-choice during the adjustment period and during the 12-week test. The crude protein content of the ration is 16% with 2.5% fat, 20.4% fiber and 60.6% TDN. Calcium phosphorus and sodium levels are .74%, .37% and 1.07%, respectively. Zinc concentration is 33.04 ppm, copper is 17.15 ppm and selenium is .21 ppm.

ABGA Approved Performance Test

In the year 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 are 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 to a Boer buck that shows an average daily weight gain (ADG) in the top five percent (5%) of the animals on test. Five (5) points will be awarded to a Boer buck that shows an average daily weight gain (ADG) in the next fifteen percent (15%) of the animals on test. All bucks must gain at least three tenths (.3) pounds per day to be awarded any points.

International Boer Goat Association, Inc. Sanctioned Test

In 2003, the Oklahoma buck performance test was sanctioned by the International Boer Goat Association, Inc.

Gain

The official performance test started on June 24 after the adjustment period was finished. Weights at the beginning of the test averaged 51 lbs with a range of 32 to 84 lbs. Weights at the end of the test averaged 92 lbs with a range of 65 to 139 lbs. Weight gain for the test averaged 41 lbs with a range of 18 to 64 lbs.

Average Daily Gain (ADG)

For the test, the bucks gained on averaged 0.49 lbs/day with a range of 0.21 lbs/day to 0.76 lbs/day.

Feed Efficiency (Feed Conversion Ratio)

For the test, the bucks consumed an average of 294 lbs of feed with a range of 154 to 496 lbs.

For the test, the bucks averaged a feed efficiency of 7.34 (feed efficiency is defined as the number of lbs. of feed needed for one lbs. of gain), with a range of 4.22 to 11.79.

Muscling

The average loin eye area as determined by ultrasonography was 1.8 square inches with a range of 1.2 to 2.3 square inches and the average right rear leg circumference was 14.9 inches with a range of 12.0 to 19.5 inches.

Index

For 2009, 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 (BW0.75)
- 20% circumference around the widest part of the right rear leg as measured with a tailor's tape adjusted by the goat's metabolic body weight.

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. Sam Stephens of Elm Creek, NE for having the Top-Indexing buck

Also, deserving congratulations are:

- Mr. Sam Stephens of Elm Creek, NE for having the #1 Fastest-Gaining buck
- Mr. Jim Rosenbaum of Gainesville, TX for having the #2 Fastest-Gaining buck
- Mr. A.L. Paul of Aubry, TX for having the #3 (tie) Fastest-Gaining buck
- Mr. Jim Hollinger of Lyons, KS for having the #3 (tie) Fastest-Gaining buck
- Mr. Ron Dilley of Stillwater, OK for having the #5 (tie) Fastest-Gaining buck
- Mr. John Scott of Lexington, NE for having the #5 (tie) Fastest-Gaining buck
- Mr. Jim Hicks of Bristow, OK for having the Most-Feed-Efficient buck
- Mr. Cody Gann of Sonora, TX for having the Most-Heavily-Muscled buck

Acknowledgments

The Buck Test was supervised by Dr. Wenping Hu and assisted by Dr. Terry Gipson. They wish to acknowledge Dr. Lionel Dawson of Oklahoma State University for his contributions as the admitting and on-call veterinarian, Ms. Amanda Manley for her management and oversight of the day-to-day activities, Mr. Jerry Hayes and Mr. Erick Loetz of Langston University for aid and supervision, Mr. Les Hutchens and his associates at Reproductive Enterprises, Inc. for conducting the ultrasound measurements for the loin eye area, and Stillwater Milling of Stillwater, OK for custom mixing the feed.

International Overview

Dr. Roger Merkel
International Program Leader

Objectives

Part of the mission of the American Institute for Goat Research is to effect positive change in goat production throughout the world. To fulfill this aspect, the Institute has developed and maintains many strong ties with research and academic institutions around the world. In addition to collaborative work with foreign institutions, the Institute hosts visiting scientists from over 20 foreign countries to conduct research. Training for foreign livestock workers and scientists as well as for U.S.-based persons who will travel and work overseas are other ways in which the Institute is active in the international arena. General objectives of the Institute's international program are to: 1) increase our knowledge of goat production systems worldwide and current constraints to increased production; 2) build human capacity through training foreign scientists and agricultural workers in goat production thereby allowing them to more effectively carry out their missions of teaching, research, and extension; 3) increase Langston University and the Institute's involvement in agricultural development and impact on human welfare; and 4) enhance the Institute's knowledge of development and development issues. As recognition of the impact that the Institute has had on international development, five Langston University scientists, Drs. Terry Gipson, Arthur Goetsch, Roger Merkel, Tilahun Sahlu, and Steve Zeng, were jointly awarded the 2006 George Carver Agricultural Excellence Award of USAID for their efforts and positive impact on international agriculture.

International Research

While most international projects conducted by the Institute have aspects of research, training, and extension, some are more research oriented. Many of these types of grants are typified by a number of projects with countries in the Middle East.

Research grants with Middle Eastern Institutions

The Institute has been involved in a number of additional grants having research collaboration with institutions in the Middle East. The first of these entails collaboration with the Newe Ya'ar Research Center of the Agricultural Research Organization in Israel on a grant entitled "Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier." There are three other grants that continue the collaborative research relationship between the Institute and the Desert Research Center of Egypt. The first project, "Effects of Acclimatization on Energy Requirements of Goats," was completed in June of 2008. Other projects, entitled "The Grazing Activity Energy Cost of Goats" and "Effects of Nutritional Plane on the Maintenance Energy Requirement of Goats" are currently underway. Each of these research grants deal with important aspects of energy expenditure by goats.

Recently, the Institute was awarded a grant for a project entitled "Enhanced Safety and Product Quality from On-Farm Thermization/Pasteurization of Goat Milk in the Middle East" by the United States – Israel Binational Agricultural Research and Development (BARD) Fund as a Facilitating Grant in the MARD (Multinational Agricultural Research and Development) program. Collaborators in this project are The Volcani Center of the Agricultural Research Organization of Israel, Al-Quds University in Palestine, and Jordan University of Science and Technology. Objectives of this project are to develop specifications of an inexpensive thermization/pasteurization equipment system suitable for use on small goat farms in the Middle

East, conduct preliminary evaluations of the prototype for possible refinement, and determine procedures for an associated MERC grant proposal to be developed.

Jordan, China, Mexico, Rwanda, Ivory Coast

Another grant involving a Middle Eastern institute also includes institutions in three other regions of the world. The grant "International Collaboration in Goat Research and Production Web-based Support Aids" partners the American Institute for Goat Research with Jordan University of Science and Technology, Northwest Science-Technology University in China, National University of Rwanda, Centre National Recherche Agronomique in Cote d'Ivoire, and University of Chapingo in Mexico. This grant expands usage of the interactive, web-based nutrient calculator for goats and the goat production simulation program developed by Institute scientists through translation into Arabic, Chinese, French, and Spanish. Having the web-based nutrient calculator in these languages will increase the number of producers and scientists who will be able to utilize the unique features of the calculator and enhance its usefulness. These versions of the nutrient calculator can be accessed from the Institute's website.

Education and Training

Increasing the Capacity of Higher Education in East Africa through the creation of a Consortium of African and United States Educators (CAUSE)

In 2009, the Institute entered into a partnership with Oklahoma State University, three universities in Ethiopia (Haramaya, Hawassa, and Mekelle), two universities in Kenya (Kenyatta and Moi), the International Livestock Research Institute and the International Maize and Wheat Improvement Center to form the Consortium of African and United States Educators (CAUSE). The objective of the grant was to establish relationships among U.S. and African institutes of higher education and to develop a strategic plan to address critical societal issues by increasing human and institutional capacity of higher education in East Africa in teaching, research, and outreach. The goals of the partnership are to: 1) Enhance Academic Programs through Regional Collaboration; 2) Develop Research-Based Solutions to Address Food and Nutritional Security in East Africa; 3) Transfer Knowledge and Skills to Enhance Community Development; and 4) Provide Research Based Information to Stakeholders and Policy Makers. The partnership held meetings in Ethiopia and Kenya to gather information and develop the strategic plan that was submitted in November, 2009.

Training of Japanese graduate student

In January and February, 2009, the Institute hosted Ms. Yoko Tsukahara, a graduate student from Kyoto University in Japan for a 4-week training course in goat production. Ms. Tsukahara was awarded a scholarship for the training from the Japan Livestock Technology Association, located in Tokyo. During her time at the Institute, Ms. Tsukahara received training in all aspects of goat production, farm management, and the research programs conducted by the Institute.

Agricultural Development

Ethiopian Sheep and Goat Productivity Improvement Program

In 2005 the American Institute for Goat Research of Langston University and Prairie View A&M University, Prairie View, TX were awarded a $5.5 million grant from the USAID Mission in Ethiopia for a project entitled "Ethiopia Sheep and Goat Productivity Improvement Program." This 5-year program entails collaboration with the Ministry of Agriculture and Rural Development of the Government of Ethiopia. The overall goal of the program is to conduct research and extension activities in the areas of production and marketing that will result in a sustainable increase in small ruminant productivity in Ethiopia to improve food and economic securities. The project works in six regions of Ethiopia (Tigray, Amhara, Oromia, Southern

States, Afar, and Somali), and addresses a number of factors including human and institutional capacity building, research and technology transfer, and introduction of improved animal genetics.

Activities in the area of research and technology transfer have focused on on-farm research and demonstration of technologies such as ammoniation of crop residues via urea and making molasses/urea blocks. Development agents are taught these techniques and participate with project staff in conducting demonstrations with village participants. Applied on-farm research on animal supplementation and improved feeding strategies, such as creep feeding and use of locally available byproduct feedstuffs, is also conducted. More detailed research on certain aspects of the Ethiopia small ruminant meat industry, such as reasons for and methods to reduce darkening of carcasses of Highland sheep, is important in assisting the growing sheep and goat meat export market.

In 2007, Boer goats and Dorper sheep were imported from South Africa into Ethiopia, the first ever importation of these animals into the country. These animals will form the backbone of a crossbreeding program designed to utilize the fast growth rate and larger carcass of these animals with the native adaptability and toughness of local breeds. The resulting crossbreds will be able to supply the export market with the desired frame size and carcass characteristics.

The training component of the project aims to enhance the knowledge and ability of village development agents to assist farmers in raising small ruminants via direct training in small ruminant productivity. Village development agents receive training in sheep and goat production and management. In support of this program, the Sheep and Goat Production Handbook for Ethiopia was published in 2008. This text, written by Ethiopian scientists, is the first of its kind in Ethiopia and has over 400 pages of information that can be used by development agents. The depth of information in the book also allows its use as a classroom text by university faculty. In addition, technical bulletins of certain aspects of sheep and goat production have been produced and distributed to development agents and institutions throughout the country. The 32 technical bulletins published to date are designed to contain material that a development agent could use directly in training village farmers. These bulletins are very popular and are now being translated into several different regional languages of Ethiopia to broaden their use. In order to combat the problem of external parasites downgrading the quality of Ethiopian sheep and goat skins for the important leather industry, the project is training villagers to be providers of dipping and spraying services to control these pests. As with the applied research and crossbreeding component, the training component aims to enhance the ability of Ethiopian institutions and personnel to effect sustainable, positive change in small ruminant production.

Finally, ESGPIP and AIGR staff have established a project website, www.ESGPIP.org, that contains the technical bulletins, handbook and other materials and reports produced by the ESGPIP.

The End Result

The American Institute for Goat Research is proud of its international activities and the impact they have on strengthening human and institutional capacity of foreign institutions, providing important and relevant research results on local issues of importance, and in the assistance provided to small farmers, and particularly women, in enhancing family nutrition and income generation. These are unique activities that support the mission and goals of the Institute.

Recent International Grants

Years	2010–2011
Title	Enhanced Safety and Product Quality from On-Farm Thermization/Pasteurization of Goat Milk in the Middle East
Collaborators	Langston University; Agricultural Research Organization, Bet Dagen, Israel; Al-Quds University, East Jerusalem, Palestine; Jordan University of Science and Technology, Irbid, Jordan
Funding source	United States – Israel Binational Agricultural Research and Development Fund
Funding amount	$50,000
Years	2009
Title	Increasing the Capacity of Higher Education in East Africa through the creation of a Consortium of African and United States Educators (CAUSE)
Collaborators	Langston University; Oklahoma State University; Haramaya University, Hawassa University, and Mekelle University in Ethiopia; Kenyatta University and Moi University in Kenya; International Livestock Research Institute and the International Maize and Wheat Improvement Center of the Consultative Group on International Agricultural Research system.
Funding source	Higher Education for Development, USAID
Funding amount	$50,000
Years	2008–2010
Title	Effects of Nutritional Plane on the Maintenance Energy Requirement of Goats
Collaborators	Langston University; Desert Research Center, Egypt
Funding source	U.S. – Egypt Joint Science and Technology Fund
Funding amount	$60,000
Years	2007–2010
Title	The Grazing Activity Energy Cost of Goats.
Collaborators	Langston University; Desert Research Center, Egypt
Funding source	U.S. – Egypt Joint Science and Technology Fund
Funding amount	$60,000
Years	2006-2007
Title	Sustainable Interventions to Increase Child Education in Ethiopia: Models for Poverty Reduction and Overcoming Child Labor Constraints
Collaborators	Langston University; Hawassa University, Hawassa, Ethiopia
Funding source	United Negro College Fund Special Programs
Funding amount	$25,000
Years	2005-2010
Title	Ethiopia Sheep and Goat Productivity Improvement Program
Collaborators	Langston University; Prairie View A & M University, Ministry of Agriculture and Rural Development of the Government of Ethiopia
Funding source	USAID Ethiopia
Funding amount	$5,500,000

Years	2005-2008
Title	International Collaboration in Goat Research and Production Web-Based Decision Support Aids
Collaborators	Langston University; Jordan University of Science and Technology; Northwest Science-Technology University, China; Département des Sciences Animales of Institut National Agronomique, France; University of Chapingo in Mexico
Funding source	USDA International Science and Education Competitive Grants Program
Funding amount	$99,959
Years	2005-2008
Title	Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier
Collaborators	Langston University; Newe Ya'ar Research Center of the Agricultural Research Organization, Israel
Funding source	United States – Israel Binational Agricultural Research and Development Fund
Funding amount	$310,000
Years	2005–2007
Title	Effects of Acclimatization on Energy Requirements of Goats
Collaborators	Langston University; Desert Research Center, Egypt
Funding source	U.S. – Egypt Joint Science and Technology Fund
Funding amount	$58,500
Years	2000 – 2008
Title	Multinational Approaches to Enhance Goat Production in the Middle East
Collaborators	Langston University; Desert Research Center, Cairo, Egypt; Volcani Center, Bet Dagan, Israel; Al-Quds University in East Jerusalem working in the West Bank; Jordan University of Science and Technology, Irbid, Jordan
Funding source	USAID/Middle East Regional Cooperation Program
Funding amount	$1,199,725

Research Overview

Dr. Arthur Goetsch
Goat Research Leader

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

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

To provide an idea about our research program since the last Field Day, listed below are research projects and experiments we have been involved with in 2009, abstracts for 2010, and summaries of scientific articles that were published in 2009 and 2010 or currently are "in press.".

Standard Abbreviations Used

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

Research Projects

Current Research Projects (2007-2010)

Title: *Enhanced Goat Production and Products in the South-Central U.S.*
Type: CSREES project
Project Number: OKLX-SAHLU
Period: 2006-2011
Investigators: T. Sahlu, A. L. Goetsch, R. Puchala, R. C. Merkel, T. A. Gipson, S. P. Hart, S. Zeng, and Z. Wang
Institution: Langston University
Objective: Study goat feeding and management, relevant health issues, and milk product technologies in order to increase the level and efficiency of goat productivity for increased profitability from goat production and lower costs to consumers of goat products.

Title: *Characterization of the Energy Requirement for Activity by Grazing Ruminants*
Type: USDA 1890 Institution Research Capacity Building
Project Number: 2005-38814-16352
Period: T. Sahlu[1], R. Puchala[1], A. L. Goetsch[1], T. A. Gipson[1], and B. Kouakou[2]
Institutions: [1]Langston University and [2]Fort Valley State University
Objectives: Develop and evaluate a system to predict the grazing activity energy cost for ruminants by determining effects of animal and dietary conditions on energy expenditure, metabolizable energy intake, the grazing activity energy cost, grazing and walking times, and horizontal and vertical distances traveled.

Title: *The Ability of Goats to Withstand Harsh Nutritional Environments*
Type: USDA 1890 Institution Research Capacity Building
Project Number: 2005-38814-16353
Period: 2005-2010
Investigators: A. L. Goetsch[1], R. Puchala[1], T. Sahlu[1], and H. C. Freetly[2]
Institutions: [1]Langston University and [2]Meat Animal Research Center
Objectives: Determine if there are differences between goats and sheep and between meat goat species of the US in the ability to utilize diets with limited supplies of nitrogen and energy and to characterize the physiological bases of any such differences.

Title: *International Collaboration in Goat Research and Production Web-Based Decision Support Aids*
Type: USDA International Science and Education Competitive Grants Program
Project Number: 2005-51160-02281
Period: 2005-2009
Investigators: A. L. Goetsch and T. A. Gipson
Institution: Langston University
Goal: Facilitate future collaborative research between the American Institute for Goat Research (AIGR) and institutions in Arabic-, Chinese-, French-, and Spanish-speaking countries, as well as to gain knowledge of goat research and production practices in other areas of the world.
Objectives: Translate and adapt two web-based goat production and research decision-support tools developed at the AIGR (goat nutrient requirements and feed intake; goat production system simulation model) for use and future collaborative research in the Middle East, China, France and other French-speaking countries, and Central and South America.

Title: *Energy Expenditure for Activity in Free-Ranging Ruminants: A Nutritional Frontier*
Type: United States - Israel Binational Agricultural Research and Development Fund
Project Number: US-3694-05 R
Period: 2005-2009
Investigators: A. L. Goetsch[1], Y. Aharoni[2], A. Brosh[2], R. Puchala[1], T. A. Gipson[1], Z. Henkin[3], and E. Ungar[4]
Institutions: [1]Langston University, [2]Newe Ya'ar Research Center, Agricultural Research Organization, [3]MIGAL-Galilee Technology Center, and [4]Agronomy and Natural Resources, Agricultural Research Organization
Objectives: Develop and evaluate a system(s) to predict the grazing activity energy cost of ruminants by determining effects of stocking rate (influencing available forage mass and forage quality) and animal production state and season (affecting energy demand) on energy expenditure, metabolizable energy intake, energy expended in grazing activity, grazing and walking times, horizontal and vertical distances traveled, and diet quality with grazing females of two breeds of cattle and goats.

Title: *The Grazing Activity Energy Cost of Goats*
Type: United States - Egypt Joint Science and Technology Fund Program
Project Number: BIO11-001-005
Period: 2007-2010
Investigators: A. L. Goetsch[1], R. Puchala[1], T. A. Gipson[1], H. El Shaer[2], and A. Helal[2]
Institutions: [1]Langston University and [2]Desert Research Center
Objective:
- Determine the magnitude of the grazing activity energy cost of goats under different common production settings in an arid region of Egypt and in the south-central U.S.
- Develop simple means of predicting the grazing activity energy cost of goats based on factors relatively easily estimable by farmers.

Title: *Impact of Sub-Clinical Mastitis on Production and Quality of Goat Milk and Cheese*
Type: USDA 1890 Institution Research Capacity Building
Project Number: 2007-38814-18474
Period: 2007-2010
Investigators: S. S. Zeng[1], D. Bannerman[2], and L. Spicer[3]
Institutions: [1]Langston University, [2]USDA ARS Bovine Functional Genomics Laboratory, and [3]Oklahoma State University
Objective:
- Assess prevalence of subclinical mastitis in dairy goats during a year-round lactation in Oklahoma
- Quantify and qualify losses in milk yield and cheese production associated with subclinical mastitis test the impact of major types of CNS bacteria
- Test the impact of major types of CNS bacteria species causing IMI (*S. epidermidis*, *S. simulans*, S. *caprae*, and *S. chromogenes*) on the inflammatory response in milk and to relate it to caseinolysis, coagulation properties, and cheese yield
- Study the mechanism by which CNS affects caseinolysis and in turn the coagulation properties
- Investigate changes in PL and SCC of milk caused by subclinical mastitis and their effects on milk coagulation, and cheese yield and texture

Title: *Effects of Nutritional Plane on the Maintenance Energy Requirement of Goats*
Type: United States - Egypt Joint Science and Technology Fund Program
Project Number: BIO12-001-016
Period: 2008-2010
Investigators: R. Puchala[1], A. L. Goetsch[1], T. A. Gipson[1], A. R. Askar[2], and A. Helal[2]
Institutions: [1]Langston University and [2]Desert Research Center
Objective:
- Determine how nutrient restriction impacts energy expenditure (EE) and the maintenance energy requirement (ME_m) with common goat genotypes of Egypt and Oklahoma
- Determine how adequate nutrient intake following nutrient restriction affects EE and ME_m with common goat genotypes of Egypt and Oklahoma
- Use data from specific objectives 1 and 2 to develop a method of predicting the impact of low nutritional planes on ME_m

Title: *Boer Goat Selection for Residual Feed Intake*
Type: USDA 1890 Institution Research Capacity Building
Project Number: 2008-38814-02661
Period: 2008-2011
Investigators: T. A. Gipson[1], A. L. Goetsch[1], R. Puchala[1], T. Sahlu[1], and C. Ferrell[2]
Institutions: [1]Langston University, and [2]USDA ARS Meat Animal Research Center, Nutrition Research Unit
Objective:
- Determine and demonstrate efficacy of use of residual feed intake to achieve genetic progress in improving efficiency of feed utilization without elevating mature size or body fatness compared with selection based on growth rate.
- Characterize relationships between residual feed intake and animal activities, feeding and social behaviors, and energy expenditure, and assess potential means of prediction of residual feed intake at an early age.

Title: *Establishing a Pilot Tannery and Capability for Goat Leather Research at Langston University*
Type: USDA 1890 Institution Research Capacity Building
Project Number: 2008-38814-02520
Period: 2008-2011
Investigators: R. C. Merkel[1] and C. K. Liu[2]
Institutions: [1]Langston University and [2]USDA ARS Eastern Regional Research Center
Objective:
- Establish a pilot tannery and capability for goat leather research at the LU campus
- Determine the effects of goat breed, diet and age upon skin chemical composition and the mechanical properties of resulting leather
- Evaluate environmentally friendly tanning methods on U.S. goat skins

Title: *Enhanced Safety and Product Quality from On-Farm Thermization/Pasteurization of Goat Milk in the Middle East*
Type: United States - Israel Binational Agricultural Research and Development Fund
Project Number: FG-9503-09R
Period: 2010-2011
Investigators: T. Sahlu[1], A. L. Goetsch[1], S. Zeng[1], Z. Abdeen[2], M. Fanum[2], K. Azmi[2], N. Silanikove[3], G. Leitner[3], K. Ereifej[4], L. Alrousan[4], and K. Al-Qudah[4]
Institutions: [1]Langston University; [2]Al-Quds University, East Jerusalem, Palestine; [3]Agricultural Research Organization, Bet Dagen, Israel; [4]Jordan University of Science and Technology, Irbid, Jordan
Objectives: Develop specifications of an inexpensive thermization/pasteurization equipment system suitable for use on small goat farms in the Middle East, conduct preliminary evaluations of the prototype for possible refinement, and determine procedures for an associated MERC grant proposal to be developed.

Experiments Active in 2009/2010

Title:	*Effects of gender and age on the maintenance energy requirement of Boer goats*
Experiment Number:	ITL-08-06
Project Number:	OKLX-SAHLU
Investigators:	I. Tovar-Luna, A. L. Goetsch, R. Puchala, K. Tesfai, and T. Sahlu
Objectives:	1) Determine effects of gender and age of Boer goats on a) fasting heat production, b) maintenance energy requirement, c) efficiency of metabolizable energy utilization for maintenance, and d) efficiency of energy utilization for growth 2) Determine the relationship between heart rate and heat production measured in growing Boer goats with ad libitum consumption and when fed near maintenance and fasted

Title:	*Development of a model to evaluate methods of modifying cattle barb wire fence for goat containment*
Experiment Number:	AG-08-07
Project Number:	OKLX-SAHLU
Investigators:	A. L. Goetsch, G. D. Detweiler, J. Hayes, T. A. Gipson, L. J. Dawson, and T. Sahlu
Objectives:	Develop and evaluate an accurate and repeatable method of evaluating methods of modifying cattle barb wire fence for goat containment

Title:	*Accuracy and precision of fixes and calculated distances of GPS animal collars*
Experiment Number:	TG-09-01
Project Number:	2005-38814-16352
Investigators:	T. A. Gipson, I. Tovar-Luna, A. L. Goetsch, and G. D. Detweiler
Objectives:	1) Evaluate the accuracy and precision of post-differentially corrected and uncorrected stationary GPS collar fixes 2) Examine the effect of post-differential correction versus raw fix data on distance traveled on mobile GPS collars

Title:	*Investigation of CNS bacteria related to subclinical mastitis: changes in goat milk composition, casein fractions, and the plasmin system*
Experiment Number:	LW-09-02
Project Number:	2007-38814-18474
Investigators:	L. Wang, S. Zeng, R. Shangguan, L. Spicer, and D. Bannerman
Objectives:	Test the impact of major types of CNS bacterial species causing intramammary infection (*Staphyloccus epidermidis*) on the inflammatory response in milk and blood, and to investigate changes in the plasmin system and somatic cell count of milk caused by subclinical mastitis, in order to study the mechanism by which CNS affects caseinolysis

Title:	*Investigation of CNS bacteria related to subclinical mastitis: changes in cheese yield, quality, and microstructure*
Experiment Number:	LW-09-03
Project Number:	2007-38814-18474
Investigators:	L. Wang, S. Zeng, R. Shangguan, L. Spicer, and D. Bannerman
Objectives:	Assess effects of subclinical mastitis in dairy goats on milk production, composition, and caseinolysis, milk coagulation properties, and curd yield and microstructure profiles

Title: *Effects of CNS bacteria induced subclinical mastitis on the gene profile of dairy goats and casein fractions and the plasmin system of goat milk*
Experiment Number: RS-09-04
Project Number: 2007-38814-18474
Investigators: R. Shangguan, L. Wang, S. Zeng, L. J. Spicer, and C. DeWitt
Objectives: Investigate the effect of subclinical mastitis caused by major types of CNS bacteria species (*S. Epidermidis*, *S. Simulans*, *S. Caprae*, and *S. Chromogenes*) on the plasmin system, casein fractions, the mechanism by which CNS affects caseinolysis, and gene profiles in Alpine and Nubian dairy goats

Title: *Effects of goat breed on energy expenditure during and after a low nutritional plane*
Experiment Number: AH-09-05
Project Number: BIO12-001-016
Investigators: A. Helal, R. Puchala, G. D. Detweiler, T. A. Gipson, T. Sahlu, and A. L. Goetsch
Objectives: 1) Determine how nutrient restriction impacts energy expenditure (EE) and the maintenance energy requirement ME_m) with common goat breeds of the USA
2) Determine how adequate nutrient intake following nutrient restriction affects EE and ME_m with common goat breeds of the USA
3) Use data from specific objectives 1 and 2 to develop a method of predicting the impact of low nutritional planes on ME_m

Title: *Selection for residual feed intake in young Boer bucks - phase 1*
Experiment Number: WH-09-06
Project Number: 2008-38814-02661
Investigators: W. Hu, T. A. Gipson, R. Puchala, T. Sahlu, and A. L. Goetsch
Objectives: 1) Determine and demonstrate efficacy of use of residual feed intake to achieve genetic progress in improving efficiency of feed utiliation without elevating mature size or body fatness compared with selection based on growth rate
2) Characterize relationships between residual feed intake and animal activities, feeding and social behaviors, and energy expenditure, and assess potential means of prediction of residual feed intake at an early age

Title: *Effects of garlic on performance of goats infected with nematodes*
Experiment Number: ZW-09-07
Project Number: OKLX-SAHLU
Investigators: Z. Wang, A. L. Goetsch, G. D. Detweiler, L. J. Dawson, S. Hart, and T. Sahlu
Objectives: Determine effects of garlic on performance and fecundity of *Haemonchus contortus* in the gastrointestinal tract of goat does and their suckling kids

Title: *Effects of goat breed, diet, and age on skin chemical composition and the mechanical properties of resulting leather*
Experiment Number: RM-09-08
Project Number: 2008-38814-02520
Investigators: R. C. Merkel, A. L. Goetsch, and T. A. Gipson
Objectives: Determine effects of goat breed (Boer vs Spanish), diet (high and low nutritive plane), and age on skin chemical composition and the mechanical properties of resulting leather

Title: *Evaluate intra-operative and post-operative complications with three different methods of castration in goats*
Experiment Number: LD-09-09
Project Number: OKLX-SAHLU
Investigators: K. Simpson, C. Baumwart, L. J. Dawson, T. A. Gipson, J. Shumacher, T. Lehenbauer, A. L. Goetsch, and J. Hayes
Objectives: Evaluate intra-operative and post-operative complications with three different methods of castration. The three methods include castration with a Henderson tool, emasculation, and banding. Evaluation of the patients after surgery will include pack cell volume, total protein, feed intake daily, weekly weight gain and feed efficiency.

Title: *Observations of effects of Carolina horsenettle on performance and immunity in goats infected with nematode parasites*
Experiment Number: ZW-09-10
Project Number: OKLX-SAHLU
Investigators: Z. Wang, A. L. Goetsch, S. P. Hart, L. J. Dawson, and T. Sahlu
Objectives: Determine effects of *S. Carolinense* on body weight change, immune responses (measured by concentrations of antibodies IgA, IgM, and IgG), and internal parasite load (measured by fecal egg count)

Title: *Management of lactating Alpine goats to minimize internal parasitism and the activity energy cost*
Experiment Number: AG-09-11
Project Number: OKLX-SAHLU
Investigators: A. L. Goetsch, Z. Wang, S. P. Hart, L. J. Dawson, T. A. Gipson, R. Puchala, E. Loetz, J. Hayes, R. C. Merkel, G. D. Detweiler, and T. Sahlu
Objectives: Determine effects of different pasture access schemes conceivably impacting ingestion of infective larvae of *Haemonchus contortus* and the activity energy cost on production and behavior of Alpine dairy goats

Title: *Effects of method of processing broiler litter on feed intake and performance by meat goat doelings*
Experiment Number: AG-09-12
Project Number: OKLX-SAHLU
Investigators: A. L. Goetsch, G. D. Detweiler, J. Hayes, and T. Sahlu
Objectives: Compare feed intake, growth rate, and efficiency of feed utilization of meat goat doelings consuming diets with deep-stacked versus ensiled broiler litter

Abstracts

2010 National Meetings of the American Society of Animal Science (Journal of Animal Science, Volume 87, ESupplement 2; the American Society of Animal Science has copyright ownership and the Journal of Animal Science is the source of this information) and the 10th International Conference on Goats in 2010

Conditions to test electric fence modifications of cattle barb wire fence for goat containment

A. L. Goetsch, G. D. Detweiler, R. Puchala, T. Sahlu, and T. A. Gipson

American Institute for Goat Research, Langston University, Langston, OK

Two simultaneous 6 x 6 Latin squares were conducted, each with 24 yearling meat goat doelings previously exposed to electric fence. After overnight fasting, groups of 4 doelings were placed in 2.4 x 2.4 m pens without forage. Pens had 3 metal panel sides and 1 side with 5 strands of barb wire 30.5, 55.9, 81.3, 106.7, and 132.1 cm from the ground adjacent to a pasture with forage and browse. Intervals between periods of 2-3 d and 1 wk were assigned to the two squares. Electric fence treatments in each square were 4 strands 15.2, 27.9, 43.2, and 58.4 cm from the ground at low voltage of 4-4.5 kV (4S-LV); 2 strands at 15.2 and 43.2 cm and high voltage of 8.5-9 kV (2S-HV); 2 strands at 15.2 and 43.2 cm and low voltage (2S-LV); 1 strand at low height of 15.2 cm and low voltage (1S-LH-LV); 1 strand at 43.2 cm and low voltage (1S-HH-LV); and 1 strand at 22.9 cm and high voltage (1S-MH-HV). The percentage of doelings exiting after 2 (during continuous visual observation) and 6 h was similar between intervals (6.3 and 4.2% at 2 h (SE=2.49) and 9.7 and 6.3% at 6 h (SE=2.33)) for long and short intervals, respectively). Doelings receiving a first shock in 2 h did not differ between intervals (16.7 and 19.4% for long and short intervals, respectively; SE=3.20). The percentage of doelings exiting at 2 and 6 h was not affected by fencing treatment. Period of the squares affected ($P < 0.05$) the percentage of doelings shocked in 2 h (62.5, 29.2, 6.3, 6.3, 0, and 4.2%; SE = 4.92) and exiting pens after 2 (20.8, 8.3, 2.1, 0, 0, and 0%; SE=3.24) and 6 h (27.1, 10.4, 6.3, 4.2, 0, and 0% for 4S-LV, 2S-HV, 2S-LV, 1S-LH-LV, 1S-HH-LV, and 1S-MH-HV, respectively; SE=3.44). Low pen exit, particularly in latter periods, suggests desirability of more thorough prior training to electric fence. Memory of previous exposure to electric fence appeared substantial, implying need to evaluate longer intervals. The overnight fasting period may not have created an adequate impetus to test electric fence for pen exit.

Effects of shearing on energy use by growing Angora goats

R. Puchala,[1] A. Helal,[2] A. L. Goetsch,[1] and T. Sahlu[1]

[1]American Institute for Goat Research, Langston University, Langston, OK
[2]Animal & Poultry Production Division, Desert Research Center, Matariya, Cairo, Egypt

Eight Angora wethers (initial BW 19.0 ± 1.14 kg) and 8 doelings (initial BW 16.3 ± 1.15 kg), approximately 17 mo of age, were used to assess effects of shearing on energy expenditure (EE) and heart rate (HR). Animals were fed a pelleted diet at 1100 h to achieve 12.5 g/d tissue gain and 7.5 g/d mohair fiber growth. Animals were placed in an indirect, open-circuit respiration calorimetry system in 4-animal sets (2 wethers and 2 doelings) for gas exchange measurement 1 d before (d 0) and for 3 d after shearing (d 1, 2, 3). Temperature and relative humidity were controlled at 20°C and 50%, respectively. Shearing was at 0900 h. To avoid effects of feeding on HR and EE, data collected during the daytime (0800 to 1900 h) were omitted. Energy expenditure was greater ($P < 0.05$) after than before shearing (3.48, 4.30, 4.01, and 3.82 MJ/d on d 0, 1, 2, and 3, respectively; SEM = 0.142). Similarly, HR (92.6, 104.8 97.5, and 100.0 beats/min; SEM = 3.02) and EE relative to metabolic size (405, 503, 468, and 448 kJ/kg $BW^{0.75}$ on d 0, 1, 2, and 3, respectively; SEM = 10.8) were affected ($P < 0.05$) by shearing. The ratio of EE to HR was similar among days after shearing (4.45, 4.87, 4.87, and 4.52 kJ/kg body $weight^{0.75}$ per heart beat on d 0, 1, 2, and 3, respectively; SEM = 0.151). A decline ($P < 0.05$) in respiratory quotient after shearing (1.049, 1.034, 1.016, and 1.015 on d 0, 1, 2, and 3, respectively; SEM = 0.0079) suggests increased body fat catabolism. Regression analysis indicated that more than 4 d would be required for EE and HR to return to pre-shearing levels. In conclusion, even with non-stressful environmental conditions, shearing Angora goats increases energy consumption.

Effects of level of feeding on energy utilization by Angora goats

I. Tovar-Luna,[1,2] R. Puchala,[1] T. Sahlu,[1] H. C. Freetly,[3] and A. L. Goetsch[1]

[1]American Institute for Goat Research, Langston University, Langston, OK
[2]Universidad Autónoma Chapingo, Unidad Regional Universitaria de Zonas Aridas, Bermejillo, Durango, México
[3]USDA, Agricultural Research Service, US Meat Animal Research Center, Clay Center, NE

Twelve mature Angora does were used in a replicated 3 × 3 Latin square to determine effects of feeding level on energy utilization. Fiber growth was measured in the first 4 wk of 6-wk periods, preceded by 2 wk of adaptation. Metabolizability and gas exchange measures occurred in wk 4, followed by feeding near maintenance then fasting in wk 5 and 6 to determine the ME requirement for maintenance (ME_m). A 60% concentrate diet was fed at levels to approximate 100, 125, and 150% of assumed ME_m. Digestibility and metabolizability were not affected by treatment with different levels of offered feed and subsequent intake near ME_m. Energy expenditure (EE) during fasting (261, 241, and 259 kJ/kg $BW^{0.75}$), efficiency of ME use for maintenance (71.6, 69.6, and 69.2%), and ME_m (365, 344, and 377 kJ/kg $BW^{0.75}$ for 100, 125, and 150%, respectively) were similar among treatments. Tissue (non-fiber) gain was lowest among treatments ($P < 0.05$) for 100% (-0.6, 23.7, and 29.8 g/d), although clean fiber growth only tended to increase with increasing level of feeding (5.60, 6.57, and 7.36 g/d for 100, 125, and 150%, respectively). Intake of ME was greater ($P < 0.05$) for 125 and 150 than for 100% (6.87, 8.22, and 8.41 MJ/d for 100, 125, and 150%, respectively). Total EE was greater for 150 vs. 100 ($P < 0.05$) and 125% ($P < 0.07$; 6.03, 6.31, and 6.77 MJ/d), and mobilized tissue energy was low but greater ($P < 0.05$) for 100 vs. 125 ($P < 0.05$) and 150% ($P < 0.07$; 0.16, 0.01, and 0.04 MJ/d for 100, 125, and 150%, respectively). Efficiency of ME use for fiber growth was similar among treatments (17.2, 16.3, and 17.7% for 100, 125, and 150%, respectively; SEM = 1.61). In conclusion, efficiency of ME use for fiber growth was similar to the NRC recommendation regardless of feeding level, although ME_m was lower perhaps because of experimental conditions employed. Energy appeared partitioned to fiber growth, although preferential usage was not complete possibly because energy metabolism for tissue and fiber accretion reached a plateau eliciting increased feed refusal.

Effects of garlic supplementation on nematode parasite infection in grazing goats

Z. Wang, A. L. Goetsch, G. Detweiler, S. P. Hart, and T. Sahlu

American Institute for Goat Research, Langston University, Langston, OK

Feeding garlic to goats infected with *Haemonchus contortus* reduced fecal worm-egg count (FEC) in a 4-wk indoor trial (J. Anim. Sci. 87(E-Suppl. 2):T354, 2009). The study reported here investigated effects of garlic supplementation of lactating meat goat does on infection with nematode parasites, mainly *H. contortus,* in summer grazing conditions. Forty multiparous Boer does (2 to 5 yr of age), naturally infected with nematode parasites, and their single- or twin-kids (1 to 4 mo old initially) were used in an 84-d experiment. Five does with their kids were allocated to each of 8 0.4-ha mixed grass-forb pastures. Treatments were control and garlic, with 4 pastures per treatment. The control group received 80 g/d of a 25% molasses and 75% corn mixture per doe. The garlic group received 20 g/d of garlic powder plus 80 g/d of the molasses-corn mixture per doe. A loose mineral-vitamin supplement was available free-choice. Initial mean FEC was 448/g (range of 0 to 1,450/g) for the control and 500/g (range of 0 to 2,450/g) for the garlic treatment (SEM = 119; $P > 0.05$). Forty-two days after the experiment started, the garlic treatment resulted in a lower ($P < 0.06$) FEC compared with the control (2,837/g for garlic and 6,105/g for control, respectively; SEM = 927), and some goats in the control group had to be treated with the anthelmintic (Levasole®, Schering-Plough Animal Health Corp, Union, NJ). Thereafter, the FEC of the garlic treatment remained steady and tended to be lower compared with the control (1,739, 1,689, and 1,303/g for garlic and 1,532, 2,340, and 1,967/g for control at d 56, 70, and 84, respectively; SEM = 280, 517, and 340, respectively). The BW of goats was not affected by garlic supplementation ($P > 0.05$). These data suggest that supplementing lactating meat goats with garlic can lessen the level of nematode parasitism.

Optimum duration of performance testing growing Boer bucks for growth rate, feed intake, and feed efficiency

W. Hu, T. A. Gipson, S. P. Hart, L. J. Dawson, A. L. Goetsch, and T. Sahlu

American Institute for Goat Research, Langston University, Langston, OK

Central performance testing of meat goats has increased in popularity recently, but minimum test length has not been ascertained. This study was conducted to determine the minimum length of time required for accurate evaluation of growing Boer bucks for ADG, feed intake, and feed efficiency as assessed by ADG:feed intake and residual feed intake. Data were collected from 425 bucks in Langston University tests from 2000 to 2009. Bucks averaged 111 ± 25 d of age and 27 ± kg BW at the beginning of the test, consumed a pelletized 50% concentrate diet ad libitum, and were weighed weekly. Daily feed intake was determined with Calan feeding gates (American Calan, Inc., Northwood, NH) and automated feeding units (MK3 FIRE, Osborne Industries Inc., Osborne, KS). Weekly data of four performance traits were analyzed using the MIXED procedure of SAS with a repeated-measures model. The first-order ante dependence [ANTE(1)] structure type was selected as the appropriate covariance structure based on goodness-of-fit criteria. Variation relative to that at 84 d (%) was 337, 275, 225, 188, 153, 129, 118, and 107% for ADG, 171, 161, 150, 141, 131, 120, 112, and 106% for feed intake, 415, 303, 223, 165, 135, 122, 111, and 105% for gain:feed intake (g/d), and 154, 138, 129, 116, 106, 101, 101, and 101% for residual feed intake at 28, 35, 42, 49, 56, 63, 70, and 77 d, respectively. Grafted polynomial break-points determined by nonlinear regression indicated that residual variance had stabilized at 64, 64, and 56 d for ADG, ADG:feed intake, and residual feed intake, respectively. A break-point for feed intake was not estimable, although the correlation between ADG at 63 and 84 d was 0.99 ($P < 0.01$) compared with r of 0.95, 0.96, and 0.97 ($P < 0.01$) for ADG, ADG:feed intake, and residual feed intake, respectively. In conclusion, the duration of Boer buck performance tests could be decreased from 84 to 63 d with little loss in accuracy.

Accuracy of calculated distances between consecutive fixes of GPS collars worn by goats

T. A. Gipson, G. Detweiler, and A. L. Goetsch

American Institute for Goat Research, Langston Univ., Langston, OK

Small ruminants have been fitted with GPS collars to estimate distance traveled in grazing studies; however, accuracy has not been assessed. To do so, a mobile stand was developed to hold 21 Lotek 3300 GPS collars (Lotek Wireless, Newmarket, Ontario, Canada) and was moved a prescribed distance between fixes on four azimuthally different courses (NE at 45°, S at 180°, W at 270°, and NW at 315°). Fixes were scheduled at 5-min intervals. Distances traveled on a course were 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 m. Distances were replicated three times for each course and the order of the distances was randomized within each replicate. Two courses were run per day and each course was paired with every other course, for a total of six different dates. Fixes were downloaded and distances between fixes were calculated using spherical geometry. The BIAS was estimated as distance calculated from collars minus true distance and was analyzed using a repeated measures design (PROC MIXED; SAS). Dependent fixed effects included true distance (0 to 100 m), course (NE, NW, S, W), and the two-way interactions. Collars and dates were considered random effects. There was no effect ($P > 0.10$) of course on BIAS. For true distance, BIAS was greatest for 0 m (7.6 m ± 0.36) and least for 60 m (0.5 m). Other estimates of BIAS were intermediate at 10 (2.9 m), 20 (1.6 m), 30 (0.9 m), 40 (1.7 m), 50 (1.4 m), 70 (0.6 m), 80 (0.8 m), 90 (1.2 m), and 100 m (1.3 m). There were linear and quadratic ($P < 0.01$) effects on BIAS when all distances were analyzed. However, if 0 and 10 m distances were eliminated, the linear effect disappeared ($P > 0.10$) but the quadratic remained ($P < 0.05$). The ability of GPS collars to differentiate between when an animal is stationary or moving only a short distance between fixes appears very limited; however, if an animal is moving more than 20 m between GPS fixes, collar estimates are within 1.6 m of actual distance traveled.

Using FAMACHA and alternative dewormers to manage gastrointestinal nematodes in a dairy goat herd

S. P. Hart[1] and L. J. Dawson[2]

[1]American Institute for Goat Research, Langston University, Langston, OK
[2]College of Veterinary Medicine, Oklahoma State University, Stillwater, OK

Gastrointestinal nematodes (GIN) are the greatest health problem in goat production. FAMACHA eye color scores have been developed for selective treatment of animals to reduce the rate of development of anthelmintic resistance. Alternative anthelmintics generally are only moderately effective (40-60% fecal egg count reduction; FECR), which may not be adequate for use with FAMACHA. The purpose of this study was to test the use of alternative anthelmintics in a FAMACHA program. Does were FAMACHA scored on May 25 and does with scores of 3 or greater were dewormed with levamisole HCl at 12 mg/kg BW (L). Lactating Alpine dairy goats (n = 91) were FAMACHA scored at 2 wk intervals from June 10 to October 15. Does with FAMACHA scores of 4 were administered one of three alternative anthelmintics and those with FAMACHA score of 5 were treated with L. Animals that were administered an anthelmintic were also given an oral supplement of iron, copper and vitamin B_{12}. Fecal samples were taken for fecal egg counts (FEC) and blood samples were taken for packed cell volume (PCV) and serum total protein (TP). The three alternative anthelmintics were: 1) 2.0 g of copper oxide wires in a gelatin capsule (W), 2) 2.0 mL of a 4% solution of copper sulfate per 4.5 kg of BW as an oral drench (S), and 3) 4.0 g of cayenne pepper in a gelatin capsule (P). At least three animals in each period that had FAMACHA score of 3 were used as controls. FECR was low and not significantly different ($P > 0.10$) among anthelmintics (35, 52, 3, 1, and -11% for L, W, P, S, and C, respectively). FAMACHA score was improved ($P < 0.05$; except for treatment P) by administering an anthelmintic (-0.48, -0.41, -0.16, -0.37, and +0.67, for L, W, P, S, and C, respectively). TP was improved ($P < 0.01$) by administering an anthelmintic (0.45, 0.10, 0.08, 1.20, and -.96 for L, W, P, S, and C respectively). PCV was improved ($P < 0.05$) by administering an anthelmintic (-1.2, 1.0, 0.3, 1.6, and -2.4% for L, W, P, S, and C, respectively. Most anthelmintics improved physiological values above the control, but W appeared superior to other alternative anthelmintics and comparable to L and would be the alternative anthelmintic of choice to use with a FAMACHA program.

Summaries of Recent Journal Articles
(2009, 2010, and In Press)

Effects of acclimatization on energy expenditure by meat goats

Patra, A. K., R. Puchala, G. Animut, T. A. Gipson, T. Sahlu, and A. L. Goetsch

Small Ruminant Research 81:42-54. 2009

Eight Spanish and eight Boer yearling doelings were used to assess relationships between energy expenditure (EE) and ambient temperature (Ta), relative humidity (RH), and temperature-humidity index (THI). Four doelings of each genotype were housed in two 5.6 x 3.1 m pens of an enclosed facility with a concrete floor without cooling and with heat provided only to prevent damage to waterers and water lines from freezing. EE was determined over 2 day periods 13 times during a 1 yr period based on EE:heart rate (HR) of each doeling. Climate variables were averaged over 2, 4, 6, and 8 wk preceding EE measurement. Doelings were fed to meet the maintenance energy requirement (ME_m). Average mean, low, and high values during the 2 wk preceding EE determination were 19.9, 7.9, and 31.8°C for Ta and 53.6, 36.1, and 62.5% for RH, respectively. Neither Ta nor THI were correlated with or had significant effects in regressions to predict the difference between EE at particular measurement times and the 1 yr mean (EEdiff). Conversely, RH was correlated ($P < 0.01$) with EEdiff. When the 13 HR measurement times were assigned to cool and warm seasonal periods, EEdiff was affected ($P < 0.01$) by a genotype x period interaction. Nonetheless, the effect of RH in models including genotype, period, and genotype x period was significant for 2, 4, 6, and 8 wk ($P < 0.01$). The R^2 of linear regressions of EEdiff against RH was slightly greater for 2 and 4 vs. 6 and 8 wk (0.11, 0.10, 0.08, and 0.07, respectively); regression coefficients for 2 and 4 wk were 1.265 and 1.163 kJ/kg $BW^{0.75}$ per 1% RH, respectively. With RH of 50%, regression coefficient of 1.214 kJ/kg $BW^{0.75}$ per 1% RH, and ME_m of 390 kJ/kg $BW^{0.75}$, predicted ME_m is 372 and 408 kJ/kg $BW^{0.75}$ at 35 and 65% RH, respectively. In conclusion, without extremes eliciting cold or heat stresses, RH appears to have a slight effect on ME_m of meat goats by acclimatization in both cool and warm periods of the year.

The relationship between heart rate and energy expenditure in growing crossbred Boer and Spanish wethers

Puchala, R., I. Tovar-Luna, T. Sahlu, H. C. Freetly, and A. L. Goetsch

Journal of Animal Science 87:1714-1721. 2009

Eight Boer (75%) x Spanish (BS) and 8 Spanish (S) wethers (155 ± 8 d of age and 19.2 ± 2.3 kg BW, initial) were used in a replicated crossover design with a 2 x 2 factorial arrangement of treatments to determine effects of genotype, diet quality, and time of the day on energy expenditure (EE), heart rate (HR), and EE:HR with ad libitum, near maintenance, and fasting levels of feed intake. Diets were 65% concentrate and coarsely ground alfalfa hay. Energy expenditure ranked ($P < 0.05$) ad libitum > maintenance > fasting (500, 390, and 270 kJ/kg $BW^{0.75}$). Heart rate did not differ between genotypes when fasting and with maintenance intake, but was greater ($P < 0.05$) for S vs BS when intake was ad libitum (BS: 55, 71, and 92; S: 52, 72, and 100 beats/min for fasting, maintenance, and ad libitum, respectively (SE = 2.0)). There was an interaction in EE:HR ($P < 0.05$) between level of feed intake and genotype (BS: 5.31, 5.59, and 5.00; S: 5.07, 5.57, and 5. 22 kJ/kg $BW^{0.75}$:beats/min for ad libitum, maintenance, and fasting, respectively (SE = 0.13)), without an effect of diet. The effect of time on EE, HR, and EE:HR differed among levels of intake ($P < 0.05$). General patterns of change in EE and HR as time of day advanced did not differ, but increases near meals followed by decreases were of slightly greater magnitude for maintenance vs ad libitum intake. The ratio of EE:HR was greater for the maintenance level of feed intake than for ad libitum intake at most times. These results indicate similar potential for use of HR to predict EE of different genotypes of growing meat goats and that establishing EE:HR with different diets or levels of intake may not be crucial. Magnitudes of difference among hours suggest that when EE:HR is used to predict EE of confined goats from full-day measurement of HR, EE:HR should be determined over an extended period of time, such as 24 h.

Impact of animal science research on U.S. goat production and predictions for the future

Sahlu, T., L. J. Dawson, T. A. Gipson, S. P. Hart, R. C. Merkel, R. Puchala, Z. Wang, S. Zeng, and A. L. Goetsch

Journal of Animal Science 87:400-418. 2009

Goat research in the U.S. has increased but at a rate less than that in production. Research on goat meat includes nutritional quality, packaging, color, sensory characteristics, and preharvest management. Goat skins have value for leather, yet quality of goat leather has not been extensively studied. Research in the production, quality, antibiotic residues, and sensory characteristics of goat milk and its products has aided development of the U.S. dairy goat industry. Limited progress has been made in genetic improvement of milk or meat production. There is need to explore applications of genomics and proteomics and improve consistency in texture and functionality of goat cheeses. New goat meat and milk products are needed to increase demand and meet the diverse tastes of the American public. Despite research progress in control of mohair and cashmere growth, erratic prices and sale of raw materials have contributed to further declines in U.S. production. Innovative and cooperative ventures are needed for profit sharing up to the consumer level. Internal parasites pose the greatest challenge to goat production in humid areas largely because of anthelmintic resistance. Study of alternative controls is required, including immunity enhancement via nutrition, vaccination, pasture management such as co-grazing with cattle, and genetic resistance. Similarly, the importance of health management is increasing related in part to a lack of effective vaccines for many diseases. Nutrition research should address requirements for vitamins and minerals, efficiencies of protein utilization, adjusting energy requirements for nutritional plane, acclimatization, and grazing conditions, feed intake prediction, and management practices for rapid-growth production systems. Moreover, efficient technology transfer methods are needed to disseminate current knowledge and that gained in future research.

Effects of small ruminant species and origin in Ethiopia (Highland vs Lowland areas) and lengths of rest and feeding on harvest measures

Abebe, G., G. Kannan, and A. L. Goetsch

African Journal of Agricultural Science (In press). 2010

Yearling goats (G) and sheep (S) from Highland (H) and Lowland (L) areas of Ethiopia were used to determine effects of species and origin and lengths of rest and feeding on harvest measures, particularly carcass surface lightness. The H goat used was Arsi-Bale , and the L goat was Somali. The fat-tail indigenous H sheep is thought to be an Arsi-Bale genotype, and the fat-rump indigenous L sheep genotype was the Black Head Ogaden. There were two experiments (each a 2 x 2 x 3 factorial), one with rest for 0, 1, and 2 d before slaughter (R0, R1, and R2, respectively) and the second with feeding 0, 2, and 4 wk (0 wk=2 d rest; 0F, 2F, and 4F, respectively). There were 10 animals per treatment. In the rest experiment, the instrumental color measure L* (indicating lightness) for the hind leg surface 3 d PS was lower ($P<0.05$) for H than for L (34.8, 36.3, 37.4, and 38.9 for G-H, G-L, S-H, and S-L, respectively). Surface L* on d 3 was increased ($P<0.05$) by 1 and 2 d of rest compared with 0 d for goats regardless of origin, but was not affected for sheep (33.2, 36.3, 37.2, 38.5, 37.8, and 38.2 for G-R0, G-R1, G-R2, S-R0, S-R1, and S-R2, respectively). In the feeding experiment, surface L* on d 3 was lower ($P<0.05$) for H vs L (36.5, 39.0, 36.2, and 39.8 for G-H, G-L, S-H, and S-L, respectively). Feeding 4 wk increased ($P<0.05$) surface L* on d 3 regardless of species and origin (37.7, 36.8, and 39.2 for F0, F2, and F4, respectively). In summary, goat and sheep carcasses from Highland areas of Ethiopia may darken more quickly compared with Lowland areas, and 1 or 2 d of rest before slaughter can increase lightness of the surface of goat carcasses.

Effects of breed and diet on growth and body composition of crossbred Boer and Spanish wether goats

Ngwa, A. T., L. J. Dawson, R. Puchala, G. D. Detweiler, R. C. Merkel, Z. Wang, K. Tesfai, T. Sahlu, C. L. Ferrell, and A. L. Goetsch

Journal of Animal Science 87:2913-2923. 2009

Sixty growing 3/4 Boer x 1/4 Spanish (BS) and Spanish (SP) wethers were used to determine influences of diet and breed on growth and body composition. A 50% concentrate pelleted diet (CON) and one based on grass hay (HAY) were fed free-choice. Six wethers of each breed were harvested at 0 wk (total of 12) and 6 of each diet-breed combination were harvested at 14 and 28 wk (24 per time). Initial BW of fed wethers was 21.6 and 18.8 kg for BS and SP, respectively (SEM = 0.67). Average daily gain during the entire experiment was influenced by an interaction ($P < 0.05$) between breed and diet (199, 142, 44, and 50 g for BS:CON, SP:CON, BS:HAY, and SP:HAY, respectively). Carcass mass was greater ($P < 0.05$) for CON vs. HAY (56.2, 56.2, 53.2, and 54.0% empty BW for BS:CON, SP:CON, BS:HAY, and SP:HAY, respectively). Mass of the liver (2.11, 1.92, 2.00, and 1.98% empty BW; SEM = 0.048) and gastrointestinal tract (5.50, 4.83, 8.43, and 8.36% empty BW for BS:CON, SP:CON, BS:HAY, and SP:HAY, respectively; SEM = 0.158) tended ($P < 0.07$) to be influenced by an interaction between breed and diet. Mass of internal fat (12.2, 12.1, 3.4, and 3.4% empty BW for BS:CON, SP:CON, BS:HAY, and SP: HAY, respectively; SEM = 0.28) differed ($P < 0.05$) between diets. Energy in the carcass (320, 236, 87, and 79 MJ), noncarcass tissues (318, 237, 77, and 72 MJ), and empty body (638, 472, 164, and 150 MJ) ranked ($P < 0.05$) BS:CON > SP:CON > BS:HAY and SP:HAY. Empty body concentration of protein was 18.3, 17.5, 18.3, and 19.7% (SEM = 0.29) and of fat was 24.0, 23.4, 10.8, and 10.3% for BS:CON, SP:CON, BS:HAY, and SP:HAY, respectively (SEM = 0.59). Energy concentration in accreted tissue was 17.0, 18.7, 16.3, and 6.4 MJ/kg for CON:wk 1-14, CON:wk 15-28, HAY:wk 1-14, and HAY:wk 15-28, respectively (SEM = 1.39). In conclusion, relatively high growth potential of growing Boer goats with a moderate to high nutritional plane does not entail a penalty in realized growth when the nutritional plane is low. Body composition of growing Boer and Spanish goats is fairly similar regardless of growth rate. For growing meat goats other than with a prolonged limited nutritional plane, an average energy concentration in accreted tissue is 17.3 MJ/kg.

Effects of stage of lactation and dietary concentrate level on body composition of Alpine dairy goats

Ngwa, A. T., L. J. Dawson, R. Puchala, G. D. Detweiler, R. C. Merkel, Z. Wang, K. Tesfai, T. Sahlu, C. L. Ferrell, and A. L. Goetsch

Journal of Dairy Science 92:3374-3385. 2009

Multiparous Alpine does (42) were used to determine how stage of lactation and dietary forage level affect body composition. Initial measures were made with six does a few days after kidding (0 mo). Before parturition does were fed a 50% concentrate diet free-choice. Eighteen does were fed a 40% forage diet (40F) and 18 received a diet with 60% forage (60F) for approximately 2, 4, or 6 mo of lactation. The 60F diet had 20% more dehydrated alfalfa pellets than the 40F diet, with higher levels of corn and soybean meal and inclusion of supplemental fat in the 40F diet. Intake of dry matter was greater for 60F vs. 40F, average daily gain tended to be affected by an interaction between diet and month (0, 24, 121, -61, 46, and 73 g), and 4% fat-corrected milk was less in mo 5-6 than earlier. Internal fat mass was greatest among times at 6 mo and greater for 40F vs. 60F. Mass of the gastrointestinal tract was less for 40F than for 60F and decreased with increasing time in lactation. Concentrations of fat in the carcass (13.8, 13.1, 16.5, 11.2, 11.5, and 14.4%), noncarcass tissues (18.6, 24.2, 33.3, 14.3, 16.5, and 24.5%), and empty body (16.5, 18.7, 25.2, 12.9, 14.1, and 19.5% for 40F:2 mo, 40F:4 mo, 40F:6 mo, 60F:2 mo, 60F:4 mo, and 60F:6 mo, respectively) were affected by stage of lactation and diet. Based on daily change in tissue mass and energy, energy concentration in tissue mobilized or accreted was 16, 20, and 32 MJ/kg in 1-2, 3-4, and 5-6 mo of lactation, respectively. In conclusion, based on tissue mass more energy was expended by the GIT with 60F vs. 40F. Considerable internal fat is mobilized in early lactation particularly with diets moderate to high in forage, with more rapid and a greater magnitude of repletion by does consuming diets lower in forage. The concentration of energy in tissue mobilized or accreted may vary with stage of lactation.

Goat nutrition and feeding

Goetsch, A. L. and R. C. Merkel

In: R. O. Kellems, and D. C. Church (Editors) Livestock Feeds and Feeding. Pages 426-455. Prentice Hall, Upper Saddle River, NJ. 2009

Goats have been selected for different purposes, such as milk production, mohair or cashmere fiber yield, and average daily gain or meat production, resulting in different physiological conditions that affect nutrient requirements and most appropriate feeding methods. Nutrient requirements and dietary management practices are also unique for indigenous or local genotypes of goats that may not have been intensively selected by many for a particular type of production, but that have adapted to survive under specific and often harsh environmental conditions. Goats differ from other domesticated ruminant livestock species, namely beef and dairy cattle and sheep, in numerous ways; however, most notable are unique feeding behaviors. Goats generally consume a wider variety of plants when available, especially browse and foliage of woody plant species. Moreover, because of factors including mobile lips and precise tongue actions, goats exert considerable selection in the particular plant fragments and feed particles consumed. Another difference between goats vs cattle and sheep is the ingestion of relatively greater levels of many plants containing 'anti-nutritional factors' such as tannins that can influence nutrient absorption and utilization. In addition to effects of selection on nutrient requirements and desired feeding management practices, previous plane of nutrition has impact. This can be assessed by body condition score as practiced with other ruminant species. Knowledge of body condition score and other factors influencing nutrient requirements, such as breed, gender, desired levels of production including pregnancy status, and grazing and environmental conditions, are necessary to assess specific needs for energy, protein, minerals, and vitamins. Then dietary means of meeting these requirements can be devised. For animals in confinement this might be considered a bit easier than for grazing goats, since all nutrients are provided by feedstuffs offered. Although, many times in confinement forage is fed free-choice as the basal diet, similar to forage consumed when grazing. In both cases nutrients provided by the basal diet must be projected in order to formulate a supplement to satisfy any nutrient deficits at the lowest cost. Total mixed rations are frequently used as well, particularly for dairy goats, in which case least-cost formulation procedures considering different available forage and concentrate feedstuffs will yield greatest profitability.

Effects of milk fat depression induced by a dietary supplement containing *Trans*-10, *Cis*-12 conjugated linoleic acid on properties of semi-hard goat cheese

Chen, S. X., M. Rovai, A. L. Lock, D. E. Bauman, T. A. Gipson, F. Z. Ren, and S. S. Zeng

Journal of Dairy Science 92:2534-2538. 2009

Dietary supplements of conjugated linoleic acid (CLA) containing *trans*-10, *cis*-12 CLA reduce milk fat synthesis in lactating goats. This study investigated effects of milk fat depression induced by dietary CLA supplements on the properties of semi-hard goat cheese. Thirty Alpine does were randomly assigned to three groups and fed diets with lipid-encapsulated CLA that provided *trans*-10, *cis*-12 CLA at 0 (control), 3 (CLA-1) or 6 g/d (CLA-2). The experiment was a 3x3 Latin square design. Periods were 2 wk in length, each separated by 2-wk periods without CLA supplements. Bulk milk was collected on d 3 and 13 of each of three periods for cheese manufacture. The largest decrease (23.2%) in milk fat content induced by the high dosage (6 g/d per doe) of *trans*-10, *cis*-12 CLA supplementation at d 13 of treatment resulted in the decreases of cheese yield and moisture by 10.2 and 10.0%, respectively. Although CLA supplementation increased the hardness, springiness and chewiness and decreased the cohesiveness and adhesiveness of cheeses, no obvious defects were detected and no significant differences were found in sensory scores among cheeses**.** In conclusion, milk fat depression induced by a dietary CLA supplement containing *trans*-10, *cis*-12 CLA resulted in changes of fat-to-protein ratio in cheese milk and consequently affected properties of semi-hard goat cheese.

Current status of composition and somatic cell count in milk of goats enrolled in Dairy Herd Improvement Program in the United States

Zeng, S. S.[1], Zhang, L.[1,2], G.R. Wiggans[3], J. Clay[4], R. LaCroix[5], J.Z. Wang[1], and T. Gipson[1]

In: New Research on Livestock Science and Dairy Farming. Nova Science Publishers, Inc. Hauppauge, NY

The effects of breed, parity, stage of lactation (month), herd size, and regions/states on fat and protein content, somatic cell count (SCC) and production of milk from dairy goats enrolled in the Dairy Herd Improvement (DHI) program in the United States (U.S.) in 2007 were investigated to monitor the current status of composition and SCC and to help goat producers improve their herd management and receive premiums for high quality goat milk. Statistical analysis of composite DHI data indicated that composition, SCC and production of goat milk were affected by many non-infectious factors. Marked variations ($P < 0.05$) in fat and protein content and milk production were found among goat breeds, particularly among those non-registered goats. In the first five parities, milk fat and protein content was relatively constant, however, a sharp decline ($P < 0.05$) was observed in parity 6. As parities increased, SCC in milk increased steadily ($P < 0.05$). Significant differences ($P < 0.05$) in all variables were discovered among regions. Large herds of goats tended to have lower milk fat and protein content but higher milk production and SCC than the small herds ($P < 0.05$). The above findings suggest that it be economically imperative to consider culling goats after their fifth lactation and that year-round breeding and lactation programs be practiced, if dairy goat producers in the U.S. are to meet the Grade "A" goat milk requirements. All factors that contributed to variations in fat, protein, SCC and production of goat milk should be taken into consideration when establishing price incentive systems for goat milk.

Effect of somatic cell count in goat milk on yield, sensory quality, and fatty acid profile of semi-hard cheese

Chen, S. X., J. Z. Wang, J. S. Van Kessel, F. Z. Ren, and S. S. Zeng

Journal of Dairy Science. In press. 2010.

This study investigated the effect of somatic cell count (SCC) in goat milk on yield, free fatty acid (FFA) profile, and sensory quality of semi-soft cheese. Sixty Alpine goats without evidence of clinical mastitis were assigned to three groups with milk SCC level of <500,000 (Low), 500,000-1,000,000 (Medium), and 1,000,000-1,500,000 (High) cells/mL. Thirty kilograms of goat milk with mean SCC levels of 410,000 (Low), 770,000 (Medium), and 1,250,000 cells/mL (High) was obtained for the manufacture of semi-soft cheese for two consecutive weeks in three lactation stages. The composition of milk was analyzed and cheese yield was recorded on day 1. Cheese samples on day 1, 60, and 120 were analyzed for scores of total sensory, flavor, body/texture by a panel of three expert judges, and FFA. Results indicated that the milk composition did not change when milk SCC varied from 214,000 to 1,450,000 cells/mL. Milk with higher SCC had a lower standard plate count while Coliform count and psychrotrophic bacteria count were not affected. However, milk components (fat, protein, lactose, casein and total solid) among three groups were similar. As a result, no significant differences in the yield of semi-soft goat cheeses were detected. However, scores of total sensory and body/texture for cheeses made from the high SCC milk were lower than those from the low and medium SCC milk. The difference in milk SCC levels also resulted in diverse changes in cheese texture (hardness, springiness, etc.) and FFA profiles. Individual and total FFA increased significantly during the ripening, regardless the SCC levels. It is concluded that SCC in goat milk did not affect the yield of semi-soft cheese, but resulted in inferior sensory quality of aged cheeses.

Effects of stocking rate, breed, and stage of production on energy expenditure and activity of meat goat does on pasture

Beker, A., T. A. Gipson, R. Puchala, A. Askar, K. Tesfai, G. D. Detweiler, A. Asmare, and A. L. Goetsch

Journal of Applied Animal Research. In press. 2009

Sixteen Boer and 16 Spanish multiparous does were used to determine how stocking rate (SR), breed, and stage of production influence energy expenditure and behavioral activities on pasture and to develop a simple method of predicting energy used for activity. The experiment began in late spring at an average of 24 days after kidding. Litter size was two and kids were Boer and Spanish. Two does of each breed resided in eight 0.5-ha grass/forb pastures. There were five periods, 56, 60, 63, 64, and 73 days in length, corresponding to mid-lactation, early post-weaning, the late dry period, early gestation, and mid-gestation. During period 1 and the first part of period 2, two additional does with kids of each breed grazed in four High SR pastures, with other pastures designated as Low SR. Because of low available forage mass in period 3, grass hay was offered for ad libitum consumption in periods 3-5 and a concentrate supplement was provided in periods 4 and 5. Energy expenditure (EE) was estimated from heart rate (HR) on pasture and EE:HR for each doe determined in a calorimetry system. A leg position/movement monitoring system and a GPS collar with position and movement sensors were used to estimate distance traveled and time spent grazing/eating, resting while lying, resting while standing, and walking without grazing/eating. EE attributable to activity (EE_a%), expressed as a percentage of the ME requirement for maintenance plus activity in confinement, was determined based on total EE, estimated milk production, and doe BW and ADG. Forage DM mass in the middle of periods was 696, 246, 125, and 196 kg/ha for the High SR and 1362, 967, 479, and 610 kg/ha for the Low SR in periods 1, 2, 3, and 4, respectively. Kid ADG at weaning after 73 days was lower ($P < 0.05$) for the High vs. Low SR (87 vs. 112 g). Distance traveled was not influenced by SR or breed but varied among periods (3.54, 3.76, 3.09, 3.08, and 4.10 km/day in periods 1, 2, 3, 4, and 5, respectively; SE = 0.193). Time spent grazing/eating tended ($P < 0.07$) to be greater for Boer vs. Spanish does (7.9 vs. 6.7 h/day) and differed among periods (8.0, 7.8, 7.6, 5.3, and 8.0 h/day in periods 1, 2, 3, 4, and 5, respectively; SE = 0.72). Total EE was greater ($P < 0.05$) for Boer than for Spanish does (13.4 vs. 11.4 MJ/day) and differed among periods (13.5, 11.6, 11.7, 11.8, and 13.4 MJ/day in periods 1, 2, 3, 4, and 5, respectively; SE = 0.41). Likewise, predicted ME intake was greater ($P < 0.05$) for Boer vs. Spanish does (14.2 vs. 12.2 MJ/day) and varied with period (16.1, 10.6, 12.8, 12.6, and 14.0 MJ/day in periods 1, 2, 3, 4, and 5, respectively; SE = 0.47). EE_a% was not influenced by SR, breed, or period, averaging 49%. Behavioral activities were not highly related to EE_a%, although no-intercept regressions against time spent grazing/eating and grazing/eating plus walking indicated an increase in EE_a% of 5.79 and 5.05%/h, respectively. In conclusion, although EE_a% was not affected by treatments of this experiment or highly related to behavioral activities monitored, it represents a sizeable cost of energy deserved of further study.

Energy expenditure and activity of different types of small ruminants grazing varying pastures in the summer

Beker, A., T. A. Gipson, R. Puchala, A. Askar, K. Tesfai, G. D. Detweiler, A. Asmare, and A. L. Goetsch

Journal of Applied Animal Research. In press. 2010

Objectives were to determine the activity energy cost for different types of goats as well as a breed of sheep and to evaluate methods of prediction. Thirty-two animals were used, with eight of four different types. Animal types were yearling Angora doeling goats, yearling Boer wether goats, yearling Spanish wether goats, and Rambouillet wether sheep slightly more than 2 yr of age. Two animals of each type were randomly allocated to one of four pastures 9.3, 12.3, 4.6, and 1.2 ha in area. Forage conditions varied markedly among pastures. The experiment was conducted in the summer with three periods, 30, 26, and 26 days in length. Energy expenditure (EE) was estimated from heart rate (HR) on pasture and EE:HR for each animal determined in a calorimetry system. A leg position/movement monitoring system and a GPS collar with position and movement sensors were used to estimate distance traveled and time spent grazing/eating, resting while lying, resting while standing, and walking without grazing/eating. EE attributable to activity (EE_a%), expressed as a percentage of the ME requirement for maintenance plus activity in confinement, was determined based on total EE, BW, and ADG. Forage mass in the different pastures and periods ranged from 2801 to 8672 kg/h. ADG was similar among animal types (-4, 30, -1, and 8 g for Angora goats, Boer goats, Spanish goats, and sheep, respectively; SE = 8.2). Distance traveled was affected by an interaction ($P < 0.05$) between animal type and period (Angora goats: 2.98, 2.33, and 2.47; Boer goats: 3.17, 3.46, and 2.68; Spanish goats: 2.85, 5.28, and 3.30; sheep: 3.04, 3.43, and 2.25 km in periods 1, 2, and 3, respectively (SE = 0.423)). Time spent grazing was lowest among animal types ($P < 0.05$) for Angora goats (4.3, 8.4, 7.8, and 6.8 h/day) and time spent walking without grazing was lower ($P < 0.05$) for Angora goats and sheep than for Boer goats (1.7, 2.4, 2.1, and 1.2 h/day for Angora goats, Boer goats, Spanish goats, and sheep, respectively). Total EE was affected by an interaction ($P < 0.05$) between animal type and period (Angora goats: 5.89, 5.55, and 5.16; Boer goats: 9.63, 10.92, and 8.55; Spanish goats: 6.73, 8.17, and 7.02; sheep: 12.54, 11.84, and 12.93 MJ/day in periods 1, 2, and 3, respectively (SE = 0.442)). EE_a% was affected by an interaction ($P < 0.05$) between animal type and period (Angora goats: 15.7, 17.4, and 15.1; Boer goats: 59.7, 67.4, and 34.4; Spanish goats: 46.2, 61.7, and 41.6; sheep: 22.3, 11.8, and 21.9% in periods 1, 2, and 3, respectively (SE = 6.07)). EE_a% of goats was predicted with moderate accuracy ($R^2 = 0.40$-0.41) and without bias from estimates of 5.79 and 5.05%/h spent grazing/eating and grazing/eating plus walking, respectively, determined in a companion experiment; however, these methods were not suitable for sheep.

Feeding behavior of goats

Goetsch, A. L., T. A. Gipson, A. R. Askar, and R. Puchala

Journal of Animal Science 88:361-374. 2010

Factors influencing feeding behavior of goats include grazing management practices, type of vegetation and season, breed and stage of production, group size, and properties of diets fed in confinement. Considerable information has been gathered from visual observation during daylight. However, there are now tools available to characterize feeding behavior of goats while grazing and in confinement throughout the day. Global positioning system collars can be used to assess horizontal and vertical distances traveled, up or down position of the head, and movement within pasture or rangeland areas. A commercially available leg activity monitor allows estimation of the number of steps and time spent standing, lying, and moving rapidly without grazing. However, these measurements do not directly determine grazing. Therefore, prediction equations based on visual observation must be developed. Classification tree analysis is a robust method in developing these equations because the decision tree can be pruned or expanded to provide the best fit. Another equipment system determines time spent eating, ruminating, and idle from pattern of jaw movement. In addition to use of *n*-alkanes as internal markers to estimate digestibility, their profile can provide an indication of botanical composition of the selected diet. Automated feeding systems for confined goats permit determinations such as number of feeder visits and meals, eating time, and rate and pattern of feed intake. Heart rate measured while goats are in normal production settings can be used to predict total energy expenditure through multiplication by energy expenditure per heart beat of individual animals. To partition the activity energy cost, an estimate of ME intake or measures of change in body energy status and milk energy yield are needed to determine other sources of heat to be subtracted from total energy expenditure. These methods create opportunity to gain a fuller understanding of factors influencing feeding behavior of goats and relationships with levels and efficiencies of production.

Effects and interactions of origin of sheep in Ethiopia (Highland *vs* Lowland areas), feeding, and lengths of rest and feeding on harvest measures

Merera, C., G. Abebe, A. Sebsibe, and A. L. Goetsch

Journal of Applied Animal Research. In press. 2010

Yearling sheep from Highland (H) and Lowland (L) areas of Ethiopia were used to determine effects and interactions of animal origin, feeding, and lengths of rest and feeding on harvest measures. The fat-tail indigenous H sheep used is thought to be an Arsi-Bale genotype, and the fat-rump indigenous L sheep genotype was the Black Head Ogaden. Ten sheep of each origin were rested for 1, 2, or 3 days (R1, R2, and R3, respectively) after arrival at the abattoir and before slaughter, with ad libitum availability of grass hay and water and an overnight fast preceding slaughter. Eighteen to 20 sheep of each origin were subjected to feeding periods 2, 4, or 6 wk in length (F2, F4, and F6, respectively), during which time grass hay was consumed ad libitum and a concentrate supplement was provided at 200 g/day per animal (dry matter basis). There was an interaction ($P<0.05$) between origin and the linear effect of feeding period length in average daily gain, with a much greater value for H-F2 compared with other treatments (209, 120, 125, 118, 90, and 113 g/day for H-F2, H-F4, H-F6, L-F2, L-F4, and L-F6, respectively). Hot carcass weight increased linearly with increasing length of rest ($P<0.05$), with a tendency ($P<0.09$) for greater change for H vs L animals, and the effect ($P<0.05$) of feeding vs rest tended ($P<0.16$) to be greater for H sheep (8.09, 8.34, 8.73, 7.88, 8.19, 8.02, 9.08, 8.54, 9.13, 8.17, 8.03, and 8.57 kg for H-R1, H-R2, H-R3, L-R1, L-R2, L-R3, H-F2, H-F4, H-F6, L-F2, L-F4, and L-F6, respectively). There were no appreciable treatment effects on carcass pH or instrumental color measures. In conclusion, there is considerable opportunity to increase carcass weight of H by use of periods of rest after arrival at the abattoir and before slaughter longer than 1 day. Moreover, a short period of feeding, such as 2 wk, can be employed with H to markedly increase carcass weight.

Effects of acclimatization on energy expenditure by different goat genotypes

Helal, A., K. M. Youssef, H. M. El-Shaer, T. A. Gipson, A. L. Goetsch, and A. R. Askar

Livestock Science 127:67-75. 2009

Five Balady and five Shami (Damascus) intact male goats, approximately 1.5 yr of age, were individually housed and used to determine effects of ambient temperature (Ta), relative humidity, and temperature-humidity index on energy expenditure (EE). Average mean, low, and high values in 2-wk periods throughout the year were 22.5, 14.9, and 28.5°C for Ta and 61.0, 49.6, and 68.5% for RH, respectively. Animal measurements occurred monthly from December, 2006 through October, 2007. Animals were fed alfalfa hay to meet the maintenance energy requirement. Because BW was relatively constant throughout the experiment, EE was considered equal to metabolizable energy (ME) intake. In January, April, July, and October, the day of measuring heart rate (HR) occurred within a 7 day period when bucks were housed in metabolism crates for total collection of feces and urine. Individual EE to HR ratio was estimated at those times and used to predict EE throughout the year based on HR. EE in kJ/kg $BW^{0.75}$ was greater for Shami than for Balady goats in January, July, and October ($P < 0.05$), for Balady ranked ($P < 0.05$) July and October < January and April, and for Shami ranked ($P < 0.05$) January, April, and July > October. EE:HR was greatest among times ($P < 0.05$) in April and greater ($P < 0.05$) for Shami vs. Balady. Digestibilities of DM and energy were slightly greater for Shami than for Balady ($P < 0.05$). For monthly measures, rectal temperature, blood hemoglobin oxygen saturation, and HR were similar between breeds. HR differed among months, with means ranging from 57.0 to 77.6 beats/min. There were large differences among months in the difference between EE at particular measurement daily times and the average (EEdiff). No climate measure in the preceding 2 or 4 wk was correlated with EE or EEdiff ($P > 0.10$). The same was true for correlations based on all data of EEdiff and the full-day measurement of climate conditions in the month preceding HR measurement. However, when correlations were conducted separately for each genotype, some relationships for Balady goats were significant while those for Shami goats were nonsignificant. A regression of EEdiff of Balady goats against mean Ta and THI on the preceding HR measurement day revealed a coefficient of 4.17 or 2.78 kJ/kg $BW^{0.75}$ per 1° C or THI unit, respectively. In conclusion, EE of Balady goats appears sensitive to climate conditions, whereas that of Shami goats is not or at least is relatively less impacted. With hot conditions, Balady goats have an advantage in a decreased ME requirement for maintenance and with low Ta, Balady goats have an increased requirement.

Grazing management systems: creep grazing for suckling goat kids

Yiakoulaki, M. D., A. L. Goetsch, and T. Sahlu

In: G. G. Papachristou, Z. M. Parissi, H. Ben Salem, and P. Morand-Fehr (Editors) Nutritional and Foraging Ecology of Sheep and Goats. Options Méditerranean Seminars 2009 - Number 85:387-392. 2009

Creep grazing is a management system designed to match particular pasture forages and(or) grazing areas with specific nutritional requirements of different classes of grazing animals. It allows access of young nursing animals to forage of high quality and palatability (creep area) while excluding mature animals. The young animals through special openings (creep gates) are able to graze the creep area and return for suckling, thus possibly increasing weight gain and weaning weight without concentrate supplementation. In this paper, creep grazing by goats is described, with special attention given to considerations of the location of the creep area, creep gates and forage species. Kids' foraging behavior and relevant management practices, with highlighting of areas deserved of future research attention, were also discussed.

Gender differences in an on-line certification program for goat producers

Merkel, R. C., T. A. Gipson, and T. Sahlu

Tropical and Subtropical Agroecosystems 11:145-149. 2009

In 2006, a Langston University unveiled an on-line training and certification program for meat goat producers consisting of 22 learning modules. Participants take pre- and post-tests and must record a minimum score of 85% to pass the 16 required and a minimum of 3 elective modules for certification. As of May 31, 2008, 638 participants had registered for the program and 64 had completed the requirements for certification. An equal proportion of males (335) and females (303) have registered for the certification program (P^2 =1.61; P = 0.21). The same nearly-equal gender frequency of registered participants also existed for those becoming certified, 39 males vs. 25 females, (P^2 = 3.06; P = 0.08). A higher proportion of registered females (P^2 = 17.38; P < 0.01) and certified females (P^2 = 11.52; P < 0.01) were engaged in full- vs. part-time farming than registered and certified males. There were no gender differences for farm size (P^2 = 7.98; P = 0.33) or for herd size (P^2 =2.89; P = 0.58). For all participants over all tests, there were no differences in pre- or post-test scores between genders (P =0.23). For those participants required to take post-tests for the 16 required modules, females scored higher on pre-tests than males (66.8 vs.62.1%, P < 0.05) For the 6 elective modules, there were no gender differences in pre-test or post-test scores. Results show that both women and men goat farmers will equally access and use an on-line certification program. Pre- and post-test scores show equivalent knowledge of goat production for female and male goat producers. The greater proportion of females than males who characterize themselves as full-time farmers illustrates the importance of women in the goat industry.

Considerations for on-farm research and demonstration of useful feeding/nutrition practices for small ruminants in Ethiopia

Goetsch, A. L., and G. Abebe

Tropical and Subtropical Agroecosystems 11:151-155. 2009

Many funding organizations view on-farm research as having greater impact than 'on-station' trials, a feeling shared by farmers and pastoralists because of the opportunity to see and evaluate findings first-hand. Langston University provides technical assistance in a 5-year project supported by the U.S. Agency for International Development, entitled Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP), which includes on-farm research and demonstrations of useful feeding/nutrition practices. The ESGPIP partners with research and extension entities throughout Ethiopia in implementing specific activities. One effective strategy in on-farm research and demonstrations used by some partners involves group management of animals by Farmer Research Groups (FRG) situated in different villages. Four or five FRG have been used by ESGPIP implementing partners, with each consisting of 9 or 10 farmers contributing 3 or 6 animals. Funds were provided to construct a simple barn with three pens (10 animals per pen) at each FRG for group housing and feeding at night. One or two animals per farmer were subjected to each of three feeding treatments. Conversely, in other settings treatment imposition on individual farmers and their animals in multiple communities was most suitable. Both approaches allow for statistical analysis of data, desirable for publication of the findings and, perhaps more importantly, true value or meaning of any differences noted. With use of farmer-owned animals in some instances it may not be feasible to impose negative control treatments, but an appropriate common or standard supplemental feedstuff treatment allows for an adequate basis of comparison. For sustainability, on-farm research should include input by and intimate involvement of producers and participation of local technology transfer personnel.

Visiting Scholars (2009/2010)

Dr. Ahmed Helal
Native of Egypt
Research Project: Effects of nutritional plane on the maintenance energy requirement of goats
Experiment: AH-09-05

Dr. Wenping Hu
Native of China
Research Project: Boer Goat Selection for Residual Feed Intake
Experiment: WH-09-06

Dr. Abdelhafid Keli
Native of Morocco
Research Project: Management of lactating Alpine goats to minimize internal parasitism and the activity energy cost
Experiment: AG-09-11

Ms. Rulan Shangguan
Native of China
Research Project: Impact of Sub-Clinical Mastitis on Production and Quality of Goat Milk and Cheese (USDA 2007-38814-18474)
Experiment: RS-09-04

Dr. Ignacio Tovar-Luna
Native of Mexico
Research Project: The Grazing Activity Energy Cost of Goats (BIO11-001-005)
Experiments: AA-07-02, ITL-08-01

Dr. Yoko Tsukahara
Native of Japan
Training Focus: Goat Research and Production and the Importance of Goats in Development Projects

Dr. Lynn Wang
Native of China
Research Project: Impact of Sub-Clinical Mastitis on Production and Quality of Goat Milk and Cheese (USDA 2007-38814-18474)
Experiments: LW-08-03, LW-09-02, LW-09-02

Cheesemaking Overview – Goat Milk Cheese

Mr. Neville McNaughton
Cheezsorce, L.L.C.

Discussion Topics

- Market Place
- Manufacture
- Milk Composition
- Milk Quality
- Milk Production

Simple Economics

Ave. Price for Goat Milk - $30.00 to $38.00/100

Assume Retail Price at Farmers Market $15.00/lb

Assume 10 goats milking 365 days

Assume 6# of milk per goat per day is 60# of milk or $22.80 value as milk for manufacturing

Assume a 15% yield as fresh Chevre is 9# of cheese per day or $135.00/day

p.a. $8.344.00 gross value of milk from #10 goats when used for cheese.

p.a. $49,275.00 gross value when manufactured into cheese

Thanks to the Engineer in Session One for pointing this out.

I will not develop this any further today due to the many variable when setting up an operation to make cheese, particularly the issue of scale.

The Market place

It is strong and has remained do during this period of economic downturn. While growth may have leveled off there is no measurable decline.

Goat cheese buyers purchase for the following reasons, goat milk and by extension the cheese made from goat milk is of higher quality, is better for you and less about price.

In the recovering economy we will see a resumption of strong growth.

Cheese Sectors

Soft cheese will remain strong, while the market place doesn't need another Chevre all regional producers must include Chevre in their product mix.

There is a growing appreciation of traditional products with a wide and varied range of surface growth treatments using yeasts and molds.

There is also a willingness to try all non traditional surface treatments as well such as dipping in annatto, grape juice etc. to stain the surface, raise the pH and then grow moulds on the surface, coat surfaces with rustic mixed herb blends.

Hard Cheese

Noticeable by their absence are high quality table cheese. This is a major opportunity.

Sales Opportunities

Farmers markets are the opportunity for regional Cheesemakers in all geographic areas of the country.

Consumers particularly in the cities are joining the producers on this journey back to the production of better food. They are tolerant of producers efforts during development periods and promoters of your product to others when you get it right.

Groups

Slow Food and other similar value based organizations who believe in eating well, eat local and sustainability are the producer advocates, producers should reciprocate and support these organizations at every opportunity

Distributors

In all major population centers we have specialty distributors who want your product, seek them out. If you are producing product far from your point of sale be prepared to spend time travelling to the metropolitan areas and promote your product. Distributors full fill the important function of distribution but they really get behind products that have producer support

Manufacture

Large manufacturers are growing fast, there is strength in companies like Mont Chevre, Bongrain, Vermont Butter and Cheese, Red Wood Hill, Cypress Grove and others. They are becoming more sophisticated as manufacturers, more efficient which enables them to be competitive on the national scene.

Smaller producers have the advantage of producing products that do not look mass produced, focus on:

Quality

Variety

Natural finishes

Look for efficiencies in your operation that will help keep you costs down

Milk Composition

This Cheesemaker's View

We need more protein

We need higher solids

We do not need higher fat

We do not need more volume

Why are producers not breeding for protein????

I suspect greater than 95% of goat milk in the USA is used for Cheese

Goats breed for fat and volume do not recognize the needs of Cheesemakers

When we increase the fat content of milk we get only a small increase in yield because we need to decrease the moisture content of the cheese or it will become too soft

When we increase protein we capture additional fat and moisture and make substantially more cheese

High solids milk lowers production cost. Cheesemakers are in the process of concentration, removal of moisture (whey), increasing the protein content of milk by 20% reduces overheads by 20% approx.

It takes the same energy and labor to process low solids milk as high solids milk. Use DHI protein data to select for protein and cheese yield.

Focus on a better protein to fat ratio and higher solids.

Milk Quality

As a Cheesemaker you're my definition of quality may be different than the producers.

A producers definition is a low Total Plate Count (TPC) and low Somatic Cell Count (SCC)

As a Cheesemaker my quality problems in cheese come from Anaerobic, thermophilic organisms.

Many pass through the pasteurization process.

Lactobacilli, Propioni, Leuconostoc, Mesophilic spores.

We do not routinely check for these bacteria

Checking for LPC – Laboratory Pasteurization Count

Lactobacilli

Mesophilic spores

Many of these organisms are in the milk as a result of:

Animal management practices

Milking Parlor Cleaning Practices – Most farmers do not know essential information about how to wash the milking parlor, the presence of non 3A components that cannot be washed with CIP is a problem.

Note: Current Milking Parlor Washing Practices are:

Wasteful of chemical, it could all be reused reducing chemical cost by up to 90%

Wasteful of energy, if the recovered solution were stored in an insulated container less heat would be required for each wash

Because farm wash systems are set up to wash at sub optimal temperatures the chemicals used are much stronger and more toxic to the environment than would be the case if we used higher temperatures. The use of high levels of phosphates in farm cleaning is unfortunate as this is the major cause of algal bloom in waterways.

Closing Note:

The Goal is!

Better Quality Milk for Cheese
More Cost Effective Milk for Cheese
Resulting in Better Cheese
A More Profitable Future