# WELCOME

The mission of the E (Kika) de la Garza Institute for Goat Research is to develop and transfer enhanced goat production system technologies through the generation and dissemination of technical information. Thus, our goal is to assist goat owners in management decisions for the optimization of inputs and increased profitability by providing technical information. We are continually generating information on dairy, meat, and fiber-producing goats that helps maintain the goat industry viable and competitive. In this regard, at the beginning of the section outlining recent research at the Institute, we have included flow sheets highlighting our program and its integration. Our work sometimes benefits other industries as well. An example for forest and timber industries is research of the use of goats to control underbrush, and for cattle and sheep producers of the removal by goats of undesirable pasture plants.

The Institute continues to have strong working relationships with scientific organizations in many countries including Ethiopia, South Africa, Morocco, Egypt, Jordan, Israel, Philippines, China, Bulgaria, Mexico, and Brazil. It is a hope and belief that such connections will benefit our clientele by leading to expanded export markets and appropriate application in the program here of knowledge gained through collaboration abroad.

The meat goat industry continues to enjoy favorable market conditions, and the future appears quite bright as well with the introduction of Boer genetics. While we can comfortably talk about the high potential rate of gain of Boer goats, still there is need to consider production under more typical rearing scenarios. The mohair market continues to suffer, placing Angora producers in a difficult time. However, many people expect this trend to end with the recent fashion shows in Europe. The demand for cashmere fiber is strong, but until we develop alternative ways of harvesting cashmere it will be difficult for the US cashmere industry to be competitive. A greater emphasis on product development and marketing of value-added products would improve economic returns to Oklahoma dairy goat producers.

The schedule of topics and speakers for this 1998 field day was derived from producer suggestions. Dr. Nelson Escobar has done an excellent job in organizing the event, and Dr. Art Goetsch coordinated preparation of the proceedings. Highlights for this year's field day include: "*Dairy Goat Showmanship and DHIA*" (Dr. Irene Brown-Crowder); "*Making Goat Milk Colby Cheese*" (Dr. Steve Zeng); "*Feeding the Pregnant and Milking Doe*" (Dr. Tilahun Sahlu); "*Dairy Goat Farm Planning and Milking Facilities*" (Dr. John Porter); "*Measuring Financial Performance*" (Dr. Chris Petermann) and "*Goat Farm Budgeting*" (Dr. Roger Sahs); "*Meat Goat Marketing Strategies*" (Dr. Robert Branson); "*Intensive Management of Meat Goats*" (Maxine Cameron); and "*General Care of Goats*" (Dr. Lionel Dawson). Please let us know your wishes for the 1999 field day, and we will do our best to again provide a quality program with requested and timely topics. On behalf of the staff of E (Kika) de la Garza Institute for Goat Research, I thank you for your continuing interest and support.

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

# MAKING GOAT MILK COLBY CHEESE

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Colby cheese is a sub-variety of Cheddar cheese and one of only a few cheeses native to the United States. It was originally made of cow milk in Colby, Wisconsin. Ripened Colby cheese has softer body and more open texture than Cheddar cheese. The moisture content of Colby cheese ranges from 38 to 42%. In recent years, goat milk Colby cheese has evolved into one of the most favorite goat cheeses. Because of a washing step implemented in the manufacturing process, goat milk Colby cheese possesses a milder taste and flavor and a smoother body and texture compared with goat milk Cheddar cheese. It is a delightful exotic goat product enjoyed by people who are not used to goat milk cheeses, as well as by many ethnic groups and goat enthusiasts. This cheese has become a popular goat milk product for our extension programs to promote dairy goats in elementary and middle schools, on field days, and in county fairs.

When manufacturing Colby cheese, it is a good idea to use at least five gallons of goat milk per batch in order to have enough curd for pressing later on. Our experience shows that a finished Colby cheese to milk ratio of 0.9 to 1.0 lb/gallon can be expected. This ratio depends on the fat and protein content of goat milk and will vary among breeds. The following manufacturing procedure is recommended for a batch of 4 gallons.

The goat milk to be used should be fresh (preferably less than two days old), clean (strained), and sanitary (total bacteria count < 100,000/mL). Most importantly, the milk should be antibiotic-free. Antibiotic residues in milk will not only present a health risk to the consumer but also inactivate the cheese culture (starter bacteria), resulting in slow or no fermentation at all.

The milk for Colby cheese manufacturing should be pasteurized. Colby cheese is usually consumed at 2 to 3 months of age while the legal requirement for ripening raw milk cheese is at least three months. Pasteurizing a batch of milk is commonly carried out at 145$^{\circ}$F for 30 min. This process kills all pathogens and almost all organisms present in the milk. Alternatively, a high temperature and short time (HTST) technique ( i.e., 161$^{\circ}$F for 15 sec) can be used. However, an elevated temperature for a prolonged period of time will destroy some of the milk proteins, resulting in a lower cheese yield.

After pasteurization, the milk is cooled down to 88 to 90$^{\circ}$F using ice water or tap water. When the desired temperature is reached, add 2 g (approximately 1/2 teaspoon) of Direct Vat Inoculant (DVI) starter. This powdered starter is packaged in a pouch and can be stored in a freezer for up to

two years. It is a good practice to dissolve the powder in clean tape water (1:40) before pouring it into milk for a uniform mixture. If desired, a liquid mesophilic starter culture can be used with a ratio of one ounce to one gallon of milk (approximately 1%; weight/weight).

Mix the starter thoroughly into milk by stirring vigorously. Let the milk set undisturbed for one hour while keeping the temperature at 88 to 90$^{B}$F. This process activates the culture bacteria and is known as milk ripening.

Measure 5 mL (approximately 1 teaspoon) of liquid cheese rennet into a cup and dilute it with one cup of tap water. Liquid rennet can be substituted with one rennet tablet dissolved in half a cup of clean water. Important: start stirring the milk first before adding the diluted rennet into the milk. Keep stirring until a uniform mixture is achieved (usually within a few sec). Caution: excessive stirring will disturb the initial curd formation and thus should be avoided. Then, leave the milk to set for 45 to 60 min to form curd while keeping the temperature at 88 to 90$^{B}$F.

When a clean break curd develops, cut the curd into ½ inch cubes with a curd knife. Leave the curd undisturbed for 5 min, allowing the newly cut surfaces of the curd cubes to form a thin film. This will help keep the cubes intact during the next few steps.

While gently agitating, heat the curd slowly to 102$^{B}$F in next 30 min. As a rule of thumb, increase the temperature by 2$^{B}$F every 5 min. Heating the cubes too quickly will seal their surfaces and cause the whey to be retained in the curd, resulting in a high moisture cheese. Caution: temperatures higher than 104$^{B}$F will injure or even kill the culture bacteria.

Cook the curd for another 30 min at the same temperature with steady agitation to remove the whey from the curd. Before draining, stop stirring for a few min to set the curd on the bottom of the vat or pot. Drain the whey to the curd level and immediately add tap water to cool the temperature down to 80$^{B}$F. Stir the curd for 15 to 20 min more. The whole process is called washing curd. It helps develop a unique flavor and a characteristic body and texture. However, a prolonged washing at this temperature will cook more whey out and result in a lower moisture cheese. Drain the whey completely and pour the curd into a perforated colander lined with cheese cloth to drain further for 20 min.

Pour out the curd in the vat or a pan and break the curd into particles. Add 3 to 3.5% (curd weight) salt (non-iodized salt preferred). Mix the salt thoroughly with the cheese curd. Put the salted curd into a cheese mold lined with cheese cloth and press at 20 pounds per square inch (PSI) for the first hour. After flipping the cheese block, increase the pressure to 30 PSI and press it overnight (12 hours).

Take the cheese block out of the press. Remove the cheese block from the mold and the cheese cloth. Place the cheese in a well ventilated cooler or a refrigerator and let its surface air-dry for 1 to 2 days. Cut the cheese into desirable wheels, wedges, or blocks and wax them with a food-grade cheese wax (red or yellow) by dipping three times. The temperature of wax should be around 170 before waxing.

Ripen (age) the cheese in a cooler or refrigerator (45 to 50$^{\beta}$F) with a moderate humidity for 2 to 3 months before consumption. An uncovered cup or pot of water can be placed in the cooler or refrigerator to create the desired humidity.

Approximately 4 lb of Colby cheese (before waxing) can be expected from 4 gallons of goat milk. The finished Colby cheese should have a mild pleasant flavor and a soft smooth body and texture.

*The proper citation for this article is:*

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# FEEDING THE PREGNANT AND MILKING DOE

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## Introduction

Feeding the high-producing dairy goat is an ever increasing challenge. As animals are selected for increased milk production, greater attention to diet composition, feed quality, and the physical form of feedstuffs is required. In addition, feeding strategies must provide for more nutrient dense diets yet remain cost effective.

Whether you are a farmer with 300 goats or a caprine enthusiast with three pets, the nutrition of your animals is of considerable importance. Not only can over- or under-feeding of animals lead to metabolic disorders, general poor health, and low production, it also can cause huge financial losses - something very few of us can afford.

How then can we ensure that we are feeding our animals at optimal levels? The answer is simple: through knowledge. We must know the animal's nutrient requirements, physiological changes that a doe goes through when pregnant or lactating and how these affect her requirements, and the quality and nutrient content of the feeds available. Formulating a diet that will be consumed to meet the nutrient needs of the animal then becomes a fairly simple task.

This workshop was designed to discuss and give better insight into:

- the physiological changes in animals associated with pregnancy, kidding, and milking;
- how these stages interact and influence one another; and
- how to formulate feeds to best meet the animal's requirements that will ultimately optimize financial returns.

## Doe Production States

Goat milk, meat, and fiber producers should be aware that pregnancy and lactation are interrelated. How you treat and feed your animals during pregnancy influences milk yield, milk quality, lactation duration and, subsequently, kid vitality and growth rate. Fiber production can also be impacted.

### *Early and Middle Segments of Pregnancy*

Energy intake is one of the most limiting factors for milk production. Like the dairy cow, the lactating goat is able to draw upon body reserves in early lactation to meet energy requirements when feed intake lags behind nutrient demand. In early lactation, energy derived from body reserves is utilized more efficiently than feed energy for milk production. These body stores can be replaced

during mid- and late lactation and in the dry period. The rate and extent to which a dairy goat is capable of drawing upon body reserves to meet the energy requirement in early lactation is critical in determining her ability to produce and sustain a high level of milk production. In addition, the ability to replenish body stores has a direct impact on the ability to conceive later.

It has not been clearly established when replenishment of body stores is most efficient or what is the optimal time pattern of tissue replenishment during late lactation and the dry period. This most likely varies with conditions such as the quantity of tissue lost earlier. From a strictly energetic point of view at particular points in time, the efficiency of energy use in tissue replacement is greater in late lactation than in the dry period, suggesting that most body weight and condition restoration should be in late lactation. However, if energy required for tissue maintenance is independent of or at least not closely associated with body composition, then the efficiency of energy use might be greater for replenishment during the dry period. Dry period tissue gain rather than in late lactation would result in a minimal period of time during which tissue must be maintained before freshening. Furthermore, in the period immediately preceding parturition and lactation, to achieve highest lactation performance it is imperative to prepare the doe for lactation demands, such as increased energy intake to increase ruminal papillae development, which lends itself well to dry period tissue replenishment.

The ability of the doe to replace energy stores in late lactation or in the dry period is obviously affected by dietary energy density. Body tissue replacement increases with increasing dietary concentration of digestible energy or concentrate level, but at excessively high energy densities fattening may result from a shift in nutrient partitioning, reducing reproductive performance and increasing periparturient health problems (i.e., fatty liver). The present nutrient requirements provided by the National Research Council do not adequately address dietary energy density in late lactation or in the dry period. There is need for information on the optimal digestible energy density in late lactation and in the dry period, so that body stores are replenished most efficiently, to avoid overconditioning, and to maximally prepare does for the onset of lactation. Overall, current information available indicates that most body energy stores used in early lactation should be replaced in the late-lactation period. European recommendations are that starting in the fourth month of lactation, multiparous and primiparous goats (i.e., does and doelings, respectively) should gain live weight at approximately 2.6 and 4.9 pounds per month, respectively. Future research at the E (Kika) de la Garza Institute for Goat Research will investigate whether there are economic advantages of differences in the time when tissue lost in early lactation is replaced.

*Transition or Late Dry Period*

In the pregnant doe, the duration of pregnancy can be divided into three stages (day 0 to 50; 50 to 100; and > 100). Up to day 100, fetuses develop but little growth takes place. During this time, the doe requires very little additional nutrients above those which she needs for lactation, maintaining body weight, different levels of activity, and(or) her own growth (i.e., young doelings). Figure 1 illustrates the dramtic increase in nutrient requirements a doe experiences in the last 50 days of pregnancy. In the last trimester, most fetal and mammary gland growth takes place, elevating the nutrient requirements of the doe considerably. Especially with twins, triplets, and quadruplets, the space that fetuses occupy in the abdomen of the doe increases, and consequently decreases the space

available for feed. During this time, the doe must be fed diets with a high concentration of digestible energy. Failing to increase the energy intake of the animal may lead to metabolic disorders such as pregnancy toxemia (also known as pregnancy disease or ketosis).

Ketosis is a common metabolic problem in early lactation and particularly late gestation with multiple fetuses. Ketosis results from an inadequate supply of glucose to maintain a normal blood glucose level. The requirement for glucose and glucose precursors is high in late gestation primarily for support of fetal development demands and in early lactation to allow the metabolism of fatty acids being mobilized from adipose tissues in support of milk synthesis. As noted later, in the last 3 to 4 weeks of gestation the dietary grain level should be increased to increase the glucose supply for fetal growth and prepare the animal to consume a mixed grain-forage diet in lactation and for the relatively sudden and large increase in demand for glucose at kidding. However, never abruptly shift animals from a high forage to a high grain diet just because nutrient requirements have increased. A drastic change can result in reduced or fluctuating feed intake, low milk fat test, large decreases in body condition in early lactation, reduced milk flow peak, poor lactation persistency, abnormal manure, and an increased incidence of metabolic diseases.

Based on research conducted at the E (Kika) de la Garza Institute for Goat Research, for the pregnant doe during the last 2 months of gestation it is recommended that daily allowances of crude protein (CP) should be at least 10 or 11% (as fed basis) and should meet or be no more than 10 to 20% above the energy recommendation of the National Research Council. Although there appears to be little influence of diet on kidding traits, care must be taken in feeding the late-pregnant doe to avoid complications arising from metabolic disturbances. Goats should have adequate fat stores at kidding to achieve high milk yields in early lactation. But, over-feeding concentrates does not enhance milk production and can be detrimental. For example, high forage intake in late gestation promotes high forage intake in lactation.

During the 3 to 4 weeks preceding kidding, does should be acclimated to any new feedstuffs to be used in lactation. The dietary grain level should be increased slowly if only forage was being consumed previously, so that at least 1% body weight of grain (dry matter basis) is being consumed before kidding. However, this level should be varied with age and milk production potential of the goat. Relatedly and ideally, forage quality should be high. Although as mentioned later, feeding of legumes, which are high in Ca, should be minimized or avoided. This increased energy density in the diet will stimulate development of ruminal papillae, necessary for high feed intake and nutrient absorption during lactation. The increased level of grain feeding also limits fat mobilization and associated metabolic problems, which is of special importance because of a decrease in feed intake that occurs in the last 2 to 3 days preceding parturition. In addition, problems with mastitis can be minimized by the increases in dietary grain level and digestible energy concentration in this transition period, due to nutrition (e.g., amino acid and trace mineral and vitamin statuses) x immunity interactions. In this regard, requirements for trace minerals in the latter part of the dry period are thought to be elevated in dairy cows, and this may be the case for dairy goats as well.

Nutrition in the transition period affects the incidence of milk fever in early lactation, although this condition is less common in dairy goats than dairy cows. In order for mobilization of adequate bone calcium (Ca) to support milk production in early lactation and maintain adequate

blood Ca levels, parathyroid hormone must be produced and active. To achieve this, dietary Ca levels should not be high in late gestation; therefore, feeding legumes that are high in calcium should be minimized or avoided if possible. In addition, feeding high dietary ratios of acidogenic (e.g., $NH_4Cl$ and $MgSO_4$) to alkalogenic minerals ($NaHCO_3$, $KHCO_3$, and MgO) will help maintain proper blood pH in this period so that parathyroid hormone activity in dairy cows is high, and this is expected to apply to dairy goats also. High dietary potassium levels should be avoided in this period as well.

Although iodine and calcium deficiencies have been observed to cause fetal deaths, a vitamin A deficiency is most likely to cause fetal deaths. Especially during or after a dry summer when grass and hay usually lack adequate amounts of vitamin A, specific care is required to meet the animal's requirements. A phosphorus (P) deficiency is more likely than a Ca deficiency in grazing goats because of the relatively low phosphorus concentration in forages. It is important to be aware of possible soil mineral deficiencies in the area where your animals are grazing or where your hay is produced, since this will influence the specific content of that nutrient in the forage.

*Early Lactation*

Figure 2 illustrates relationships between feed intake, body weight, and milk production in the lactating does. Generally, milk yield peaks 6 to 9 weeks after kidding, with the peak being about 1 week later in Alpine doelings than does. However, feed intake does not peak until the third month of lactation or sometimes 12 to 16 weeks postpartum; thus, does are usually in a state of negative energy balance during this time. Therefore, body reserves (fat and protein) have to be used to make up for this energy deficit. The animal's nutrient intake will not meet her demands until milk production has decreased to 60 to 80% of the peak. During the first month of lactation goats may lose over 2 pounds of adipose or fat tissue each week to support milk production. An average weekly loss of adipose tissue in the second month is about 1 pound.

To increase doe productivity and to ensure high feed efficiency, producers need to pay close attention to the lactation curves of does within their herds. This could help to reduce feed costs and permit more accurate monitoring of herd health. For instance, changing of does to feeding programs with lower nutrient densities should be on the basis of milk yield and body condition. Table 1 is a summary of the nutrient requirements of does at different levels of milk production. Since high-producing does direct more nutrients to milk, it is important to monitor their body condition closely to ensure that body reserves are replenished during late lactation or the dry period.

Even though daily feed intake increases after kidding, diets need to be sufficiently high in digestible nutrients to support the increasing milk yield. Based on the quantity of dry matter a doe can consume, the diet should be formulated in such a way that it meets her requirements. The doe should preferably be fed a completely mixed diet. Lactation diets should contain 60 to 75% total digestible nutrients (TDN) and 12 to 17% CP depending on the stage of lactation, level of production, and size of doe. However, responses to different dietary CP levels have varied greatly among experiments. But it is agreed upon that milk production responses to high dietary CP levels are more likely with sources of protein that are not thoroughly degraded in the rumen (e.g., fish, blood, feather, and corn gluten meals) compared with ones that are extensively degraded by ruminal

microbes (e.g., soybean meal and direct-solvent-processed cottonseed meal). Furthermore, for most efficient utilization of diets high in CP, with much of the CP supplied by feedstuffs with protein that is extensively degraded in the rumen, the digestible energy concentration of the diet must be high, such as with a 60% concentrate level and high-quality forage.

Digestible energy and protein levels of diets are commonly increased by incorporating more grain and less forage. An increased TDN or digestible energy concentration in the diet can, however, lower the dietary fiber concentration below that required (e.g., crude fiber as presented in Table 1). For lactating dairy cows, minimum recommended dietary levels of neutral detergent fiber are 25 and 28% for cows of differing milk production potentials or in different stages of lactation, with at least 75% of this neutral detergent fiber from forages rather than concentrate or byproduct feedstuffs; minimum recommended levels of acid detergent fiber are 19 and 21%. From research conducted at the E (Kika) de la Garza Institute for Goat Research, it would appear that these fiber levels also can be applied to goats. We noted that lactating dairy goats producing over 7.7 lb/day of milk utilized dietary energy most efficiently and maintained a milk fat percentage above 3 when dietary dry matter was 18 to 22% acid detergent fiber. Lower dietary fiber levels can depress milk fat percentage and increase fat storage in the body of the doe or doeling, at a time when nutrient partitioning to milk synthesis is desired. Therefore, it is important to observe the ratio of concentrate (i.e., grains, which are thoroughly and rapidly digested) to roughage (i.e., forages, which are less completed and more slowly digested) and not to exceed 60:40.

In addition to feeding more grain to increase the TDN concentration, or as an alternative, fat products may be added to the diet. There are at least three advantages to adding fat to the diet: 1) it may increase total energy intake and milk production in early lactation; 2) it may allow the dietary level of grain to be decreased, allowing more forage to be included in the diet without lowering energy density; and 3) it may improve the metabolic efficiency of lactation. However, unprotected fat sources should not be included in the diet at more than 3 or 4%, since they can reduce fiber digestibility. High dietary fat levels also decrease Ca absorption. In accordance, somewhat higher levels of fat products that are inert in the rumen can be used, and many dairy cow producers include both types of fat sources in diets. In a recent experiment at the E (Kika) de la Garza Institute for Goat Research, a partially hydrogenated tallow product could be added to a lactating goat diet at up to 9% of dry matter without adverse effects. Economics should be a primary consideration, however, when making such dietary management decisions.

High-producing does in early lactation may require more protein than be synthesized by ruminal microbes from nonprotein nitrogen and protein sources that are thoroughly degraded in the rumen. However, there appears relatively less potential to temporarily meet this nutrient demand through tissue mobilization compared with use of body stores to provide energy needed for maximal milk production. Thus, feed sources high in protein that pass from the rumen without being degraded by ruminal microorganisms are frequently used in early lactation diets of high-producing dairy cows. Providing more amino acids to the small intestine will increase the supply of amino acids to the mammary gland, and as a result can stimulate milk synthesis. The potential for such a response is due to several factors: 1) an increase in the amino acids that are limiting production; 2) providing more glucogenic amino acids, thus sparing glucose for lactose synthesis or to provide energy to the mammary gland; and 3) alteration of hormone levels that control milk synthesis. The

efficacy of dietary inclusion of feedstuffs high in ruminally undegradable protein in lactating doe diets has not been adequately established. Thus, there is currently an experiment to address this issue underway at the E (Kika) de la Garza Institute for Goat Research.

Some producers allow access of high-producing dairy goats to a block of trace mineral salt to ensure adequate trace mineral nutrition. Completely mixed diets should contain appropriate amounts of calcium and phosphorus, typically with a ratio of 1.5:1 (Ca:P). A level of 0.4% P in the total diet is recommended. Because the sodium content of many feeds is inadequate to meet the need of dairy goats, the diet should contain added salt, with a level of 0.5% common.

**Feed Formulation and Guideline Tips**

When formulating diets there are several guidelines and generalizations worth keeping in mind:

- High-producing lactating animals should be fed totally mixed concentrate-forage diets, since consumption of forage alone does not facilitate sufficient energy and nutrient intakes for maximal production. The diet should be as high in digestible nutrients as possible.
- For does, other than the high milk-producing ones, the most economically rewarding strategy is usually to formulate the diet based on the quality of available forage. In short, if you have got grass or hay, use it and add a supplement to it.
- Grouping the animals (by stage of pregnancy, milk production levels, or period of lactation) will make diet formulation and the proper allocation of quantities and qualities of available feedstuffs a lot easier.
- The maximum predicted dry matter intake of an animal is important. It influences the amount (and therefore the cost) of feed offered per animal and desired nutrient and energy concentrations. There is considerable variation among does in dry matter intake, which can vary between 3 and 8% body weight.

By adhering to the following management criteria, feeding animals at optimum levels to maintain high production efficiency becomes a fairly simple task:

1. Define groups of does (i.e., according to body weight, milk production, or days in milk) and determine their nutrient requirements (energy, protein, Ca, and P) per day. You can either work with the group combined (total requirements) or with an average doe and later multiply by the number of animals to determine the requirement of the group.
2. Estimate the dry matter intake per animal or that of the group as a whole.
3. You can now calculate what the specific level of a nutrient must be per kilogram dry matter of the diet:
    - 3.1. Calculate the energy concentration in the diet (include fat/protected fat sources to boost the energy for early lactation, if needed and if economical).
    - 3.2. Check dietary protein levels.
    - 3.3. Determine dietary protein levels.
    - 3.4. Determine the forage to concentrate ratio in the diet.
    - 3.5. Balance the diet for minerals and vitamins.
4. Provide adequate amounts of clean water that is cool in summer and luke warm in winter. Check for feces that is too dry or too moist.

5. Keep the same feeding frequency and sequence.
6. Milk producers: check milk volume for individuals and for the group and check the amount of milk fat.

Information on the nutrient requirements of goats is available in a book called the Nutrient Requirements of Goats, published by the National Research Council in Washington, DC in 1981. It is commonly referred to as the NRC (1981). Two tables from the NRC (1981) are presented on the next two pages. The first table represents the nutrient requirements of goats while the second presents information on the nutrient content of a variety of feedstuffs. Examples of feeds formulated by using these tables are also presented. In addition to these tables, a list of relevant publications is provided, many of which are concerned with research conducted at the E (Kika) de la Garza Institute for Goat Research.

Figure 1.- Nutrient requirements of does during pregnancy.

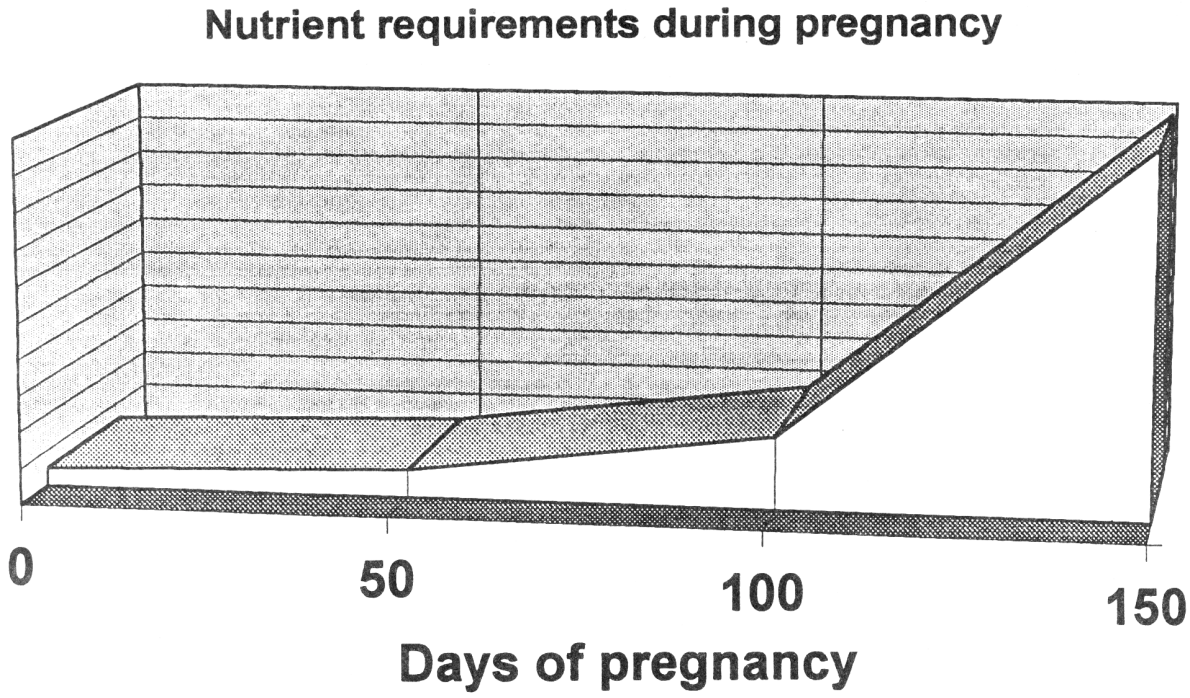


Figure 2.- Relationships of milk yield (—), body weight (- - -) and feed intake (•••) of lactating goats.

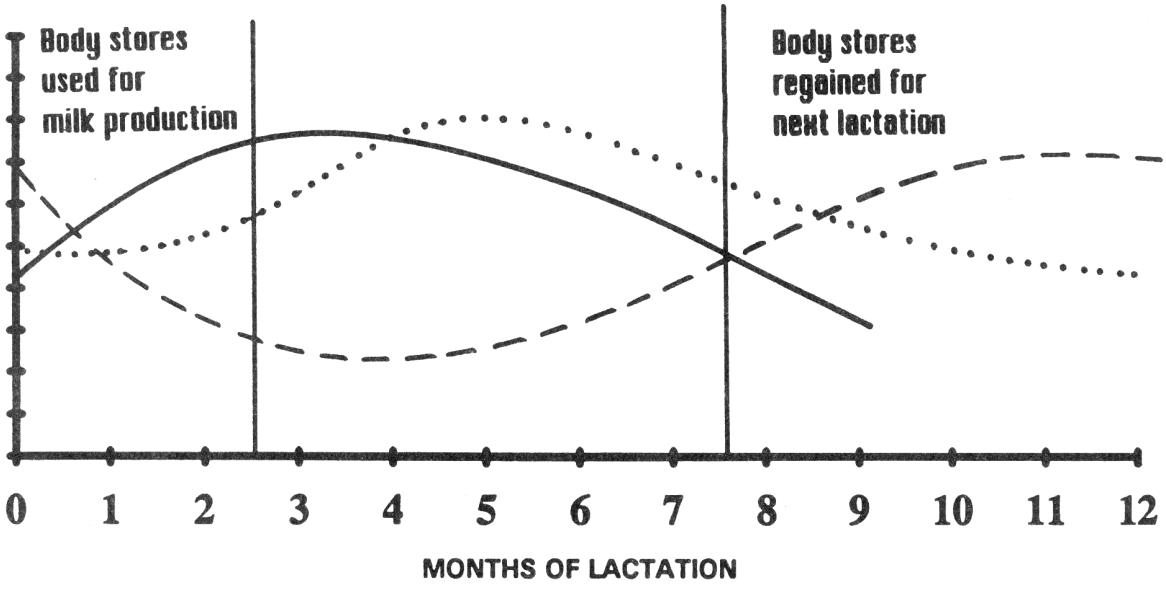

TABLE 1. Feeding the milking doe based on the level of milk production[a].

| Milk | TDN | Protein | Ca | P | Crude fiber |
|---|---|---|---|---|---|
| | ----------%---------- | | | | |
| > 9 lb/d | 75 | 18 | 0.7 | 0.5 | 20 |
| 7-9 lb/d | 71 | 16 | 0.6 | 0.4 | 23 |
| 4-7 lb/d | 67 | 14 | 0.6 | 0.4 | 26 |
| < 4 lb/d | 65 | 14 | 0.5 | 0.3 | 29 |

[a]Keep in mind that these are percentages and not absolute quantities. At a specific level of milk production, the size of the doe and the amount that she can consume (% of body weight) will influence the absolute quantity an animal needs.

TABLE 2. Nutrient requirements of animals under different production stages (NRC, 1981).

| Function | Body weight (lb) | Body weight (kg) | TDN (g) | CP (g) | Ca (g) | P (g) |
|---|---|---|---|---|---|---|
| **ALL GOATS (Choose 1)** | | | | | | |
| ***Maintenance only (Penned)*** | 22 | 10 | 159 | 22 | 1 | 0.7 |
| *(Little to no grazing/activity)* | 44 | 20 | 267 | 38 | 1 | 0.7 |
| | 66 | 30 | 362 | 51 | 2 | 1.4 |
| | 88 | 40 | 448 | 63 | 2 | 1.4 |
| | 110 | 50 | 530 | 75 | 3 | 2.1 |
| | 132 | 60 | 608 | 86 | 3 | 2.1 |
| | 154 | 70 | 682 | 96 | 4 | 2.8 |
| | 176 | 80 | 754 | 106 | 4 | 2.8 |
| ***Maintenance only (pasture)*** | 22 | 10 | 199 | 27 | 1 | 0.7 |
| *(Some/low physical activity)* | 44 | 40 | 334 | 46 | 2 | 1.4 |
| | 66 | 30 | 452 | 62 | 2 | 1.4 |
| | 88 | 40 | 560 | 77 | 3 | 2.1 |
| | 110 | 50 | 662 | 91 | 4 | 2.8 |
| | 132 | 60 | 760 | 105 | 4 | 2.8 |
| | 154 | 70 | 852 | 118 | 5 | 3.5 |
| | 176 | 80 | 942 | 130 | 5 | 3.5 |
| **ADDITIONAL REQUIREMENTS** | | | | | | |
| ***Growing:*** | | | | | | |
| 0.11 lb/day | | | 100 | 14 | 1 | 0.7 |
| 0.22 lb/day | | | 200 | 28 | 1 | 0.7 |
| 0.33 lb/day | | | 300 | 42 | 2 | 1.4 |
| ***Late pregnancy*** | | | 397 | 82 | 2 | 1.4 |
| ***Lactation (per lb of milk):*** | | | | | | |
| if 3.0% milk fat | | | 153 | 29 | 0.9 | 0.6 |
| if 4.0% milk fat | | | 157 | 33 | 0.9 | 0.6 |
| ***Mohair production*** | | | | | | |
| ***(At different annual fleece yields)*** | | | | | | |
| 4.4 (lb/year) | | | 16 | 9 | | |
| 8.8 (lb/year) | | | 34 | 17 | | |
| 13.2 (lb/year) | | | 50 | 26 | | |
| 17.6 (lb/year) | | | 66 | 34 | | |

CONVERSION FACTORS: 1 kg = 2.2 lb = 1,000 g; 1 lb = 454 g.

TABLE 3. Estimated as fed nutrient composition (per lb) of feeds (NRC, 1981).

| Feedstuff | | Moisture | TDN | Protein | Ca | P |
|---|---|---|---|---|---|---|
| Common name | Scientific name | (%) | (g) | (g) | (g) | (g) |
| **HAYS** | | | | | | |
| Alfalfa hay, early vegetative | *Medicago sativa* | 10 | 268 | 90.7 | 7.4 | 1.5 |
| Alfalfa hay, late vegetative | " " | 10 | 259 | 81.2 | 6.3 | 1.2 |
| Alfalfa hay, mature | " " | 9 | 222 | 35.4 | 5.1 | 0.8 |
| Alfalfa meal (17% CP) | " " | 8 | 254 | 78.5 | 6.4 | 1.0 |
| Bahiagrass hay | *Paspalum notatum* | 9 | 213 | 33.6 | 2.1 | 0.9 |
| Coastal bermudagrass, early | *Cynodon dactylon* | 6 | 259 | 68.0 | 1.8 | 0.7 |
| Coastal bermudagrass, late | " " | 9 | 227 | 68.0 | 1.8 | 0.7 |
| Common bermudagrass (8% CP) | " " | 9 | 191 | 36.3 | 2.0 | 0.7 |
| Dallisgrass, midbloom | *Paspalum dilatatum* | 9 | 213 | 29.5 | 1.8 | 0.7 |
| Ryegrass hay, early | *Lolium multiflorum* | 11 | 277 | 61.7 | 2.4 | 1.3 |
| Ryegrass hay, late | " " | 14 | 240 | 39.9 | 2.4 | 1.3 |
| **GRAINS** | | | | | | |
| Corn grain (8% CP) | *Zea mays* | 13 | 322 | 36.3 | 0.2 | 1.1 |
| Corn, yellow dent (9.5% CP) | *Zea mays indentata* | 11 | 349 | 43.1 | 0.1 | 1.2 |
| Cottonseed meal (41% CP) | *Gossypium sp.* | 9 | 313 | 186.9 | 0.8 | 5.0 |
| Molasses, sugar beet pulp | *Beta vulgaris altis.* | 9 | 304 | 39.9 | 2.9 | 0.4 |
| Molasses, sugarcane | *Saccharum officin.* | 25 | 245 | 20.0 | 3.4 | 0.4 |
| Oats | *Avena sativa* | 11 | 308 | 53.5 | 0.3 | 1.5 |
| Rice bran with germs | *Oryza sativa* | 9 | 286 | 57.6 | 0.3 | 7.0 |
| Sorghum (milo) grain | Sorghum bicolor | 11 | 354 | 46.3 | 0.1 | 1.3 |
| Soybean meal (45% CP) | *Glycine max.* | 10 | 358 | 203.0 | 1.4 | 2.9 |
| Wheat germ | *Triticum aestivum* | 11 | 354 | 64.4 | 0.2 | 1.7 |
| **ANIMAL PROTEIN** | | | | | | |
| Fishmeal, menhaden (61% CP) | *Brevoortia tyrannus* | 8 | 304 | 277.1 | 23.5 | 13.1 |
| Meat and bone meal (50% CP) | | 7 | 299 | 228.6 | 46.7 | 23.1 |
| **MINERAL SUPPLEMENTS** | | | | | | |
| Calcium carbonate ($CaCO_3$) | | 1 | 0 | 0 | 178.7 | 0.2 |
| Calcium phosphate, dibasic | | 3 | 0 | 0 | 96.6 | 84.8 |
| Limestone | | 0 | 0 | 0 | 154.0 | 0.1 |
| Oystershell, ground | | 1 | 0 | 0 | 170.6 | 0.3 |
| Rock phosphate | | 0 | 0 | 0 | 145.1 | 81.6 |
| Sodium phosphate, monobasic | | 3 | 0 | 0 | 0 | 98.9 |

**Feed Formulation Examples**

Example 1

Scenario: Pregnant doe weighs 130 lb, is in late pregnancy, stays in backyard.
DM intake (average = 3.5% of body weight) = 4.55 lb

**Requirements:**

| Productive Function | TDN | CP | Ca | P |
|---|---|---|---|---|
| | ----------g/day---------- | | | |
| Maintenance, low activity, 130 lb | 760 | 105 | 4.0 | 2.8 |
| Late pregnancy | 397 | 82 | 2.0 | 1.4 |
| Total daily requirement (g/day) | 1157 | 187 | 6.0 | 4.2 |

**Feed Composition:**

| Feed Ingredient | Feed intake, lb/day | Nutrients provided | | | |
|---|---|---|---|---|---|
| | | TDN | CP | Ca | P |
| | | ----------g/day, as fed basis---------- | | | |
| Common bermudagrass hay | 2.25 | 430 | 81.7 | 4.50 | 1.58 |
| Corn, ground | 2.00 | 644 | 72.6 | 0.40 | 2.20 |
| Soybean meal | 0.25 | 90 | 50.8 | 0.35 | 0.73 |
| Total intake[a] | 4.50 | 1164 | 205.1 | 5.25 | 4.51 |

[a]Additional mineral supplementation required (to increase the amount of Ca in the diet).

Comments:

1. If the doe is unable to consume the 4.55 lb/day day and if you know exactly how much she eats, recalculate the feed according to her intake.

2. According to the ration formulated here, the animal will need an additional 0.75 g Ca to fulfill its needs. How much limestone contains 0.75 g Ca?

   In 1 lb of limestone = 154.0gCa(NRC table)and 1 lb = 454 g

thus, 454 g limestone = 154 g Ca
and **X** g limestone = 0.75 g Ca

1. Cross multiply: 154 * **X** = 340.5 Ca
2. Divide on both sides by 154, solving for **X**:
   154 * **X** (limestone)/154 = 340.5 (Ca)/154
   **X** (limestone) = 2.211 g

**Solved !**: You need 2.211 g of limestone to add to the diet to provide the 0.75 g of Ca needed.

**Example 2**

Scenario: - Very dry pasture (120 g TDN/lb; 25 g protein/lb; 1.4 g Ca/lb; 0.4 g P/lb). Compared with common bermudagrass (191 g TDN/lb; 36.3 g protein/lb), the quality is very low.

- Angora doe weighing 110 lb, produces 13.2 lb of fleece/year, is on pasture and in mid-pregnancy.

- You have bought a pelleted feed containing 60% TDN and 10% protein on an as fed basis. How much of this supplement must you feed your animal, keeping in mind that the grass is "for free" and you want to feed as little as possible of the pelleted feed?

- DM intake at 3.5% body weight = 3.85 lb.

**Step 1: Nutrient requirements of the animal.**

| | Nutrient Requirements | | | |
|---|---|---|---|---|
| Productive Function | TDN | CP | Ca | P |
| | ----------g/day---------- | | | |
| Maintenance, pasture grazing, 110 lb | 662 | 91 | 4 | 2.8 |
| Fleece yield, 13.2 lb/year | 50 | 26 | - | - |
| Total requirement | 712 | 117 | 4 | 2.8 |

**Step 2: Nutrient content of the pelleted feed.**

60% TDN = 600 g/kg = 600 g/2.2 lb = 273 g TDN/lb feed
10% protein = 100 g protein/kg = 100 g protein/2.2 lb = 45.5 g protein/lb feed

**Step 3:** **Calculate the quantity of pellets needed by first looking at the energy and protein alone.**

| | Pellets | | Pasture | | Total | |
|---|---|---|---|---|---|---|
| Attempt | TDN | CP | TDN | CP | TDN | CP |
| | ----------g/day---------- | | | | | |
| 1 (2 lb pellets; 1.9 lb pasture) | 546 | 91.0 | 228 | 47.5 | 774 | 139 |
| 2 (1.7 lb pellets; 2.2 lb pasture) | 464 | 77.3 | 252 | 55.0 | 743 | 132 |
| 3 (1.6 lb pellets; 2.3 lb pasture) | 437 | 72.8 | 264 | 57.5 | 713 | 130 |

**Step 4:** **Calculate the Ca and P contributions from 1.6 lb pellets and 2.3 lb pasture.**

| Feedstuff | Ca | P |
|---|---|---|
| | --------g/day--------- | |
| 2.3 lb pasture | 2.99 | 0.92 |
| 1.6 lb pellets | 2.18 | 1.09 |
| Total | 5.17 | 2.01 |

Comments:

The animal requires a further 0.8 g P to fulfill the 2.8 g of P it needs. Checking the Ca:P ratio, it will then be 1.85:1, which is in the recommended range of 1.5:1 to 2:1.

The additional 0.8 g P can be supplied by adding sodium phosphate to the diet.

How much sodium phosphate will provide 0.8 g P?

1 lb sodium phosphate contains 98.9 g P;
therefore, 454 g sodium phosphate = 98.9 g P,
and **X** g sodium phosphate = 0.8 g P

Multiply diagonally:
98.9 * **X** = 363.2 g
98.9 * (**X** sodium phosphate)/98.9 = 363.2/98.9
**X** = 3.67 g sodium phosphate

**Solved!:** You need to add 3.67 g sodium phosphate to the diet to fulfill the animal's for phosphate.

Although these examples may not reflect the situation on your farm, the math and reasoning behind them are applicable to many situations. The steps follow one another logically; balance the requirements of the animal and how much it can consume (dry matter) with the nutrients in the feedstuffs available to you. Good luck!

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# DAIRY GOAT FARM PLANNING

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## Introduction

Dairy goat farms need to be well planned to accommodate the accessory structures needed for efficient operation. Commercial dairies generally fit under one of two main categories: production of milk for a wholesale market or on-farm processing of fluid milk or cheese. The wholesale producer needs to plan for the efficient handling of large numbers of animals with provisions for expansion. The on-farm processor often has a smaller herd but needs more auxiliary buildings, has larger waste disposal requirements and may need retail areas for the public. Time needs to be spent developing goals and objectives, financial budgets and a business strategy with the future in mind, in order to adequately plan a dairy goat operation.

## Master Plan

The first step in planning a dairy goat farm is to draw up a master plan. This is simply a layout of the farmstead indicating where the present buildings are located and where future facilities will be. This is essential to assure that buildings aren't constructed in places that will be in the way in the future. It also allows for incremental expansion, whereby small units are built which can be easily expanded to meet future needs.

*Master Planning Procedure:*

1. Establish a family and business zone.

2. Determine herd size and future expansion goals.

3. Decide on the type of facility desired.

4. Compute sizes of all facilities based on numbers of animals and square footage requirements.

5. Identify possible sites, considering such things as overall building sizes, access from the rest of the farmstead and relationship to existing buildings.

6. Sketch tentative layouts to scale for each possible site using recommendations for orientation, traffic routes, weather exposure, drainage, waste disposal and building sizes selected.

7. Select the combination of site and layout which best fits your needs and recommended space allotments.

8. Check the layout with family members and employees, Extension specialists, USDA agencies, other farmers, builders, town officials and public health authorities.

9. Keep a copy of the Master Plan on file and post one on the office wall so all future building decisions are synchronized with it.

## Site Selection

After completing a Master Plan, the next step is to select the specific site for each building identified in the plan as it is needed. Things to consider when siting a building include:

Access

1. Ease of entry from the main road.

2. Provision for large delivery trucks to turn around and unload.

3. Visibility from the road (especially if access by public is important).

4. Area for vehicles to park.

Topography

1. Amounts of fill needed to create a level site on a slope.

2. Slopes or drop-offs can be used to an advantage.

3. Limitations of topography on traffic flow between buildings.

4. Surface and subsurface drainage as they relate to topography.

Orientation

1. Southern exposures can take advantage of winter sun and provide some protection against summer heat.

2. Wind currents and storm patterns can determine placement of buildings.

3. The position of the building can take advantage of beneficial wind currents for natural ventilation.

4. Relationship to neighbors (boundaries, odor control, flies, etc.).

5. Provision for expansion.

Utilities

1. Access to electrical lines with adequate capacity to run commercial equipment. Location of poles and overhead or underground lines.

2. Adequate supply of water with capability of piping it to present and future buildings.

3. Communication lines for telephone and computers.

4. Location of gas tanks.

Ancillary Services

1. Feed and material storage.

2. Waste management.

3. Chemical and fertilizer storage.

4. Equipment storage and repair.

5. Fire protection and security.

Proper planning can't be overemphasized when setting up a goat farm. Buildings last a long time and are used daily, so they want to be well laid out and efficient. As the herd size increases, mechanizing the chore routine becomes more important. Buildings need to be designed to accommodate tractors and mechanical cleaning. Animal flow is also important to allow efficient handling of goats and to prevent injury to both the animals and the operator. After the site for the building is determined, care must be taken in designing a floor plan to scale so the proper relationships of spaces are apportioned for the various needs. See a list of space requirements in Table 1.

**Table 1. General Space Requirements for Goats**

| Item | Space |
|---|---|
| Housing a mature goat | 15 - 20 square feet/animal |
| Feeder space | 1 foot/animal |
| Holding area outside a milking parlor | 5 - 7 square feet/animal |
| Grain storage | 45 lbs./cubic foot |
| Baled hay storage | 6 - 8 lbs/cubic foot |
| Sawdust storage | 12 lbs/cubic foot |
| Pasture | .2 - .5 acres /animals |
| Exercise lot | 30 - 50 sq. ft/animal |
| Daily production of manure | 1/8 - 1/4 cubic feet/day/animal |
| Water consumed | 1 - 2 gal/animal/day |
| Driveway | 12-14' wide |
| Access doors and gates | 10-12' wide |
| Height of building side walls | 10-12' high |
| Maternity pen | 30 sq. ft/pen |
| Waterers | 1 / 25 animals |

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# DAIRY GOAT MILKING FACILITIES

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## Introduction

Regardless of the size of a dairy goat operation, provision needs to be made for milking. Goats are generally housed in group pens and should be removed from that environment to be milked. A small herd may only need an isolated corner or area set aside for milking, whereas a commercial dairy would need a separate room often referred to as a milking parlor. The key to any system is that it be separated from bedded areas and easily cleaned and kept sanitary, and it must meet public health requirements if milk is commercially produced.

The most basic system is to use a milking stand for the goats while they are being milked. This separates the goat from the housing area and confines it, as well as providing an opportunity for individual grain feeding. A milking stand will suit the needs of smaller dairy goat farms and can be used for hand milking as well as with milking machines. A wooden milking stand can be adequate for home use, but on commercial dairies, all contact surfaces must be made from impervious materials such as concrete or steel.

A basic milking parlor can be set up with a series of milking stands placed side by side with space in between for the operator. They should be arranged in such a way that goats enter at one end of the room and exit at the other to provide for good animal flow. A pipeline can be mounted overhead with the goat being milked from the side or the rear.

## Types of Milking Parlors

Milking parlors are often constructed with a pit that puts the operator below the level of the goats to provide easy access to the udder; or the parlor can be an elevated platform which puts the animal at about waist level, and then the goats enter and exit by way of a ramp. The types of parlors listed below could be built either way.

### Herringbone Parlor

The herringbone parlor is commonly used with dairy cattle. There is a pit in the middle so the animals stand elevated to the operator at a 30$^{o}$ to 40$^{o}$ angle on both sides of the pit for easy access to the udder. With goats there could be a problem in properly positioning them and the short length of the animal

might make the angle less of an advantage. The pit should be 6' to 7' wide, and the working height of the animal platform needs to be custom-designed to the comfort of the operator to avoid bending, but often varies between 34" to 40" high. The animals enter and exit as a group, which makes efficient animal handling, but a slow milker will detain the whole string. For efficient traffic flow, there should be a holding area outside the parlor to hold animals close to the entrance and a well-defined exit alley to direct the animals back to the barn.

Straight-Through Parlor

A straight-through parlor is similar to the herringbone, but the animals do not stand at an angle to the operator. They are lined up head to tail and enter and exit as a group. This makes positioning the animal easier and there is a short distance from udder to udder between goats, which provides for efficient handling of the milker unit. Often times headlocks are mounted on the side of the parlor next to the operator, and each goat stands with its head locked in place and its body parallel to the operator. With the goats' heads facing the operator, grain can be fed on the side next to the parlor pit, making an easy access for re-filling the grain boxes.

Parallel Parlor

In the parallel parlor, the animals are elevated above the pit and stand parallel to one another, facing away from the operator on one or both sides of the pit. Only the rear udder is accessible, which is convenient but could be a problem for goats with non-symmetrical teat placement. The pit dimensions are similar to those outlined previously for the herringbone parlor, but the pit is sometimes deeper for easier access to the udder. With the animals standing parallel, more animals can fit in a space than a herringbone; however, additional space is needed in front of the animals so they can be exited out the front or off to the side by lifting the restraining bar. Provision needs to be made for collecting the urine and manure to deflect it from the milking area.

Side Opening Parlor

The side opening parlor is another option for dairy goat operations. There is a pit similar to the ones described previously, but the goats stand in individual stall units which run parallel to the pit, with the animals in a line head to tail, often separated by a grain feeder. The animals can enter and exit at their own pace and not affect the rest of the animals. While individual stalls help in handling each goat as a separate unit, they do create more opening and closing of gates and there is a greater distance to walk from one milking unit to the next.

Rotary Parlor

The rotary parlor can be more expensive and may add some more animal handling considerations to properly channel the animals onto the rotating parlor. These are set up for either the operator to be inside the pit with the animals rotating around them on a circular platform facing out, or the animals face the center of the circle and the platform rotates by the operators who work along the outside circumference.

These are mechanically propelled at a slow speed to keep the animals progressing around the circle to the exit as they complete milking. The platform can be suspended on water or on a metal track so it is easily rotated with a small motor. This type of parlor is more suited for large, commercial operations.

Parlor Mechanization

There is a wide variety of equipment available which can be installed to mechanize a milking parlor operated on a large commercial scale. Some of these include:

- Automatic detachers - These units sense the milk flow and shut off the vacuum and remove the unit when milking is complete. There can be a flexible arm or a retractable cord, depending upon which type better fits the parlor design. These are used in dairy cattle milking parlors, but the expense is usually not justified with dairy goats.

- Crowd gates - A crowd gate can be electronically controlled to advance forward and keep the animals confined to a smaller area and encourage them to enter the parlor.

- Power gates and doors - Power operated entrance and exit doors can be opened and closed with pneumatic cylinders. This saves pulling ropes and having to walk from one end of the parlor to the other to open and close doors.

- Feed gates and feed bowl covers - These can be used in a parlor to prevent animals from stopping and eating as they walk past feed in mangers. Covers or gates can open in sequence as animals enter or close in sequence as they exit the parlor.

- Milk meters and recorders - Electronic and mechanical flow-through meters are available to record milk production on each animal. The data can be manually or electronically recorded and compiled to assist in herd management decisions.

## Milking Parlor Construction

The milking parlor should be a separate room but readily accessible to both the milk room and animal housing area. Consideration needs to be given to adequate drainage and proper joining of roof lines to maintain the slope needed to minimize snow loads. Milking parlors are humid areas due to the large amount of water used for cleaning, so construction materials and methods need to take this into account. Below are a few key points:

- There should be an 18" high concrete base wall to prevent rotting of the sills.

- Wood frame walls are recommended above the concrete, insulated to R-19.

- Inside wall and ceiling surfaces should be water resistant, cleanable, and smooth. Well-sealed fiberglass or plastic board is preferable to paint.

- Floors need to be relatively smooth for cleaning but have enough texture to be slip-free.

- Lighting should illuminate animals properly for milking.
- Floors should be sloped in one direction to a cross channel which slopes to a drain located in the corner.

- Ventilation and fresh air inlets need to be provided.

- Provisions need to be made for adequate electric and water supplies.

- There should be good animal flow in and out of the parlor.

- Parlor platforms are often 34" to 40" from the floor, depending upon the height of the operator.

## Milking Equipment

When several goats are being milked on the farm, it generally necessitates the use of milking machines. There are complete, self-contained milk units built for goats that include the compressor and milker unit on a portable stand. Care should be taken when purchasing some of these units to make sure they have adequate capacity for proper milking. New or used dairy cattle equipment can also be adapted to goats. The components are basically the same whether cows or goats are being milked, with the exception of the milker claw, which only needs two teat cups for goats; however, there are some equipment specifications that need to be modified for goats. (See Table 1)

**Table 1. Specifications for Dairy Goat Milking Equipment**

| Item | Specifications | | |
|---|---|---|---|
| Pulsation Speed: | 60 - 85 pulsations per minute (ppm)[1] | | |
| Milk to Rest Ratio: | 50:50 to 70:30[2] | | |
| Inches of Operating Vacuum: | High line 13-14"<br>Low line 11-13"<br>Mid line 12-13.5" | | |
| Minimum air flow requirements (extrapolated from cow data): | Bucket System - | Base | 10 cfm |
| | | Additional, per milking unit | 2 cfm |
| | Pipeline - | Base | 25 cfm |
| | | Additional, per milking unit | 2 cfm |
| Milk line: | A 1 ½" diameter stainless steel line can be used for up to 3 - 4 units per slope and a 2" line can handle 6 to 8 units per slope. Larger milking systems need to be designed according to manufacturers' recommendations. | | |
| Clawless Units: | When using direct feed into the line without a milking claw, 3' of milk tube is needed between the inflation and the fork or joining device. | | |

[1]Speeding up a pulsator designed to operate in the 45 - 60 ppm range used by cows to 85 - 120 ppm used by goats may not give the desired effect as the opening and closing times may take up too much of the cycle.

[2]50:50 is for simultaneous pulsation only.

The above specifications are just rough guidelines. A milking system should be carefully designed using the manufacturers' recommendations. A lot of the guidelines being used today are extrapolations from cow data, and more research needs to be done with dairy goats. A milking system needs to be laid out for efficient operation that is gentle on the animal, designed for proper cleaning and meets public health regulations. The goal is to produce quality milk to ensure a safe and high quality milk supply for the marketplace.

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# MEASURING FINANCIAL PERFORMANCE

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## Introduction

Enterprise budgets are not only useful in determining the profitability of an enterprise, they also provide an integral link between enterprises and financial statements. Their estimated cost and returns form a basis for documenting business strengths and potential as shown in financial statements. For example, most of the information necessary to complete a cash flow plan can be gathered from individual enterprise budgets. While the information is summed into totals on the cash flow plan, details can be obtained from budgets used to develop the plan.

A good information system contributes to the financial success of the farm business. The information system should provide the manager with production information as well as current measures of the financial position, financial progress, income performance, and debt repayment capacity. A financial information system contains four essential and interrelated components: 1) the cash flow statement, 2) the balance sheet, 3) the income statement, and 4) farm records and budgets.

A cash flow plan (figure 1) is a recorded projection of the amount and timing of all cash inflows and cash outflows expected to occur throughout the planning period. Larger farms, substitution of capital assets for labor, and inflation increase the amount of cash required to operate the farm or ranch and make the cash flow plan an increasingly valuable tool in farm financial management. The cash flow plan:

- establishes target levels for income and expenses, which can be used in monitoring progress towards goals
- points out potential problems in meeting financial obligations
- indicates when cash is available for new investments

Although the cash flow plan is important in farm management, it is most effective when used with the balance sheet (OSU F-752) and income statement (OSU F-753). These three statements, supported by good farm records and enterprise budgets, form the core of financial decision making information. Financial planning involves projecting the consequences and results of possible actions, using the financial statements, and then analyzing the projected results. Thus, the potential effect of actions and decisions can be analyzed prior to their implementation and the financial requirements can be evaluated in advance. Comparing budgeted flows with those actually occurring is a useful management technique for monitoring performance.

The balance sheet (figure 2) indicates the financial position of the farm business at a particular point in time. The balance sheet shows what is owned versus what is owed and is used to analyze the financial position of the farm business. The difference between what is owned and owed represents the owner's claim to the assets of the business, or owner's equity.

The income statement (figure 3) indicates whether a business has earned money or suffered a loss. Actual financial statements help evaluate past performance so that improvements can be made as needed. Projected financial statements allow for evaluating options from production to marketing strategies to risk management. It is important to keep good farm records throughout the year to help ease the burden of financial statement preparation and planning.

To be useful, analysis needs to be done at regular intervals using consistent reporting techniques. Annual reviews should be standard, but for some businesses monthly, quarterly, and/or semi-annual evaluation are necessary. Most people prepare tax information on a calendar year. Therefore, financial planning is often done on the same calendar year basis. The balance sheet, cash flow, and income statement planning periods need to align to be effective.

**Cash Flow**

As stated earlier, a cash flow plan is a recorded projection of the amount and timing of all cash inflows and cash outflows expected to occur throughout the planning period. Target levels are estimated for income and expense items by using farm records and budget information. Because this is an estimated plan, the projected target levels can periodically be compared to what is actually occurring during the year to point out any problems that may be occurring. The problems could be a result of lower than expected sales prices, higher than expected death loss, increased expenses, or other discrepancies from the plan. By monitoring the plan against what is actually occurring, changes can be made which may help offset problems before they become severe. The cash flow plan will also indicate when cash is available for loan payments or other investments, and when cash is needed from loans or other sources. To be most effective, the cash flow plan should be prepared annually (at approximately the same time) and monitored on a regular basis. A brief discussion of the sections used in the OSU cash flow worksheet is given below. For more information about cash flows and the layout of the OSU cash flow plan, consult OSU F-751 "Developing a Cash Flow Plan".

**Revenue** - The OSU Cash Flow worksheet is separated into revenue, expense, loan payments, new borrowing, and a summary section. Revenue is further distinguished by cash received from operations, cash received from capital sales, and other cash received. Cash received from operations includes livestock (except breeding livestock) sales, crop sales, government payments, crop insurance, custom work, patronage dividends, and other receipts from normal farm operation. Cash received from the sale of breeding livestock, vehicles, machinery, real estate, and buildings is included in the capital sales section. Non-farm cash receipts that will be available for use in the farm or ranch business during the coming year are included in other cash received.

**Expenses -** Projecting expenditures is generally easier than projecting revenues. Operating expense figures can come from several sources. The previous year's cash expenditures serve as a good starting point. If an actual past cash flow statement is not available, hand records, year-end summaries of computerized records, or tax forms from prior years are useful. For some expenses, adjustments may be needed to reflect changes in the farm plan and expected prices. For other expenses, simply inflating or deflating the previous period's actual expenditures by an appropriate factor may adequately estimate upcoming expenditures. Use your judgment in applying one or both methods to develop good estimates of anticipated cash outflows. Cash operating expenses refer to those cash expenses incurred for the on going operation of the business. Purchased feed, fuel, seed, and rent are examples of operating expenses. Any livestock purchased for resale, such as stockers and feeder cattle, should be included in cash operating expenses. Cash outlays to acquire assets with a productive life typically longer than one year, e.g. breeding livestock, machinery, equipment, buildings, fences, land, and major repairs or improvements that depreciate, are also included. Other cash payments include cash withdrawals for family living, income and social security taxes, and dividends and capital distributions.

**Loan payments** - Cash expenditures for scheduled loan payments include both scheduled interest and principal payments on loans. In projecting these payments, the previous year's balance sheet, current loan schedules, or a liabilities schedule (OSU WF-792)[1] should be useful in determining balances of principal and interest due by the end of the year. Check your loan schedule to see if the interest portion of payments due is listed separately from principal payments. If other than annual payments are to be made, the amounts must be prorated to the proper periods. A loan schedule or a copy of the original note should indicate the exact amount and timing of the payments.

To estimate payments for this coming year on new term loans, review capital asset purchase plans and expense categories. If financing payments are expected on new loans for capital purchases, make the proper entry(s). A discussion with the lender and use of OSU WF-792, "Liabilities Schedule", should increase the accuracy of this estimate.

**New Borrowing** - Money flowing into the operation from new loan obligations is summarized in the new borrowing section. New loans for short term operating notes, new term debt, and new non-farm debt are included in this section. Advances on the line of credit note are not included in this section, but are shown in the summary section.

**Summary and loan balances** - The cash flow summary section is used to calculate the beginning cash balance, inflows minus outflows, cash position, and expected line of credit borrowing (if any). It also shows payments on line of credit interest and principal, tracks accrued interest on the line of credit and determines the ending cash balance. If the calculated cash position is in excess of the minimum balance, payments are made on the line of credit, interest first then principal. If the cash position is less than the minimum cash balance, then the line of credit increases to obtain the desired

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[1]WF indicates a fact sheet that is available through the Oklahoma Cooperative Extension Service (OCES) website, http://www.okstate.edu/OSU_Ag/agedcm4h/pearl/agecon/agecon.htm. If you do not have access to the www, contact the author for copies of the fact sheet of interest.

minimum cash balance.

Loan balances are maintained for line of credit, operating notes, term debt, and non-farm debt. If payments are made during the month, the appropriate balance is reduced by the amount of the principal payment. If new borrowing occurs then the balance increases by the amount of principal borrowed.

**Balance Sheet** ( Assets = Liabilities + Owner Equity)

The balance sheet indicates the financial position of the farm business at a particular point in time. The balance sheet shows what is owned versus what is owed and is used to analyze the financial position of the farm business. The difference between what is owned and owed represents the owner's claim to the assets of the business, or owner's equity. An accurately prepared balance sheet measures the financial position of a firm at a given point in time. It shows the value of assets that would remain if the business were liquidated and all financial obligations to others were paid. A series of balance sheets prepared at the same time of year for successive years shows the change in financial position and the progress being made by the business.

One of the difficulties in preparing a balance sheet is the valuation of assets. Market-basis valuation is an estimation method based on fair market value less selling costs. Cost-basis valuation adjusts the original cost of the assets for accumulated depreciation. Base value is a stipulated amount which roughly approximates cost and may be used when valuing raised breeding livestock (OSU WF-323) to reduce the amount of record keeping necessary in accounting for all costs of raising each animal. Market-basis valuation is an appropriate method for evaluating financial position for credit analysis and estimating owner equity. Cost-basis valuation is typically more useful when measuring the financial progress of an individual business from year to year. For more information on balance sheet preparation, see OSU F-752 "Developing a Balance Sheet".

The balance sheet is one of the most commonly used financial tools. Time invested in keeping records and preparing financial statements including the balance sheet yield positive returns. However, the balance sheet does not measure profitability except to the extent that profits increase retained earnings and total owner equity from one period to the next. It also does not measure the repayment capacity or the ability to meet financial obligations when they come due. Thus, for financial analysis and credit management purposes, the balance sheet should be supplemented with an income statement and cash flow projection.

**Current & non-current assets** - Assets are usually defined as items of value owned by the business plus items owed to the business. The assets include items held for sale (e.g. stocker calves, grain) or resources used in the business operation (e.g. breeding livestock, machinery, land). For financial analysis, the assets are usually categorized according to their liquidity or how readily they can be converted to cash. Further, both current and non-current assets are divided between farm and non-farm.

Current assets are cash and other assets which are typically and easily converted to cash in the course of business during the year without any loss in value. Examples of current assets include cash and checking, marketable securities, accounts receivable, prepaid expenses, marketable livestock, crop and feed, and supplies among others.

Non-current assets are not normally for sale but rather are held for the production of livestock or crops to be sold later. Non-current assets are usually not easily and quickly converted to cash without some expense or loss in value. Some non-current assets are depreciable; others are not. Breeding livestock, machinery, and buildings are used up in the production process over more than one production cycle. These are depreciable assets (see OSU WF-791, "Schedule of Assets"). Land is a non-depreciable asset and is typically the least liquid of the assets. Most non-current assets are entered at current market value when preparing a market-based balance sheet. Book value (cost less accumulated depreciation) is entered on a cost-based balance sheet and is also needed to calculate valuation equity (WF-938). Tax basis for assets is needed to calculated deferred taxes. For more information on deferred taxes see OSU WF-939 "Deferred Taxes".

**Current & non-current liabilities** - Liabilities are claims by others against the assets and are categorized according to the time period in which the obligations are to be paid. Like the assets, liabilities are either current or non-current. OSU WF-792, "Liabilities Schedule", may be used to summarize the liabilities for an individual or business. Like assets, current and non-current liabilities are separated between farm and non-farm liabilities.

Current liabilities are those which are due in the current operating period, usually within 12 months. Examples of current liabilities include accounts payable, line of credit and operating notes, current portion of term debt, accrued interest, deferred taxes, and taxes.

Non-current liabilities are those which are not due in the current operating year, but are due beyond this year. The non-current portion of term debt is found by subtracting the principal balance due in the current year from the total principal owed. Machinery notes, land notes, and non-current deferred taxes are examples of non-current liabilities.

**Owner Equity** is a calculated residual after the claims of others (liabilities are subtracted from the value of assets). Total equity is, therefore, easy to determine once the value for total assets and total liabilities has been calculated. Division of total equity into contributed capital, retained earnings, and valuation equity is very useful in analyzing the farm's productivity and financial position.

Contributed capital represents the original investment into the business (or reporting entity) plus additional amounts which may have been added by some source from outside the entity such as gifts and inheritances. When the farm business alone is the reporting entity, additional investment of the owner's personal funds (e.g. wages from off-farm work) would be added to the initial investment and withdrawals from the business (e.g. family living expenses) would be subtracted.

Retained earnings are an accumulation of net earnings which have not been withdrawn or distributed. A series of retained earnings provides strong historical evidence of the ability of the business to generate profits above withdrawals. The amount may be difficult to determine directly if adequate records are not available to show net farm income for each year since the beginning of the business. However, the amount may be determined indirectly by subtracting contributed capital and valuation equity from total equity.

Total valuation equity is the change in owner equity due to changes in the market values of assets owned. Valuation equity equals the sum of market values of assets minus the sum of book values (cost less accumulated depreciation) and minus non-current deferred taxes.

**Income Statement**

The income statement indicates whether a business has earned money or suffered a loss. Actual financial statements help evaluate past performance so that improvements can be made as needed. Projected financial statements allow for evaluating options from production to marketing strategies to risk management. It is important to keep good farm records throughout the year to help ease the burden of financial statement preparation and planning.

To be useful, analysis needs to be done at regular intervals using consistent reporting techniques. Annual reviews should be standard, but for some businesses monthly, quarterly, and/or semi-annual evaluation are necessary. Most people prepare tax information on a calendar year. Therefore, financial planning is often done on the same calendar year basis. The balance sheet, cash flow and income statement planning periods need to align to be effective.

The income statement shows whether the farm operation returns a profit or a loss to unpaid labor, management, and equity. Profitability is defined as the extent to which an entity generates revenue over and above expenses with the available assets. Assets include land, capital, labor and management. Information from the income statement is also used to evaluate repayment capacity, capital investment potential, and financial efficiency (see OSU F-790, “Evaluating Financial Performance and Position”).

Two basic accounting methods exist for determining net income. Both the cash and accrual methods are acceptable in tax reporting for farmers, and each has its advantages and disadvantages. Most farms use cash accounting to compute income taxes. Cash accounting requires only single entry record keeping, which is achieved through maintaining receipts for income and expenses. Under the cash method, receipts and expenses are reported for the period during which cash or money actually changes hands. If feed is purchased and used during one accounting period, but not paid for until the next accounting period, the feed expense is not recorded until it is paid in the next accounting period. Here, profits are overstated during the first period and understated during the next accounting period. Reliance on cash income figures can delay recognition of financial problems.

The accrual method more accurately reports net income and is better for financial analysis.

However, accrual accounting requires double-entry bookkeeping which is more complicated. Accrual accounting "matches" associated expenses to revenue as they are earned. The Farm Financial Standards Council (FFSC) recommends that farm financial statements be developed using "accrual adjusted" accounting, a compromise between cash and accrual methods. Accrual adjusted financial statements are based on cash records with accrual adjustments to revenue (e.g. changes in inventories, accounts receivable, and prepaid expenses) and expenses (e.g. accounts payable, accrued taxes and interest).

For more information on the income statement see OSU F-753, "Developing an Income Statement". The basic sections of the OSU income statement format is presented below.

**Revenue** - Revenue is income generated by the farm operations. Not all cash inflows are income. Cash proceeds from an operating loan are an example of a cash inflow that is not income. Revenue includes proceeds from the sales of market livestock, livestock products and crops, plus government payments. Changes in inventories of market livestock, raised crops and feed, gains or losses from the sale of culled breeding stock, changes in accounts receivable, and prepaid expenses are also recorded in the revenue section. Revenue using the OSU format is broken into gross revenue from market livestock and products, gross revenue from crops, and other farm revenue.

Gross revenue from market livestock and products includes sales of raised market livestock, livestock purchased for resale, and livestock products. Raised livestock may include stockers, feeder pigs and broilers. Livestock purchased for resale may include purchased stocker steers and heifers or feeder pigs. Examples of livestock products are milk, eggs, wool, and mohair. Note that sales of breeding livestock are not included in this section. An accrual adjustment is also made for the change in market livestock inventory.

Gross revenue from crops includes sales of raised crops and crops or feed purchased for resale. An accrual adjustment is made for changes in the inventory of stored crops/feed.

Other farm revenue includes government payments, cash rent income, crop insurance claims, patronage dividends, and custom work to name a few. The gain/loss from the sale of culled breeding stock sums gains and losses from sales of raised and purchased breeding animals culled (WF-323). For raised breeding livestock, the gain/loss is calculated by subtracting the base value from the sale proceeds; for purchased breeding stock, subtract the cost basis from the sale proceeds to determine the gain or loss. Only the gain from the sale, not the gross revenue, is recorded; otherwise, revenue will be overstated. Change in value due to change in quantity of raised breeding stock is the sum of the changes in value of raised livestock which are being retained for possible future use in the breeding herd, but for which the related cash costs have been expensed in the income statement. Raised livestock for breeding are not depreciated if using a base-value method. Instead, revenue is recognized each period when the animals are at a transfer point such as changing from market livestock to replacement heifer, replacement heifer to bred heifer, or bred heifer to cow. The value recorded on the income statement is the gain in value (no cash exchanged) of market livestock as they change livestock classes within the breeding herd. Other accrual adjustments are made for the change in accounts

receivable, prepaid expenses, cash investment in growing crops, supplies, other current assets, contracts and notes receivable, and investments in cooperatives. Gross farm revenue is a summation of gross revenue from market livestock and products, gross revenue from crops, and other farm revenue.

**Expenses** - Operating expenses are those expenses incurred to generate revenue. An expense is the amount of goods or services (cash or non-cash) used to produce a revenue generating item or service. Cash expenditures do not always constitute an expense. For example, principal payments on farm loans are cash expenditures and are recorded on the cash flow statement; however, they are not operating expenses. Only the interest portion of a loan payment is recorded as an expense for the income statement. Expenses included on the income statement include purchased market livestock, chemicals, insurance, labor hired, and supplies to name a few. Accrual adjustments are made for the change in purchased feed inventories, accounts payable, ad valorem taxes, employee payroll withholding taxes, other accrued expenses, other current liabilities, and other non-current liabilities from the beginning to the end of the fiscal year.

Depreciation is considered an operating expense and it is reported on a separate line on the income statement. Economic depreciation is used for the income statement because it tends to better estimate the useful life of assets. It differs from depreciation used for tax purposes. Economic depreciation is a systematic and rational method of allocating the non-recoverable cost of breeding stock, machinery, and buildings over the estimated number of years that the item will generate revenue. Economic depreciation is based on a known quantity and cost, an estimate of the useful life of an asset, and the salvage value at the end of the useful life. Only the appropriate amount of depreciation for the reporting period is recorded. Land is not depreciated, since it is assumed that land will not be depleted and will continue to generate revenue.

Interest expense includes cash interest expense plus the change in accrued interest. Cash interest paid is the sum of cash interest payments for farm loans, including operating notes, line of credit, machinery and equipment notes, and real estate loans. Accrued interest is the amount of interest outstanding at the reporting date from all farm notes and loans. The change in accrued interest is the accrued interest at the end of the accounting period minus the accrued interest at the beginning of the accounting period. Principal payments are not a farm operating expense; rather they are repayment of cash that was received from loan proceeds and so are not included on the income statement.

**Net Farm Income from Operation (NFIFO)** is the amount of profit (loss) strictly from the farm operations, not including gains or losses on the sale of farm capital items or personal and income tax. Thus, net farm income from operations equals gross farm revenue minus total farm expenses. NFIFO is useful for comparisons over time periods as it focuses on the net returns to normal farm operations (capital sales are expected to be occasional).

**Net Farm Income** is a standard measure of profitability for a farm business, calculated by matching revenue with expenses incurred to generate the revenue, plus the gain or loss from the sale of farm capital assets, before taxes. It is a residual return to the unpaid labor and management and owner equity. Net farm income equals NFIFO plus/minus gains or losses on sales of farm capital assets and

gains or losses due to changes in base value of breeding livestock. Net farm income must be positive for the farm to be profitable. A profit shows that operating expenses and debt interest are paid and that owner and family labor and management have earned a positive return. Generating profits over time allows the farm business to expand, replace capital, and reduce debt.

**Non-Farm** - The OSU income statement also provides for non-farm revenue and expense entries. Further, entries can be made for cash income taxes paid, change in accrued income taxes, change in current portion of deferred taxes, and extraordinary items.

**Integrated Farm Financial Statements (IFFS)**

IFFS is spreadsheet-based software to facilitate farm/ranch financial planning and analysis. Enterprise budgets can be summed to build a cash flow plan or actual summary data can be entered in a cash flow statement or plan. Both version 3 and 4 can generate enterprise budgets, customized budgets, a monthly cash flow statement, debt worksheets, balance sheet, income statement, and financial measures. Version 4 requires detailed asset information to generate additional statements conforming to the FFSC recommendations: schedules of assets and liabilities, schedule of deferred taxes and valuation equity, statement of cashflow (annual), and owner's equity.

Currently two Lotus 1-2-3 based versions of IFFS are available on 3 1/2" diskettes for $150.00. Both versions handle multiple-year planning. To request additional information or to order, contact Department of Agricultural Economics, Oklahoma State University, 515 Agricultural Hall, Stillwater, OK 74078, or (405) 744-9835. More information on IFFS can also be obtained from the Farm Financial Management Resources web page at http: //www.okstate.edu/OSU_Ag/asnr/agec/ffmr.htm.

**Intensive Financial Management and Planning Support (IFMAPS)**

IFMAPS, a special program provided through the Oklahoma Cooperative Extension Service, has helped farm and ranch families develop sound financial plans since 1985. Trained financial specialists work one-on-one with agricultural producers to increase their financial management skills, analyze the current financial condition of their farm or ranch operation, identify options for change, and evaluate alternative plans. Over 4,700 farm families have received IFMAPS one-on-one assistance while broadening their personal planning and management skills. Oklahoma farm and ranch families receive assistance free and financial information is kept confidential. The only cost to the producer is the time spent working with the financial specialist to prepare the plan. For further information contact IFMAPS at (800) 522-3755. More information on IFMAPS can also be obtained from the Farm Financial Management Resources web page at http:

//www.okstate.edu/OSU_Ag/asnr/agec/ffmr.htm.

**Quicken Training**

Quicken is a popular and inexpensive personal financial record-keeping software package that can be adapted for farm use. The Oklahoma Cooperative Extension Service offers "hands on" Quicken workshops to help producers use and adapt Quicken to their operation.. Contact your extension office to determine the next available training. Instructions are also posted on the WWW at http: //www.okstate.edu/OSU_Ag/asnr/agec/Doye/QUICKFRN.HTM.

**Fact Sheets**

Oklahoma Cooperative Extension Service publishes OSU Fact Sheets that describe many different topics. Some of the more relevant Fact Sheets which will supplement this article are listed below.

| Fact Sheet Number[2] | Title |
|---|---|
| F-139 | Budgets: Their Use in Farm Management |
| F-779 | The OSU Livestock Enterprise Budget |
| E-887 | Goal Setting for Farm/Ranch Families |
| F-751 | Developing a Cash Flow Plan |
| F-752 | Developing a Balance Sheet |
| F-753 | Developing an Income Statement |
| F-790 | Evaluating Financial Performance and Position |
| WF-323 | Valuation of Raised Breeding Livestock |
| WF-791 | Schedule of Assets |
| WF-792 | Liabilities Schedule |
| WF-935 | Capital Leases |
| WF-937 | Consolidated Financial Statements |
| WF-938 | Owner Equity Section |

[2]WF indicates a fact sheet that is available through the OCES website, http://www.okstate.edu/OSU_Ag/agedcm4h/pearl/agecon/agecon.htm.

*The proper citation for this article is:*

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# GOAT FARM BUDGETING

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## Introduction

Management is the most important factor in the success of any farm operation. Profit maximization is traditionally assumed to be the overriding goal in most management decisions. In reference to the economic feasibility of a goat enterprise, producers should understand the probable cost and returns of such an operation, the profit equation, financial and production risk, and potential alternatives. Questions may arise as to whether goats will help supplement farm income or if a larger goat operation is even technically feasible. Enterprise budgets are designed to provide a decision framework for assessing both short- and long-range economic analyses of production agriculture.

Three basic types of budgets can assist with the farm and financial planning process. Each type of budget provides different information to the manager for use in the decision making process. 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 then be answered once the puzzle is completed.

### ***Whole-Farm Budgets***

How to best organize and manage the farm business in a manner that is consistent with the goals and objectives of the farm family are vital issues in charting the future direction of the farm organization. The decision as to whether the enterprise in question will help achieve goals rests on the farm family acting as managers. OSU Circular E-887, "Goal Setting for Farm/Ranch Families", can help with the process of farm and family goal creation, prioritization, and the maximization of resources owned or controlled by the operator.

The whole-farm budget is a summary of the major physical and financial components of the entire farm business. The budget identifies the resources available to the farm business and assists in the selection of overall management strategies that complements the goals in mind. More information on whole-farm budgeting can be found in OSU F-139, "Budgets: Their Use in Farm Management".

## ***Enterprise Budgets***

An enterprise budget incorporates information about the specific resources, management practices, and technology used in the production process. More specifically, an enterprise budget illustrates the expected costs and returns, inputs and production, and timing for a particular farming activity. Among the various uses for enterprise budgets are:

1. Evaluating options before a commitment of owned or controlled resources.
2. Estimating potential income for a particular farm.
3. Estimating the size of farm needed to earn a specified return.
4. Uncovering costs that have not been previously considered.
5. Providing the documentation necessary to obtain/maintain creditworthiness.
6. Learning how to better organize and reorganize.
7. Comparing the profitability of two or more different systems of production.
8. Estimating the amount of rent that can be paid for land or machinery.
9. Identifying production and financial risks and whether they may be managed.
10. Projecting cash flows for a specific period of time.

## ***Enterprise Budgets - Components and Concepts***

Budgets estimate the full economic costs and returns projected to accrue to an enterprise. The goat budgets (Tables 1 and 2) are provided to assist goat producers in estimating their costs of production. Unless costs of production are known, you will not even realize if you are making a profit. And like the old adage says, "Nobody ever went broke while making a profit". Profit is shown as residual earnings in these budgets and will be discussed in greater detail later. The column at the right of the budget (Your Value) may be used by an individual to make planning adjustments.

The front page of the Oklahoma State University livestock enterprise budget contains a summary of operating inputs, fixed costs, and production. These values represent the economic outcome expected for a production period. Details of monthly operations, as well as monthly labor and capital requirements, are provided on the second page.

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 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 (as shown in the goat examples) in enterprise budgets. Variable costs are illustrated in operating input section while fixed expenses are shown in the fixed cost section.

*Variable Costs*

Variable costs are those operating inputs which vary as the level of production changes. They are items that will be used during one year's operation or one production period. They would not be purchased if production is 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. An assumption is made where there is no differentiation made between owner supplied or hired labor. If the farm operator or his family supplies the labor, a wage rate that represents a salary if employed elsewhere would be shown.

*Fixed Costs*

Fixed costs are those that do not change with the level of production. Generally, fixed costs are those ownership costs associated with buildings, machinery, and equipment which are pro-rated over a period of years. Fixed costs may also be cash or noncash in nature. Real estate taxes, personal property taxes, and insurance on buildings are examples of cash fixed costs. Noncash costs such as depreciation and interest on capital investments result in foregone opportunities. A closer inspection of the fixed costs in a typical livestock budget follows.

The interest charge for durable 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. Money that is tied up in these capital assets could have earned a return in an alternative use. This foregone opportunity is what economists define as opportunity costs and reflects a payment to the 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 ownership. For example, when a tractor is worn out, it should be completely "paid for" by depreciation. A producer must, in effect, save this much every year or reinvest it in machinery and equipment, or he will eventually find himself 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 budgets, the annual charge for taxes is based on 1% of the purchase price.

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

*Production*

The total quantity of production is multiplied by the actual or expected price to determine a value for production. In the goat budgets, the expected returns to the 100 doe unit are averaged for reporting on a per doe basis. This averaging process yields a realistic estimate of the per doe returns to

the herd given death loss, replacement rates, and kidding percentages.

*Returns Above Total Operating Costs*

The returns to fixed cost, land, risk, and management is computed by subtracting total operating costs from total receipts. As long as returns are greater than total operating costs, production is economically rational for an enterprise already in production. As shown in the goat budgets, both operations generate enough revenue to more than offset variable costs.

*Returns Above All Specified Costs*

In determining overall enterprise profitability, fixed costs also have to be part of the profit equation. Returns to management, land, and risk is calculated by subtracting total variable and fixed costs from operating revenues. This amount is residual earnings to the producer for management and to land (because land/pasture costs can have a large variation within a region, the goat budgets show no land cost). Each individual must decide whether this return is a sufficient reward for management skills, risk taking, and land devoted to the enterprise. It should be noted that since noncash items may be included in fixed costs, profits as shown here are not the same as net cash or operating receipts as shown in a cash flow statement.

## ***Dairy Goat Operations***

Most often, dairy goat enterprises mainly supplement income and milk consumption at home. If a dairy goat operation is primarily viewed as a hobby, the discussion of economics may be of lesser importance than a commercial dairy. That is not to say that an enterprise budget as a decision tool is not needed for home dairies. A small herd producing milk is sometimes an expensive hobby and an enterprise budget will help illustrate why.

The whole economic emphasis changes when the discussion turns to a commercial dairy. If plans are to go public with milk sales or sell to a commercial processor while building the herd to over 50 head, the farm manager is faced with a different set of resource requirements needed to develop a productive and profitable enterprise system. An enterprise budget would be an essential tool in evaluating whether such an alternative would be to the manager's financial advantage. Farm management skills and knowledge are a very integral aspect of success with commercial dairies. The ability to bear losses from business risk, a large capital base, and well trained labor are also important considerations.

As illustrated in Table 1, the producer is faced with a decision whether a return of $10,000 per 100 goats is satisfactory. Does it contribute enough revenue to general farm maintenance and family living? Is it adequate compensation for management efforts? If the returns are high enough, then resources may be committed to the operation in the long term.

The budget in Table 1 allows break-even analysis for the defined enterprise. Break-even analysis is a useful technique in balancing demand (revenue) and cost factors. Revenue per output is found in terms of price times production volume relationships. If one revenue component is kept constant, what would the other part need to be for that item's revenues to equal costs? For example, the break-even costs for producing 20 hundredweights (cwt.) of milk per doe when considering only operating inputs (and leaving other receipts constant) would be $14.86 per cwt. In other words, this is the market price of milk one would need just to cover variable costs in the operation while separating out other revenue items from consideration. This break-even price is found by subtracting other revenues per doe unit ($47.50) from total variable costs ($344.71) and then dividing by the production level of 20 cwt.. Revenues of $297.21 (20 cwt. x $14.86/cwt.) is equal to $297.21 (adjusted operating costs) and net returns above total operating costs are zero. To determine the break-even production level needed to cover operating inputs, one would divide the adjusted variable costs ($297.21) by the budgeted milk price per cwt. of $24 to get approximately 12.4 cwt. of milk required. Similar calculations using total variable and fixed costs may be made when determining break-evens to cover all specified costs.

Risk assessment recognizes that production and price parameters are subject to considerable variation. Production and market uncertainty exist in goat operations due to the inability to accurately forecast productivity and prices. The producer should consider a range of outcomes in addition to average or expected values. Scenarios that produce unfavorable returns will jeopardize cash flow and financial solvency.

Table 3 provides a sensitivity of expected returns above operating costs at various milk price and production combinations. Each producer would need to evaluate their options given individual financial strengths, track record/experience, price outlook, and wiliness to assume risk.

**Table 3. Sensitivity of Milk Production versus Price on Per Head Net Returns Above Total Operating Costs for a 100 Head Commercial Dairy Goat Herd.***

| Milk Prod. (in cwt.) | -10% $21.60 | -5% $22.80 | Expected Price/cwt. $24.00 | +5% $25.20 | +10% $26.40 |
|---|---|---|---|---|---|
| -20% 16.0 | $48.39 | $67.59 | $86.79 | $105.99 | $125.19 |
| -10% 18.0 | $91.59 | $113.19 | $134.79 | $156.39 | $177.99 |
| Expected 20.0 | $134.79 | $158.79 | $182.79 | $206.79 | $230.79 |
| +10% 22.0 | $177.99 | $204.39 | $230.79 | $257.19 | $283.59 |
| +20% 24.0 | $221.19 | $249.99 | $278.79 | $307.59 | $336.39 |

Break-even milk production/cwt. above total operating costs is 12.38 using the $24.00 price of milk.
Break-even milk price/cwt. above total operating costs is $14.86 using a production of 20 cwt.
* As shown in Table 1. Break-even price and production are calculated to cover total operating costs only while keeping revenues from kid and cull sales constant.

***Meat Goat Operations***

Although meat may be produced from Angoras and dairy goats, other goats are raised exclusively for this purpose. Income from meat goat production may not generate as much income as other livestock, except in areas where land areas will not support other grazing livestock such as beef cattle. Many herds are utilized for smaller land areas where brush or weeds are a problem. As with dairy goat operations, there are a number of management practice considerations that influence profitability more than perhaps buildings and equipment.

Due to a lack of a developed nationwide marketing system in the United States, prices tend to vary widely and fluctuate seasonally. However, goat meat is favored by a number of ethnic groups in this country and many producers cater to these population centers on an individual basis. Improved production practices and management techniques will be needed to insure profitability within the commercial production sector. On the demand side, meat quality standards will need to be in place before national distribution systems develop.

In Table 2, revenues are sufficient to cover all variable costs and a portion of the fixed costs. However, returns above all specified costs are negative. The enterprise would not be self-supporting in the long run and is not rewarding the operator financially for management skills. If meat goats are viewed as a hobby or for home consumption, then once again, economics may play a lesser role in deciding whether to produce or not. Many producers in this situation realize that the operation may not "pay for itself", but that is a sacrifice they are willing to make. However, if long-run returns appear unsatisfactory, the best decision may be to exit the enterprise and employ resources in a different enterprise or investment.

The meat goat budget also allows a break-even analysis for this enterprise. One could determine break-even costs above operating cost when separating fed kid revenues from culled does. For example, when considering only male kid production (and keeping other receipts constant), the break-even price per male kid would be close to $30. This is found by dividing adjusted operating costs ($43.84 - $24.32 = $19.52) by 0.65. Once again, revenues of $19.52 ($30/hd. x 0.65) equals total operating costs (adjusted by subtracting other revenues not in consideration). Therefore, net returns above total operating costs are zero.

Production and price uncertainty will also impact a meat goat operation. Several "what-if" scenarios consisting of male kid prices and overall kidding percentages are shown with their effects on net returns above operating costs in Table 4.

**Table 4. Sensitivity of Kid Crop Percentage versus Male Kid Price on Per Head Net Returns Above Total Operating Costs for a 100 Head Meat Goat Herd.***

| Kid Crop % | -10% $40.50 | -5% $42.75 | Expected Price/hd. $45.00 | +5% $47.25 | +10% $49.50 |
|---|---|---|---|---|---|
| 0.8 of Exp. 115% | -$3.19 | -$2.02 | -$0.86 | $0.31 | $1.48 |
| 0.9 of Exp. 130% | $1.77 | $3.08 | $4.39 | $5.70 | $7.02 |
| Expected 144% | $6.72 | $8.18 | $9.64 | $11.10 | $12.56 |
| 1.1 of Exp. 158% | $11.68 | $13.29 | $14.89 | $16.49 | $18.10 |
| 1.2 of Exp. 173% | $16.64 | $18.39 | $20.14 | $21.89 | $23.64 |

Break-even kid crop percentage above total operating costs is 117 using the $45.00 price per male kid.
Break-even male kid price per head above total operating costs is $30.12 using the 144% kid crop.
* As shown in Table 2. Break-even price does take into account adjustments in female sales while keeping other production parameters constant. Break-even kid crop percentage assumes a constant price structure from other revenue sources with respect to male kid prices.

## ***Partial Budgets***

The third type of budget that is useful in farm management and planning is the partial budget. Partial budgets reveal the effects of a specific change from an existing operation. It only considers the net economic effects of a proposed change and its impact on the total farm budget.

For example, one may consider kid sales at weaning versus at 90 days postweaning. Will the cost savings more than offset a loss in revenues? A partial budget format as shown below helps determine the positive and negative economic effects.

**If I Sell Kids at Weaning Instead of 90 Days Later.**

| ***Additions to Income*** | | ***Subtractions from Income*** | |
|---|---|---|---|
| **Added Receipts**<br>Kid sales at weaning weight of 15-20 lbs. | | **Added Expenses**<br>None, assuming marketing expenses are constant. | |
| **Reduced Expenses**<br>Expenses associated with feeding kids 90 more days. | | **Reduced Receipts**<br>Kid sales at heavier weights, approx. 65 lbs. | |
| ***Total Additions*** | $$$ | ***Total Subtractions*** | $$$ |
| | | ***Net Change*** of selling weaned vs. heavier kids | |

For more information, please refer to OSU F-139, "Budgets: Their Use in Farm Management".

## ***Sources of Budget Information***

To enhance their use as a decision aid, goat budgets should be based on the best information possible. And many times, that begins with the operator's own records. The sample budgets previously discussed may be tailored to fit an individual producer's operation. Their reliability as a planning tool is only as good as the quality of the data.

Other sources of information are:

1. Books on goat husbandry and industry.
2. Goat organizations.
3. Other goat producers/breeders.
4. University specialists, educational materials, and meetings.
5. Goat web sites on the Internet.

Oklahoma State University crop and livestock enterprise budgets are available via the Internet, disks, or paper copies. Front page budget summaries in Excel spreadsheet format can be found on the Internet at http://www.okstate.edu/OSU_Ag/asnr/agec/Budgets/index.htm. Spreadsheet budget summaries on diskettes are available for a fee. Paper copies with front and back page formats similar to the budgets shown in Tables 1 and 2 are also available at a fee. To request additional information or to order, contact:

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## ***Budget Limitations***

Budget projections may become incomplete or unrealistic resulting in little or no value to the producer or lender if adequate farm records are not available. It is also important to understand that 'best estimates' are influenced by production and price uncertainty. Everything doesn't always proceed just like you planned it. Identifying the potential sources of risk and reducing potential unpleasant surprises will result in fewer repayment problems in the future.

Budget preparation is also time consuming and hard work. Who has time to do budgets when work has to be done outside? Sitting down and documenting creditworthiness through budget planning can generate major dividends. Not only is it important to work hard, but to work smart.

***Summary***

Budgets, whether they are whole-farm, enterprise, or partial, are a management tool that is invaluable when evaluating the profit potential of the farming business. Although managers lack the information needed to make perfect decisions, they are forced to make decisions on the basis of information available and must accept the risk associated with that decision. Knowledge of budgeting and the ability to use them will help them make the right decision.

Two goat budgets developed at Oklahoma State University were shown to demonstrate the basic economic concepts and components of an enterprise budget. Their apparent profitability or lack thereof was not meant to mislead individuals into believing that dairy goats are always more successful than meat producing ones. They are only intended to be used as guidelines for the kinds of expected costs and returns typical with these operations. Alternatives that appear profitable for one producer may not work for another. Every goat producer's experience levels, managerial abilities, and willingness to assume risk are different. Because of these variations, each budget will need to be examined in detail to see if it is representative of his unique situation. The budgeting process is a continuous one and requires hard work. But it has become a prerequisite for survival in the goat industry.

*The proper citation for this article is:*

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# EVALUATING THE MARKET DEVELOPMENT OUTLOOK FOR GOAT MEAT

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Changes in U.S. agriculture policies take away the longstanding price supports for wool and mohair. More interest results in marketing goats for meat. The Livestock Division of the U.S. Department of Agriculture, together with state agricultural departments, has made several goat meat marketing research projects possible. One was a nation-wide study of goat meat marketing within the basic U.S. food marketing channels. The national study also included a consumer survey in four major U.S. cities. A second study evaluated goat meat ratings by a consumer taste panel at Texas A&M University.

The national study was in 15 cities among the 5 geographic regions of the U.S. Telephone interviews were made with 60 wholesalers, with 45 central or division offices of food chains, and 104 independent food stores. A total of 50 chain/franchise eating establishment headquarters were interviewed nationwide, and 199 independent eating establishments. The consumer survey included 418 households among the cities of Philadelphia, Kansas City, Houston, and San Francisco.

Goat meat is now marketed mostly in whole carcass form at 20 to 30 pounds dressed weight. It is consumed primarily by ethnic groups whose culture has included goat meat use. An added marketing challenge is to also produce goats placed in feedlots to reach a 50 to 60 pound dressed carcass size, or about double present marketing weight. That would permit marketing of primal cuts instead of the whole carcasses. It would thereby set the stage for marketing goat in more retail food stores and, to the broader spectrum of present consumers of other meats. An appreciable number of the meat wholesalers surveyed are already carrying goat meat. The same holds true for food chain stores.

Independent food stores catering to ethnic groups have goat meat. Therefore, the marketing channels are already present. Found lacking most is serving of goat in restaurants and other eating establishments. Goat meat processing is mostly by small local slaughter houses, much of it is on a custom order basis.

Of the 45 food chain division offices, 44 percent were marketing goat in selected stores . Among their total stores, 9 percent were selling goat meat. In independent food stores selling fresh meats, 26 percent sold goat. Average size carcass purchased was 30 to 35 pounds. In about half of the independent stores selling goat, it was only on a seasonal basis.

Among food chain division offices, 80 percent were buying whole carcasses. The preference instead of half of them was to buy primal. Independent stores had about a third instead wanting to buy parts. Most food chains were inclined to buy direct from packers or local slaughter plants, but also used

meat wholesalers. Independents relied more on wholesalers. Among food chains only 4 percent would like to buy it frozen versus 23 percent among the independent stores with meat markets. Attitudes toward expanding goat meat marketing were generally positive, if a supportive meat supply and marketing programs were provided.

The consumer survey found about 15 to 20 percent said they had eaten goat meat. Consumers in Houston and San Francisco were more likely to have eaten goat meat than those in Kansas City or Philadelphia. That likely reflects more of a Hispanic influence in Houston and San Francisco. Liking of goat meat can be influenced by how it is cooked. The average proportion liking goat meat, if they had eaten it, varied from about a third in Kansas City and San Francisco to 64 and 78 percent respectively in Philadelphia and Houston.

Expanding the marketing of goat meat depends upon developing a better vertically integrated production and marketing program. Use of feedlots, higher volume packing houses and direct liaison with food chains would be a start. Consumers, according to the survey, have the cooking equipment to prepare goat meat, but need to know how to cook and serve it. In-store demonstrations are needed and recipes should be made available to shoppers.

Further consumer taste panel tests are needed to identify the most appealing dishes, and meat seasoning procedures. According to the consumer panels, no major rating differences were recognized in blind taste tests among the following combinations: Boer/Angora, Boer/Spanish, Spanish/Angora, the Spanish or the Angora breeds. This was a stringent test because no seasoning whatsoever was used on the meat. Both baked and broiled cooking methods were employed. Ground goat meat from the carcass shoulder was tested at 1,00 percent goat and 25 and 45 percent beef mixtures. Favorable ratings were given.

If goat meat were placed on more stores where there is potential interest, the minimum requirement would likely be to triple the number of carcasses marketed per year. This, of course, depends on good market development to fit consumer interests.

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# GOAT DHIA LAB TRAINING

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Langston Goat DHIA (Dairy Herd Improvement Association) Workshops are open to all interested parties. We have trained producers and any potential testers invited by the producer. The course covers National DHIA and ADGA rules, how to fill out the paperwork, the costs involved in testing, and a short quiz to certify the testers.

There are several testing plan options available to goat producers interested in the DHIA program. The plans listed below are approved by ADGA and National DHIA.

| | |
|---|---|
| *Standard Test* | The tester would sample and record milk weights at two consecutive milkings. |
| *AM/PM Test* | The herd owner records the milk weight at the first milking. At the second milking, the tester would sample and record the milk weights. If the tester feels that there is a large discrepancy in the weights, they may test the next milking. |
| *Every Other Month Test* | The tester would sample and record milk weights at two consecutive milkings the first month. The second month, the herd owner records milk weights and send the paperwork to the lab. The third month, the cycle starts over with the tester. |

The AM/PM and the Every Other Month tests are considered Innovative Test Plans. Under ADGA rules, these test plans are subject to a verification test. All other plans are available to the goat producer under the DHIR program. Also, it is required that scales be certified yearly.

## GOAT DHIA LABORATORY TERMINOLOGY

**Abnormal Records**. In case of severe sickness, injury or if a cow or doe is in estrus on test day, production may be considered abnormal.

**Abortion**. Premature expulsion of the fetus from the uterus.

**ADGA**. American Dairy Goat Association serves as the goat registry for dairy breeds.

**Age and Month-of-Calving Factors**. Factors used to eliminate the environmental effects of different

ages and months of the year at calving or kidding. These factors standardize lactation records for genetic evaluations.

**Age at Last Calving**. Age determined by subtracting the cow's or doe's birth date from her most recent calving or kidding date.

**Agricultural Research Service (ARS)**. The research branch of the U.S. Department of Agriculture.

**AGS**. American Goat Society serves as a registry for goats not recognized by ADGA.

**Animal Improvement Programs Laboratory (MPL)**. A U.S. Department of Agriculture research service computing laboratory that calculates genetic evaluations of cows or does and sires using data collected through the DHI system.

**AP**. AM/PM. Abbreviations commonly used to describe alternate morning/evening monthly types of testing plans. Milk weights and samples are collected at the morning milking for 1 month and at the evening milking the following month. Accurate milking times for all milkings are necessary to correctly calculate herd records. AP programs are available for official and unofficial testing plans; however, approved monitoring devices to record milking times are required for official records.

**Approved Meters and Weighing and Sampling Devices**. Mechanical or mechanical-electronic devices that record milk weights when milking with a pipeline milking system. The device must obtain accurately a representative sample for milk component testing. These devices may be portable or fixed in place on the farm and must meet accuracy levels as indicated in Appendix to Official DHI Rules #1 a, b and c.

**Babcock Test**. Traditional method of measuring the butterfat content of milk, which may he used for calibrating modern electronic testing devices.

**Balanced Ration**. A ration containing all the dietary requirements to meet the purpose for which it is being fed.

**Barnsheet**. The prelisted sheet used in the DHI system for collection and input of DHI data and information at the farm.

**BASIC**. A simplified, inexpensive testing plan to provide basic management information to dairy farmers. Since basic plans involve owner sampling and recording, Official DHI Rules need not he followed.

**Bovine Growth Hormone**. (See Somatotropin.)

**Breeding Value**. The genetic merit of an animal for a certain trait. (May also be expressed as twice the animal's transmitting ability.)

**Bronopol**. A noncorrosive milk preservative in tablet or granular form (2-Bromo-2-Nitro propane-1,3 diol).

**Calf's Sire Identity** - the sire that brought the dam into milk.

**California Mastitis Test (CMT)**. A mastitis screening test useful for determining the somatic cell content in milk. A reagent is required to react with nuclear material of cells present in milk to form a gel. (This is a cow side test and requires a subjective score based on the amount of gel formed when the milk is mixed with the reagent.)

**Casein**. One of a group of several phosphoproteins that comprise the principal proteins in milk.

**Classification**. A conformation appraisal program offered by a breed association to evaluate each animal's resemblance to the breed's ideal. A numerical score is assigned each animal.

**Component Sampling (CS)**. Milk samples collected for component testing. The DHI testing plan (APCS) indicates milk samples are collected in the morning for 1 month and in the evening the following month. Milk weights are collected at all milkings in the APCS testing plans and APCS programs are available for official and unofficial testing plans.

**Composite Herd Average**. In large herds, or herds with multiple units of cows or does, composite herd averages are calculated for the total (or composite) of the individual units.

**Concentrates**. Feeds low in fiber and high in total digestible nutrients and energy.

**Conception**. Fertilization of the ovum.

**Conception Rate**. Total number of conceptions obtained divided by total number of services.

**Confidence Range** (CR). Indicates the accuracy in the estimation of a sire's genetic merit in a sire proof by giving a probable range for future summaries.

**Contemporaries**. Cows or does of the same breed that were born and raised, and initiated their lactations during similar periods. Usually separated into two lactation groups for comparison-first lactation and all other lactations.

**Contemporary Comparison**. Method for estimating the transmitting ability of bulls or bucks and cows or does using information on contemporaries.

**Cooperative Extension Service (CES)**. The state, university and county educational outreach service of each state land-grant institution. This service extends the research results and educational programs of land-grant institutions to all the people in the state. CES is a cooperating member serving the educational function of National Cooperative Dairy Herd Improvement Program (NCDHIP).

**Cow Index (CI)**. A measure of a cow's genetic merit for a given trait by estimating her transmitting ability.

**Culling**. The removal of cows or does from a herd as a result of low production or other factors that reduce the profitability of the cow or doe.

**Dairy Herd Improvement (Dm)**. DRPC Code 00. Official DHI type of testing plan that requires supervision and compliance with all Official DHI Rules (DHI abbreviation is used commonly to designate the testing plans).

**DHI Records**. Generic term used to classify any records computed by the Dairy Record Processing Centers.

**DHI Supervisor**. An officially trained and DHIA-certified employee qualified to collect milk samples and record milk weights for all official types of testing plans.

**Dairy Herd Improvement Association (DHIA)**. The title given to local, regional, state or national dairy collecting and record keeping cooperatives and organizations.

**Dairy Herd Improvement Registry (DHIR)**. DRPC Code 20. Abbreviation used to designate Official DHIR type of testing plan for registered cows or does. Record supervision and verification are required in compliance with Official DHI and DHIR Rules.

**Dairy Records Processing Center (DBPC)**. A computing facility where information from the periodic tests in NCDHIP herds is summarized and analyzed and where information to he used in future management decisions is prepared for the dairy producer.

**Dairy Cattle Breed**. Group of dairy cattle having a common origin and identifiable traits (frequently color). The major U.S. breeds are Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey and Milking Shorthorn.

**Dairy Cow**. A bovine from which milk production is intended for use or sale for human consumption, or is kept for raising replacement dairy heifers.

**Dairy Goat Breed**. Group of dairy goats having a common origin and identifiable traits (frequently color). The major U.S. breeds are Alpine, La Mancha, Nubian, Oberhasli, Saanen, and Toggenberg.

**Dairy Goat**. Any goat from which milk production is intended for use or sale for human consumption, or is kept for raising replacement dairy kids.

**Dam**. The female parent of any dairy animal.

**Daughter-Herdmate Comparison**. Amount by which a daughter of a bull or buck differs in yield or other traits from the average of cows or does of other bulls' or bucks' daughters of the same breed in the same herd during the same period.

**Days in Milk**. The number of days during the present lactation that the cow or doe has been milking, beginning with the last date of calving or kidding to the current test date.

**Direct Microscopic Somatic Cell Count (DMSCC)**. Microscopic count of the actual number of somatic cells in milk. (This system is used to check and verify electronic cell count machines used in DHI laboratories.)

**Disallowed Practices**. Certain procedures or practices that may impair or attempt to impair the reliability of any Official DHI record.

**Doe**. A female dairy goat.

**Doe Index (DI)**. A measure of a doe's genetic merit for a given trait by estimating her transmitting ability. (See Cow Index (CI) on DHI paperwork)

**Donor Dams**. Genetically superior cows or does from which embryos are collected and transferred to recipients to allow these cows or does to produce a greater number of off-spring than possible in a normal reproduction scheme.

**Dry Cow/Doe**. Any cow/doe that has calved/kidded once and is not producing milk.

**Dry Date**. First calendar day the cow or doe is not milked (See Dry Period).

**Dry Doe**. Any doe that has calved once and is not producing milk.

**Dry Period**. Period of non-lactation following a period of lactation. This non-lactating time is generally a 5-to 6-week rest period before freshening.

**Eartag**. A tag that generally is attached to the ear of a dairy cow or doe for easy and accurate identification.

**Embryo Recipient**. Any cow or doe or heifer that serves as a surrogate mother and carries the embryo of another cow or doe throughout the development of the embryo and birth of the calf or kid.

**Embryo Transfer**. Modern technology that allows dairy animals to he superovulated and bred. The eggs (ova) are flushed from the donor's uterus, and the fertilized ova are transferred to a recipient that serves as a surrogate mother. The fertilized ova may he frozen and stored indefinitely before they are thawed and transferred to recipients. DHI programs and rules assist dairy farmers in

using this new technology.

**Estimated Producing Ability (EPA)**. An estimation of the amount of milk and/or components that a cow or doe will yield above or below herd mates based on the cow's or doe's pedigree information and performance, if available. (Also called Estimated Relative Producing Ability or ERPA)

**Estimated Transmitting Ability (ETA)**. An estimation of an animal's genetic transmitting ability based on pedigree information and the animal's performance, if available. (Also called Estimated Average Transmitting Ability or EAT.)

**Estrous**. Pertaining to the entire cycle of reproductive changes in the nonpregnant female animal.

**Estrus**. Period of sexual receptivity in females. Also referred to as a heat period in dairy cattle.

**Extension Dairy Scientist**. Also referred to as Extension dairy specialist. A land-grant university or college dairy scientist with responsibilities for educational outreach programs. May be designated "for NCDHIP" if given specific DHI program responsibilities.

**Fat**. See Milk Fat.

**Filter DNA**. A mastitis screening test useful in determining somatic cells present in milk by filtering and measuring the amount of deoxyribonucleic acid (DNA) produced.

**Forage**. A crop that is high in fiber and grown especially to feed ruminant animals.

**Fraudulent Practices**. Any practice a herd owner or his or her agent may use that impairs or attempts to impair the reliability of any official DHI record.

**Freemartin**. A sterile heifer born twin with a bull.

**Freeze Branding**. A method of identification to aid in easily identifying dairy cattle. Most commonly, liquid nitrogen is used to lower the temperature of a branding iron to permanently lighten the hair color where applied.

**Freshen**. To give birth to a calf and simultaneously to begin a period of lactation. Also referred to as parturition.

**Generation Interval**. The average age of parents when their offspring are born.

**Genetic Appraisal**. Cows and sires are evaluated by researchers at the Animal Improvement Programs Laboratory, ARS-USDA, to determine their genetic values. Cows are appraised according to milk and component transmitting abilities and assigned cow or doe indexes. Sires are

appraised and assigned predicted differences for milk and components.

**Genetic Base**. The average genetic merit of a population (usually a breed) at a specified period, which is used as a reference point to express a genetic difference from a base population (genetic merit of cows or does and bulls).

**Genetic Merit**. The genetic value of the animal used in a breeding program. (Also see Breeding Value.)

**Genetic Trend**. Genetic change per year for a trait in the population.

**Gestation**. The period of fetal development between fertilization of the ovum and birth of the offspring.

**Grade Cattle**. An animal possessing the distinct characteristic of a particular breed but not registered with a breed association.

**Heifer**. A female dairy animal that has yet to give birth to a calf.

**Herd Average**. Average milk and component production per cow or doe for all cows or does in the herd unit for 12 months. Herd averages that are calculated include rolling herd average, lactation average and ME lactation average.

**Herd Code**. An exclusive reference number that identifies every DHI herd. The first two numbers identify the state, the next two the county or association and the final numerical series identifies the herd within a county.

**Herd Owner**. The declared owner of a herd of dairy cattle as recorded on a legal document, registration papers or other official documents.

**Herdmate Comparison**. Method of estimating genetic transmitting ability in which a cow's or doe's yield is compared to that of other cows or does in the same breed from different sires that calved in the same herd during the same season.

**Heritability**. The fraction of variation in a trait that is genetically transmissible from parent to offspring.

**Incomplete Record**. A cow's or doe's production in a lactation that is terminated early for some reason. (May be referred to as a record in progress.)

**Induced Lactation**. A lactation that is artificially initiated by the use of hormones.

**Kid**. Young goat (male or female) under the age of one year.

**Lactation Average**. Sometimes referred to as DHIR Lactation Average. Actual 305-day average milk and component production for all cows or does in the herd that was completed during a 12-month period. It may or may not be a calendar year. (Since dry days are not included, lactation averages usually are 8 to 15 percent higher than rolling herd averages.)

**Lactation Record**. The total milk and components produced by a cow or doe beginning on the day of calving or kidding and ending on the day the cow or doe goes dry. For purposes of genetic comparison, 10-month (305-day) lactation records are the standard of the industry. A 306 to 365-day lactation record may be used for promotion. Lactation records greater than 365 days will not be published.

**Lactation Totals to Date**. The production totals for milk and components through the current test date.

**Lactose**. See Milk Lactose.

**Lifetime Production Totals**. The production totals for milk and components for a cow or doe since her first calving or kidding (or first time on DHI test). Totals will include production beyond 365 days in a lactation, production credits for an abnormally initiated record and any production from prepartum milking.

**Linear Score (SCC)**. Linear scores for somatic cell counts (SCC's) convert SCC logarithmically from cells per milliliter to a linear score from 0 to 9. The linear score has a straight line, inverse relationship with milk yield. An increase of one in the linear score is associated with a 400-pound decrease in lactation milk yield or a 1.5-pound drop in daily yield.

**Long Test Interval**. Routinely, tests are conducted each 15 to 45 days, or approximately one each month. An emergency or supervisor vacation schedules may extend the interval beyond 45 days. For herds on official plans, reasons for a long test interval (46 to 75 days) must be reported on the Barnsheet by the supervisor. Official status of the record is lost if the interval exceeds 75 days.

**Mature Equivalent (ME)**. Standardization of lactation records to the level of yield that would have been attained by each cow or doe if she had been a mature cow or doe and calved in the month of highest calving or kidding frequency for her breed.

**Mature Equivalent (ME) Lactation Average**. ME average milk and component production per cow or doe for all cows or does in the herd for the previous 365 days. ME lactation averages are updated with each new test. Since ME represents an estimate of mature production an ME lactation average usually is 5 to 10 percent higher than the rolling herd average.

**Mastitis**. Inflammation of the mammary gland.

**Memorandum of Understanding**. The formal agreement between National DHIA, Inc., the Cooperative Extension in each state, ARS-USDA, ES-USDA and the Extension Committee on Organization and Policy (ECOP) for cooperatively carrying out the programs and policies of the National Cooperative Dairy Herd Improvement Program.

**Microcomputer**. A small and powerful, yet inexpensive, computer that can be used on the farm to keep financial, herd management and other types of records. Microcomputers also can communicate with other computers.

**Milk Composition**. Average composition of dairy cow or doe milk includes the following constituents: 87 percent water, 3.5 percent protein (casein), 5 percent sugar (lactose), 3.7 percent fat and 0.8 percent minerals and vitamins.

**Milk Fat**. A complex mixture of triglycerides containing numerous fatty acids. Milk fat is one of the components of milk, which provides the basis for differential pricing of milk. DHI laboratories use electronic photometry and infrared absorption for rapid milk fat tests. Milk fat also is referred to as butterfat or fat.

**Milk Lactose**. Average milk contains just under 5 percent lactose. Lactose is the sugar in milk. It is converted to lactic acid in sour milk and is used in the production of various cheeses and buttermilk. Little variation in lactose content exists among cows or does or breeds.

**Milk Only (MO) Record**. Type of testing plan where only milk weights are recorded and no milk samples are collected for component sampling. This plan is intended for management use only. The records made are not official and DHI Rules need not be followed.

**Milk Preservative**. A compound used to stabilize and to prevent decomposition of milk samples sent to DHI laboratories for component analysis.

**Milk Protein**. A complex chemical substance contained in milk, which upon hydrolysis breaks down to amino acids. Milk proteins are an excellent source of the necessary amino acids and are economically important because they increase cheese yield and enhance milk flavor. DHI laboratories test for total proteins with electronic, high-speed, automated equipment.

**Milk Solids-Not-Fat (SNF)**. The solids portion of the milk minus the fat component represents about 8.5 to 9.2 percent of the total milk solids. SNF is of interest because of renewed use of component pricing for milk. (Also called PLM for protein, lactose and minerals.)

**Modified Contemporary Comparison (MCC)**. A calculation procedure adopted by USDA in 1974 to provide accurate sire summaries and cow or doe indexes.

**National Association of Animal Breeders (NAAB)**. The national organization made up of representatives from the artificial insemination (M) industry. NAAB, which is administered by an

executive vice president and elected officers, is headquartered in Columbia, Missouri.

**NAAB Stud Code**. An identification number composed of a one- or two-digit prefix indicating the AI stud and a letter indicating the breed of bull or buck. The remaining numbers identify the bull or buck within a stud.

**National Cooperative Dairy Herd Improvement Programs (NCDHIP)**. The national, industry-wide cooperative framework within which all DHI-related activities function.

**NCDHIP Policy Board**. The 12-member governing body for NCDHIP.

**NDIAA, Inc**. The national DHI organization, made up of member state DHI organizations and administered by an executive secretary and an elected board of directors. The office is located in Columbus, Ohio.

**Owner-sampler (0S)**. *DRPC Code 40*. This type of testing plan allows dairy farmers to weigh and sample milk from their cows or does. Records are intended for management use only and are not official.

**Official**. The status given to DHI records that follow the Official DHI Rules. Data collection is supervised and the dairy herd is subject to verification tests. Official records may be published for advertising and promotional purposes.

**Official DHI**. Used synonymously with DHI (see DHl).

**Official DHI**. Rules. Basic and minimum standards to be followed uniformly and enforced in Official DHI and Official DHIR herds throughout the United States, ensuring accuracy, uniformity and integrity.

**Oxytocin**. A naturally secreted hormone that is important in milk letdown and the contraction of smooth uterine muscles during parturition.

**Parturition**. The process of giving birth. Permanent Identification. Identification that stays with the animal for its lifetime and cannot be lost. Examples are tattoo, color markings (sketch or photo) and hot or freeze brand. (Also see Unique Identification.)

**Potassium Dichromate**. A milk preservative in tablet or granular form. A DHI milk sample contains 41 milligrams or less of potassium dichromate. (See Milk Preservative.)

**Predicted Difference (PD)**. Estimate of the genetic transmitting ability of dairy bulls or bucks for performance traits in the United States. PD is defined as the amount by which daughters of a bull or buck will, on the average, differ in performance from the average breed performance in the genetic base period.

**Predicted Difference Dollars (PD$)**. A selection index value that combines the predicted differences for milk and components weighted by their gross economic value.

**Preliminary Milking**. The first milking of a three-milking verification test for herds milked twice daily. The purpose of the preliminary milking is to ensure complete milk out and to establish a 24-hour milking interval.

**Premature Calving**. Termination of pregnancy during the last trimester.

**Preservatives**. See Milk Preservatives.

**Production and Type Index (PTI)**. Combines PD$ and PD Type (PDT) on a 3 to 1 ratio thus ranking sires on their ability to transmit a balance of these traits. The index is used on Aryshire, Brown Swiss, Guernsey and Jersey breeds.

**Production Report**. The computer report of production and management data which is returned to the dairy producer 5 to 7 days following the test day and after component sampling is completed at the laboratory. The records are processed at one of the DRPC's.

**Progeny Test**. An evaluation of the transmitting ability of an individual based on the performance of offspring.

**Projected 305-Day Lactation**. A method of predicting a cow's or doe's total yield in 305 days based on the information from a lactation in progress.

**Protein**. See Milk Protein.

**Purebred**. An animal with two registered parents of the same breed.

**Purebred Dairy Cattle Association (PDCA)**. An organization made up of members of the six purebred dairy cattle registry associations: Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey and Milking Shorthorn. PDCA is administered by an executive secretary and elected officers and is a cooperating member of NCDHIP.

**Quality Calification Standards (QCS)**. A set of national standards that must be met and maintained by state DHI organizations to assure the accuracy, uniformity and integrity of NCDHIP.

**Record (2X, 305-day, ME)**. Estimates how much the cow or doe would have produced during the present lactation when milked twice daily in the first 305 days of her lactation if she had been a mature cow or doe calving in an average month.

**Recording**. Procedure used by DHI supervisor or dairy producer to record milk and test-day data on a record sheet or Barnsheet.

**Record in Progress (RIP)**. A cow's or doe's production from her calving or kidding date until the most recent test day.

**Record Plan**. Specific DHI program that provides a particular service to dairy farmers. The plans are either official or unofficial according to rules of the program.

**Registered**. An animal that is recorded in the Breed Registry Herdbook.

**Registration Certificate**. Proof that the parentage of an animal is known and is recorded in the Breed Registry Herdbook.

**Repeatability**. The degree of confidence or reliability of the predicted difference (PD) or cow or doe index (CI or DI) for milk, fat, fat percentage, protein or physical type score.

**Representative Sample**. A sample of milk obtained by thoroughly mixing or agitating the total quantity of milk produced by a cow or doe. Milk meters are designed to collect automatically a representative sample from the total quantity of milk.

**Retest**. Herd owners who question the results of a regular test may request a retest of the herd not later than 15 days following the original test day. Expenses of most retests are paid by the herd owner.

**Rolling Herd Average (RIlA).** Actual average milk and component production per cow or doe for all cows or does in the herd for the immediate past 365 days. RHA's are updated with each new test.

**Roughage**. A feed that is high in fiber content and relatively low in rate of digestion. (Also see Forage.)

**Rule Violation**. Dairy producers, their employees or DHIA supervisors who, for any reason, fail to follow the Official DHI/DHIR Rules or fail to report infractions of the rules, may be found in violation of those rules and be disciplined or dismissed according to the decision of the local or state DHI board of directors.

**Scale**. Mechanical device to record milk weights to the nearest one-tenth of a pound. Scales usually are limited to 60 pounds per weighing and must have the ability to compensate for pail weight.

**Selection Intensity**. The margin of true genetic superiority of those animals selected in comparison to all those from which the choices were made.

**Service Sire**. The sire to which a female currently is bred. Service sire information should be reported on DHI barnsheets.

**Sire**. The male parent.

**Sire Selection**. Process of identifying bulls or bucks to be used as service sires with the goal of increasing the genetic potential of the herd.

**Software**. A precise set of instructions, written in computer language, that is needed to make computers function.

**Solids-Not-Fat**. See Milk Solids-Not-Fat.

**Somatic Cell Count**. A measurement of the number of somatic cells present in a sample of milk. A high concentration of more than 500,000 somatic cells per milliliter of milk indicates an abnormal condition in the udder. (Electronic somatic cell counters are available in nearly all DHI laboratories to provide dairy farmers with an inexpensive screening test for subclinical mastitis.)

**Somatic Cells**. The cell content of milk is composed of approximately 75 percent leukocytes (white blood cells) from the blood and 25 percent epithelial cells from the secretory tissue of the udder. Leukocytes are present in response to infection or injury, and epithelial cells are present as a result of infection or injury. Collectively, these cells are called somatic cells.

**Somatotropin**. A protein hormone produced by the pituitary gland, which stimulates growth of muscle, bone and mammary development in young animals and increases milk production in lactating animals by making available nutrients for milk synthesis and secretion.

**Stage of Lactation**. Period of milk production during a lactation determined by the length of time since parturition.

**Tattoo**. A method of permanent identification to be cross-referenced with visible identification. Permanent ink used with tattoo numbers creates a lifetime record of identification in the ears of dairy cattle. Tattoos are used primarily in the Jersey and Brown Swiss breeds.

**Test**. The process of collecting milk samples and recording milk weights. Sometimes called test day".

**Test Interval**. The interval, in days, between successive DHI tests. As a routine procedure, a test interval shall not consist of less than 15, or more than 45 days. For Official DHI/DHIR records, the test interval shall not exceed 75 days.

**Time Recording Device/Monitor**. A mechanical/electronic device that automatically monitors the interval between milkings. The time is expressed in hours plus minutes, and the device must display the starting and ending time of the previous milking.

**Times Milked**. Cows or does are normally milked twice per day with records being labeled 2x;

however, cows or does may be milked more frequently (3x, 4x, etc.).

**Total Performance Index (TPI)**. Method of ranking Holstein sires based on an index combining PD milk, PD percentage and PD type.

**Transfer**. Process when ownership of a registered animal is changed and recorded in the Breed Registry Office or when ownership of a Verified Identification Program animal changes. When the ownership of the animal changes, the production credits must be transferred. This procedure is done by the DRPC with the assistance of the dairy producer and the DHI supervisor.

**Unified Series Eartag**. A form of unique identification engraved in a metal tag and fixed to the ear of a dairy cow or doe. Each number is unique with the first two numbers representing the state code, followed by three letters and four numbers.

**Unique Identification**. A series of non-duplicating numbers such as a registration, uniform series eartag or VIP number. These numbers are cross-referenced with permanent identification for registered, VIP and other recorded nonregistered animals. (Also see Visible Identification.)

**U.S. Department of Agriculture (USDA)**. The branch of the Federal government that is administered by the Secretary of Agriculture appointed by the President of the United States.

**Verification Test**. A special test conducted on Official DHI/DHIR herds to verify production records of cows or does and herds or for investigation of rule violations. A supervised preliminary milking prior to the verification test is required to determine a 24-hour milking interval. (Tests may be ordered by breed organizations, state DHI boards of directors, state DHI managers and/or the Extension dairy specialist for NCDHIP.)

**Verified Identification Program (VIP)**. A program sponsored by the National DHIA, Inc., in which a DHIA supervisor verifies the required identification information for an animal. NDHIA issues an identification certificate, permanently identifying the animal and its parentage.

**Visible Identification**. A readily visible, numbering system attached to the animal that is used to identify the animal easily on test day.

**Weighing**. Procedure used by supervisors and dairy producers to determine the amount of milk given by a cow or doe on test day.

*The proper citation for this article is:*

*Brown-Crowder, I. 1998. Goat DHI Lab Training. Pages 60-73 in Proc. 13th Ann. Goat Field Day, Langston University, Langston, OK.*

# THE SHOW RING

Dr. Irene Brown-Crowder
Langston University

Goat shows provide an opportunity to the exhibitor/owner to learn how to select top show animals. There are other benefits involved in showing goats; prize money to help with the feed bill, interaction with other goat producers that have a common interest and the relationship an exhibitor develops with their goat. In order to understand how to show your dairy goat, follow the simple instructions below.

Listen for the class to be announced. Bring your animals to ring side immediately and get checked in to avoid delay of the show. When it comes time to enter the show ring make sure you have your animals under control and looking good as many judges watch the exhibitors and their animals as they enter the show ring. You should walk on the left side of your animal, holding the neck chain in your right hand. Watch the judge and pay attention to what he or she is saying. Do not talk to the judge unless you are asked a question.

When you enter the ring, walk in a clockwise direction. Make sure to keep your animal between you and the judge at all times. Figure #1 shows you how to cross in front of your animal when the judge is in the ring. This will keep your animal in front of the judge as you walk by them. When the judge calls for you to stop walking, make sure you leave enough room for the judge to walk between the animals.

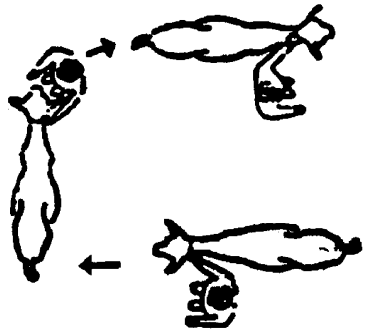

***Figure 1***

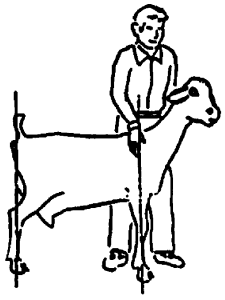

***Figure 2***

Figure #2 shows the correct way an animal should be positioned. Place the front legs squarely under the animal and spread slightly.

To position the legs, grasp each one above the knee and place the leg in the correct position. Always set the legs nearest the judge first (Figure 3).

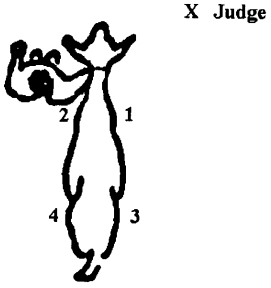


***Figure 3***

Stretch the hind legs slightly, this will help to accentuate body length and level the rump if needed.

If your animal moves out of position or the judge asks you to change places, lead your animal forward out of the line, then back through the line following steps describe the making a circle and return to judge's position in the show the indicated position. When performing this maneuver, make sure you give the animal plenty of turning room (Figure 4).

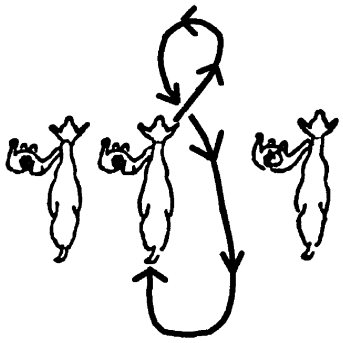

***Figure 4***

Position your animal in the lineup will depend on the position of the judge. These following steps describe the judge's position in the show ring. If the judge is positioned in front of the animals, move the animal out of line and walk toward the judge. Place the animals in the position indicated by the judge and set the animal up (Figure 5).

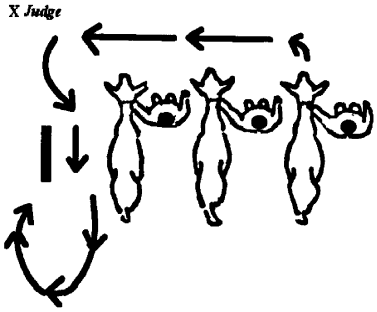


***Figure 5***

If the judge is positioned behind the line of animals, move the animal out of place and circle toward the front of the line. Place the animal in the position indicated by the judge and set the animal up (Figure 6).

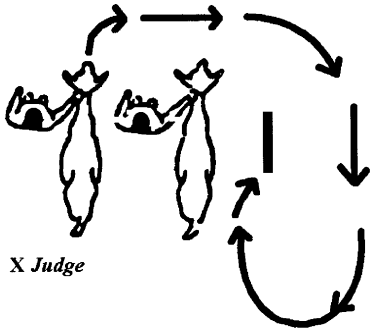


***Figure 6***

If animals are lined up in a head to tail fashion and there is a change in the position by the judge, the number 1 animal is led out of the line and the number 2 animal would move up. The number 1 animal moves into the new position (Figure 7).

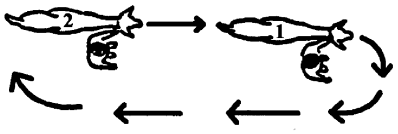


***Figure 7***

The number 1 animal follows the number 2 animal and circle one behind the other clockwise through the line and back to the requested position.

If animals are side by side and there is a change in position by the judge, both animals are led forward and turn right (Figure 8).

If the judge wants to compare two animals (Figure 9a) side by side, the butterfly pattern is used. A. Shows the animals walking away from the judge. B. Shows the turning of the

animals, C. Shows the return of the animals toward the judge, D. Shows the turning of the animals, E. Shows the turning of the animals away from the judge, F. Shows the return of the animals to the original position in the line

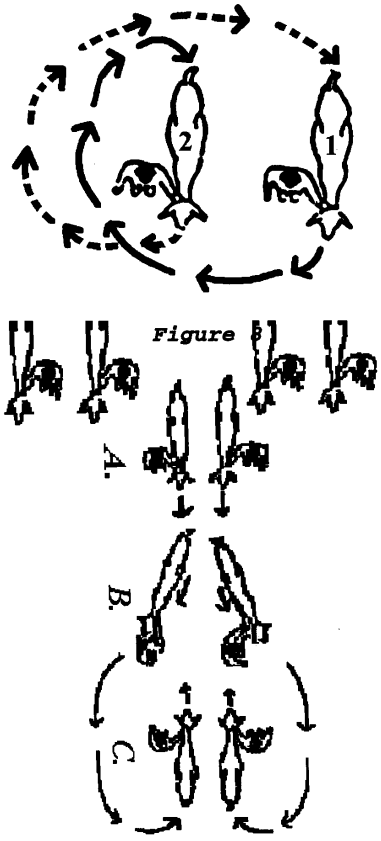


Figure 9

(Figure 9b).

When the judge wishes to check the animal, more control over your animal can be achieved by raising the front leg opposite from you (Figure 10).

Some judges will watch the animals on the move therefore, you have a chance to cover up some faults when you set up your animal. If the animal is a little steep in the rump, stretch the hind legs as you set up. It will also help to pinch the third vertebrae in front of the hip bones. If the animal has a sway in the back

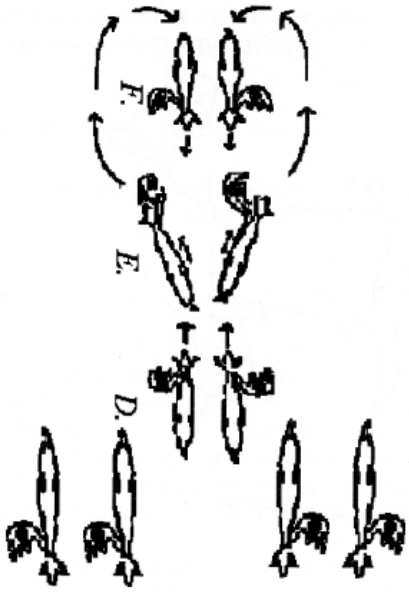


Figure 9b

move the hind legs up and under the body and hold the animal's head lower to cover up this fault. If you want to strengthen the topline, tickle the tummy.

After the judge places the animals, he or she will give the reasons of the placing. If you have any questions about the placing, ask the judge before leaving the show ring.

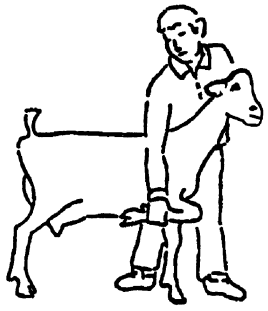

Figure 10

*The proper citation for this article is:*

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# THE EFFECT OF AGE AND SEX ON PRODUCTION AND CARCASS CHARACTERISTICS OF GROWING SPANISH X BOER KIDS

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## Introduction

The improved Boer goat of South Africa has a large mature size and high growth rate. These two qualities have made the Boer goat very attractive to American meat goat producers as a means of improving existing goat herds and overall production. Little information exists regarding the performance and nutritional management of the Boer goat in the U.S. However, to achieve its growth potential, the Boer goat may require more intensive management than that currently practiced in the U.S. Utilizing the popular Spanish cross, the authors investigated the effect of both age and sex on growth rate, feed efficiency, and carcass quality of Spanish x Boer kids under intense management (i.e., feedlot conditions).

## Procedures

Sixty Spanish x Boer kids (20 intact males, castrates, and females) were used. Kids were raised on pasture with their dams until being weaned at 10 wk of age. Kids were then slowly adapted to a high concentrate diet over a period of 3 wk. Kids were then placed in individual pens. Kids consumed ad libitum a corn-soybean meal-based concentrate (80% TDN, 18% protein, and 12% ADF). Feed intakes were recorded daily. Kids were weighed every 2 wks. Twelve kids (four per sex) were slaughtered at 13, 21, 29, 36, and 45 wk of age.

## Results

*Table 1. Production characteristics of growing Spanish x Boer kids.*

| Item | Age at Slaughter (wk) | | | | |
|---|---|---|---|---|---|
| | 13 | 21 | 29 | 36 | 45 |
| Weight, lb | | | | | |
| *Intact males* | 37 | 52 | 71 | 95 | 112 |
| *Females* | 33 | 43 | 52 | 71 | 79 |
| *Castrates* | 37 | 52 | 59 | 90 | 98 |
| Feed intake, lb/d | | | | | |
| *Intact males* | --- | 1.2 | 1.5 | 2.0 | 2.2 |
| *Females* | --- | .9 | 1.2 | 1.4 | 1.6 |
| *Castrates* | --- | 1.3 | 1.4 | 2.0 | 2.0 |
| Average daily gain, lb/d | | | | | |
| *Intact males* | ---- | 0.26 | 0.31 | 0.34 | 0.35 |
| *Females* | ---- | 0.18 | 0.17 | 0.24 | 0.21 |
| *Castrates* | ---- | 0.29 | 0.17 | 0.33 | 0.27 |
| Feed:Gain | | | | | |
| *Intact males* | ---- | 4.3 | 4.7 | 4.9 | 5.4 |
| *Females* | ---- | 5.5 | 6.5 | 5.6 | 6.1 |
| *Castrates* | ---- | 4.6 | 7.8 | 5.1 | 6.2 |

*Table 2. Carcass characteristics of growing Spanish x Boer kids.*

| Item | Age at Slaughter (wk) | | | | |
|---|---|---|---|---|---|
| | 13 | 21 | 29 | 36 | 45 |
| Carcass weight, lb | | | | | |
| *Intact males* | 15 | 25 | 35 | 47 | 55 |
| *Females* | 15 | 21 | 26 | 37 | 43 |
| *Castrates* | 15 | 26 | 30 | 48 | 51 |
| Dressing percentage, % | | | | | |
| *Intact males* | 41 | 48 | 49 | 50 | 50 |
| *Females* | 43 | 48 | 50 | 52 | 52 |
| *Castrates* | 41 | 50 | 50 | 52 | 51 |
| Carcass lean, % | | | | | |
| *Intact males* | 39 | 49 | 47 | 48 | 48 |
| *Females* | 46 | 48 | 46 | 47 | 48 |
| *Castrates* | 45 | 48 | 46 | 48 | 48 |
| Carcass fat, % | | | | | |
| *Intact males* | 19 | 26 | 27 | 28 | 28 |
| *Females* | 24 | 23 | 24 | 24 | 27 |
| *Castrates* | 20 | 23 | 25 | 27 | 25 |
| Internal fat, lb | | | | | |
| *Intact males* | 0.7 | 2.2 | 3.6 | 5.3 | 7.9 |
| *Females* | 0.9 | 2.0 | 3.5 | 5.1 | 9.2 |
| *Castrates* | 0.7 | 2.9 | 3.5 | 7.7 | 9.7 |

## Discussion

In terms of performance, intact males had greater body weight gain and feed intake. Male kids were also the most efficient in converting feed to body mass. Therefore, it is more economical to market intact males than castrates, especially at younger ages when buck taint of the meat is not a factor. The Spanish x Boer kids also exhibited feed:gain ratios comparable to those of lambs and steers. Spanish x Boer kids dressed out slightly less than lambs but, contrary to popular belief, showed significant amounts of carcass fat. The predominance of internal fat gains at younger ages is reflected by inefficient gain during this period; restricting feed intake or feeding less grain during the early stages of growth may be more economical. The optimum levels of both feed intake and diet composition for the various stages of growth in Boer crossbreds needs to be determined. The ability to lay down appreciable quantities of carcass fat means that goats are capable of marbling and that it may be possible to use nutrition to enhance both quality, palatibility, and flavor of goat meat; more research is needed in this area.

*The proper citation for this article is:*

*Cameron, M, T. Sahlu, C. Gilchrist, S. Hart, and S. Coleman. 1998. The Effect of Age and Sex on Production and Carcass Characteristics of Growing Spanish x Boer Kids. Pages 79-82 in Proc. 13th Ann. Goat Field Day, Langston University, Langston, OK.*

# GENERAL CARE OF GOATS

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## Introduction

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

## Pre-Parturition

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

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

## Parturition

The doe should kid in a clean environment, either a well-rotated pasture or stall bedded with straw or other absorbent material. The kid prior to birth has been existing in a germ-free environment and parturition represents exposure to common disease organisms to which the mature animal has developed resistance. The location of the kidding stall or pasture should be near a well-traveled area

so that the doe can be frequently observed for kidding difficulties. Few adult does require assistance at the time of kidding though problems are always a possibility. First-freshening does should be closely watched, especially if bred to bucks known to sire large kids.

## Kid Management

At birth, two management practices are critical to the future health and survival of the newborn kid. The navel cord should be dipped in a solution of tincture of iodine to prevent entry of disease-causing organisms through the navel cord and directly into the body of the kid. If necessary, a long navel cord can be cut to 3 or 4 inches in length. A bleeding cord should be tied with surgical suture material. Dipping of the cord in iodine not only prevents entry of organisms but promotes rapid drying and the eventual breaking away of the cord from the navel.

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

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

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

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

Kids will nibble at fine-stemmed leafy hay at one or two weeks of age. At three to four weeks a calf starter should be offered. As the hay and grain consumption increases, gradually reduce the milk being fed. When the kid is eating 1/4 pound of grain per day plus some hay and is drinking water from a bucket, it is time for weaning.

**Birth to Weaning**

Milk is the principal component of the diet of the pre-weaning kid. There are numerous ways to feed milk including the use of bottles or pails, suckling the dam or nurse does, and self-feeder units. The method chosen will depend upon such factors as the size of the herd and available labor, as well as personnel preference. With any system, the health of the kid, sanitation, and available labor are the major factors to consider. Under natural suckling, kids consume small amounts of milk at very frequent intervals. Ideally, artificial rearing should mimic natural suckling but the constraint of available labor precludes frequent feeding. Nevertheless, kids should be fed 2 to 4 times daily for the first week or two and twice daily thereafter. Bottle feeding is more labor intensive but kids receive more individual attention and are easier to handle post-weaning than kids that are allowed to suckle does. Pail or pan feeding may reduce labor somewhat but body weight loss and need for extra "training sessions" at the beginning must be expected.

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

In raising dairy goat kids, increase in size and weight is not the only measurement of success. A well-formed skeleton and proper development of internal organs are often neglected when the emphasis is on rapid gains. An average daily gain of 250 g during the first weeks of life should be the goal. By limiting daily milk consumption to about 2 quarts, daily consumption of dry feed will be encouraged. Dry feed consumption is important in developing body capacity. By increasing body capacity, feed intake and digestion increase. Research has shown that at two months of age a weaned kid has a reticulo-ruminal capacity 5 times as large as suckling kids of the same age.

Kids should be consuming forages such as pasture grass or hay by two weeks of age and grain within four. Careful attention need 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. Through few studies with kids have been done, crude protein contents of the pre-weaning ration should be within the range of 14 to18%. Ground alfalfa may be added at 5% or less to provide additional stimulation for reticulo-ruminal development.

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

## Disbudding

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

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

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

The equipment most commonly used is an electric-heated metal rod with a hollowed-out end. None of the irons can be relied upon to maintain a constant temperature, and it is extremely important to match temperature and time. Underburning will result in scurs and overburning will lead to brain damage or death. The horn bud is located over the sinus close to the cranium in kids. After the de-horning iron is hot, apply the de-horner firmly over the horn area and rock it around slowly for 3.5 to 4 seconds. Remove the iron and repeat if necessary and do the other side. Descenting could be

done at the same time if necessary. Inject the kids with 150 IU tetanus antigen. Although he risk of tenanus after disbudding is not great, it is a good practice to do it.

## Dewattling

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

## Castration

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

Rubber ring
Burdizzo
Surgical

## Reproduction

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

## Pregnancy Diagnosis

| | | |
|---|---|---|
| 1. | Non-return to estrus | |
| 2. | Ballottement | |
| 3. | Vaginal biopsy: | > 40 days |
| 4. | Cervical palpation: | 30-50 days, soften, blunt |
| 5. | Radiographs: | 75 days |
| 6. | Rectoabdominal palpation: | Hulet rod > 70 days |
| 7. | a) Real-time: | B-mode > 25 days |
| | b) Amplitude depth: | A-mode 60 to 90 days |
| | c) Doppler: | > 30 to 40 days |
| 8. | Progesterone assay: | Post breeding at 21 days |
| 9. | Estrone Sulphate: | > 50 days - milk or urine |

## Parturition

Stage I Uterine contractions 6 cervical
Dilation. Lasts 3 to 6 hours
Stage II Abdominal contractions
1 to 3 hours
< 1 hour before the first fetus born

Stage III Placental expulsion usually within two hours after the last fetus

Signs of parturition

Udder engorgement
Vulva edema
Pelvic ligament relaxation
Udder secretion becomes colostrum
Anorexia, restlessness
Cervical mucus

Induction of parturition

Lutylase - drug of choice
20 mg given intra-muscular
Kid in 27 to 40 hours

## Common Diseases of Goats

*Caseous lymphadenitis*

Caseous lymphadenitis is otherwise called pseudotuberculosis. Lymph nodes get abscessed commonly under the jaw and ear, in front of the shoulder, flank, above the udder or scrotum and in the hock. The lymph nodes may feel warm, and may swell to 3 to 5 cm or larger. The disease is seldom fatal, unless involving a major artery or nerve around the head or internal lymph nodes. The abscesses contain a characteristic cheesy, greenish color pus. Diagnosis is based on the location of the abscess, character of the pus and culture. Transmission is through ingestion of contaminated feeds and break in the skin.

Treatment is by isolating the infected animals, surgically lancing the abscess and flushing it with 7% iodine away from the rest of the animals. Injectables like penicillin and tetracycline may be used parenterally for 3 to 5 days.

Prevention is by keeping a closed herd. Any new addition needs to be quarantined 30 to 90

days. There is a vaccine available with some success.

*Enzootic Abortion*

Enzootic late term abortion in does is caused by Chlamydia psittaci. It causes late term abortions, stillbirth, mummified fetus or weak kids. Retained placenta with uterine disease is usually associated with this disease. Chlamydia abortion can be positively diagnosed by culturing the aborted fetus or membranes and also serology may be useful.

Transmission is by ingestion, with the organism delaying growth in the doe until late in the following pregnancy. Treatment is by using tetracycline given intramuscularly for 5 to 7 days will reduce the number of abortions by reducing the spread of the organism to uninfected goats. Feeding tetracyclines at 110 to 165 g/ton or 10 to 165 mg/kg is helpful to control the disease. Isolating the aborting does, burning the aborted kids and after firth is necessary to control the disease. Prevention is by vaccination.

*Colibacillosis*

Clinical signs include watery diarrhea, rapid dehydration, severe depresion, and weakness. Diagnosis is based on clinical signs and by culture. This syndrome is seen in newborns up to two weeks of age with high mortality. The organism is taken in by mouth, usually very soon after birth. Outbreaks readily worsen unless strict sanitation procedures are begun. Lack of adequate colostrum usually contributes to colibacillosis.

Treatment is by replacing the fluid loss and parenteral antibiotics. Prevention is by good sanitation and colostral mangement. Vaccinating the does during gestation may be helpful.

*Enterotoxemia*

Clostridium perfringens type C: struck, kid dysentery
Clostridium perfringens type D: overeating disease, pulpy kidney disease

Clinical signs: star gazing, convulsions, tooth grinding, twitching and death within few hours. May or may not have blook tinged diarrhea.

Necropsy: fluid around the heart with clots (chicken fat) and blood in the lumen of the intestine. Urine will have high levels of glucose.

Predisposing factors: change in feed, increased amount of grain fed or increased consumption of milk.

Treatment: Not successful
Antitoxin

Penicillin
Charcoal

Prevention: vaccination of does or kids

*Johne's Disease*

Mycobacterium paratuberculosis

Clinical signs: loss of weight, rough haircoat, milk production decreased, depressed, off feed and diarrhea. Seen in animals 3 to 5 years old.

Diagnosis: fecal culture
serology
I/V Johnin test
lymph node biopsy

Treatment: not successful

Prevention: remove infected animals; buy health animals; avoid stress.

*Pinkeye*

Infectious kerato conjunctivitis

Clinical signs: watery eyes, rendess of the eye, swelling of the eyelids, photophobia, cloudy cornia with vascularization and ulcers.

Etiology: various bacteria
viruses
rickettsia
chlamydia

Treatment: eye ointment; long acting tetracycline

*Tetanus*

Clostridium tetani

Clincial signs: usually appear 7 to 14 days after the organisms enters the body. Initially, stiffness or hardness to localized muscle groups and later generated stiffness. Violent spasms to any squick movements or noise, flared nostrils, dilated pupils and protrusion of the third eyelid.

Treatment: unsuccessful
antitoxins
penicillin
tranquilizers

Prevention: vaccination

*Caprine Arthritis Encephalitis Syndrome*

Caused by a virus and is spread from older infected goats to kids, perhaps by contact or through the milk from an infected doe to her kid. Even though a high percentage of goats may be serologically positive, only a small percentage of goats ever show signs of the disease.

Clinical signs: young kids develop a weakness in the rear legs, stumble, and finally cannot rise. The unused legs lose muscle strength and eventurallydie. They appear bright and alert, eat well, and wre not febrile. In older goats, have one or more swollenjoints, eventually leading to an arthritic condition. After a few years, they cannot keep up with the rest of the flock while grazing, loose weight and eventually die. Some of the animals may have contracted joints and eventually walk on their knees.

Treatment: none

Prevention: serologically monitoring the herd, isolating kdis atr birth, feed them heat treated colostrum or colostrium from a CAE free flock.

*Contagious Ecthyuma or Sore Mouth*

Contagious ecthyma is caused by a virus. Kids can pick up the disease from surroundings and may spread it to their mother's udder by nursing. Recovery from the disease gives an immunity for at least one year. There is little transfer of immunity from the doe to the kid by the colostrum.

Clinical signs: Thick scabby sores that occur on the lips and gums, udders or other areas that have little hair. Lesions on udder may lead to mastitis.

Treatment: best done by making the goat feel comfortable, ointments or antiseptics on the lesions are helpful. Adults need not be vaccinated again after the disease is in the herd and all young have been vaccinated. Continual exposure to the disease will keep the adults immune or resistant to sore mouth.

This disease is contagious to man. People who work with these infected animals should wear gloves while handling these animals.

*Acidosis*

When goats overeat easily digestible feed. The pH of rumen usually drops below 5.

Clinical signs: Bloat, dehydrated, diarreha, depressed, anorexic and grinding of teeth.

Treatment: stomach tube, remove part of the watery rumen contents, mineral oil with bicarbonate. Severe dehydration need to give fluid intravenously. Rumenotomy indicated if the animal is severely depressed and down.

*Impaction*

Feeding poor quality roughage may cause ruminal impaction. Animals will not have ruminal motility and the rumen will feel hard and doughy.

Treatment: mineral oil with laxative like carmilax in it; Rumenotomy.

*Bloat or Ruminal Tympany*

This condition is always an emergency.

Clinical signs: Full left flank, pain, discomfort and rapid respiration.

Frothy bloat is usually caused by feeding on rapidly growing legumes and small grain pastures (wheat, barley, oats, rye).

Gas bloat is usually caused by high grain diet, blockage of the esophagus by a mass or foreign object.

Treatment: Relieve the gas bloat using a stomach tube or a trocar.

Frothy bloat may be relieved by pumping in mineral oil or vegetable oil, mild detergent or poloxalene.

*Milk fever*

(Parturient paresis, Hypocalcemia)

Seen in does fed high levels of calcium fed late in pregnancy.

Clinical Signs: seen within 24 hours of kidding. Animals will show a wobbly gait or with foot dragging. Later she may be down, have curved neck, hypothermic, pupils dilated and may show muscle twitching.

Treatment: I/V 25% calcium barogluconate 50 to 100 ml. Monitor the heart.

Some clinicians like to give 50 h 100 ml S/C after the I/V treatment.

Prevention: feed low calcium diet during the last month of gestation. Does having triplets or quadruplets may be prone to milk fever.

*Polioencephalomalacia*

Thiamine deficiency seen in animals on high grain ration or sudden change in management practice.

Clinical Signs: sudden loss of appetite, depression, no fever, rumen motility decreased, head pressing, aimless wandering, blindness, grinding of teeth, muscle tremors and hyperexcitable.

Treatment: Thiamine 5 to 10 mg/kg 1/M every 4-6 hours.

*Pregnancy Toxemia (Ketosis)*

Pregnancy toxemia occurs during the last few weeks of gestation. Usually seen in does carrying more than two or when the does are fat. This syndrome is caused by sudden extra demand for energy by the fast growing kids. The space available in the rumen is limited in the does carrying more than two or the ones which are fat, resulting in less intake. The does in turn breakdown the fat reserves in her body to support the increased energy demand. This rapid breakdown of body stores produces ketones.

Clinical Signs: Does with pregnancy toxemia are depressed, weak, poor muscle tone and down.

Treatment: 2 to 3 ounces of propylene glycol twice a day. I/V glucose drip. Not successful in getting them up if they are down until they deliver the kids. Caesarian section if they are close to term will sometimes save the doe and kids.

Prevention: Do not let the doe get too fat early in gestation. Feeding them good quality grains or grain by-products and a good quality hay. If she has a history of having more htan two kids, increase her energy intake.

**Vaccination Schedule for Goats**

| Period | Time to Vaccinate | Disease | Booster |
|---|---|---|---|
| Kids | 2, 4, and 8 weeks | CL perfringens C&D<br>CL tetani - toxoid | Annual |
| Kids | 4 to 6 weeks | Contagious ecythma<br>(if a herd problem) | --------- |
| Kids | 16 weeks | Rabies | Annual |
| *Prebreeding* | | | |
| Doe | 30 days prior to breeding | Chlamydia (abortions) | |
| *Gestation* | | | |
| Doe | 30 days prior to lambing | CL. perfringens C&DE<br>CL. tetani - toxoid | |

*Basic supplies*:

Iodine (7% tincture) for diping navels after they are trimmed. Empty film canisters (2/3 full) are handy to prevent spilling or contaminatign the main bottle.
Betadine® or Nolvasan®. Use to disinfect vulva of goat and hands. Squeeze bottles are handy for dispensing.

Nolvasan® solution. Use diluted to disinfect scissors and other equipment.

Obstetrical sleeves and lubricant.

Paper towels for washing off doe, and for hands.

Cloth towels to clean off newborn kids.

Clean bottle and nipple to feed colostrum.

Red rubber feeding tube (18 French), with 60 ml catheter tip syringe or funnel to feed colostrum to weak kids.

Body socks or warming box for chilled or weak kids.

*CAE prevention*:

1. Tape dam's teats securely 1 week before due date with 2-3 layers of 1 inch cloth adhesive tape. Hold the teat for 10-20 seconds after taping. This allows the heat from your hand to seal the tape.

2. Remove kids from dam immediately after they are born.

3. As soon as possible, certainly within 6 hour, begin to feed colostrum from a safe source. Give at least 10% of kid's body weight within 12 to18 hours, for example, an 8 lb kid needs 13 ounces of colostrum. To heat-treat colostrum, first preheat a regular thermos bottle with warm water. Using a double boiler, SLOWLY heat colostrum to 135ºF and pour into prewarmed thermos. Check temperature after 1 hour - it should remain at 135ºF .

4. Dip navel in iodine at birth; repeat in 12 hours.

5. Feed milk from a safe source after colostrum is consumed. To pasteurize milk, heat to 165ºF for 15 seconds.

6. House kids separately from positive does.

*Other disease preventive measures*:

Dam - 1 month prior to kidding

CDT vaccine to help increase colostral antibodies against enterotoxemia and tetanus. BoSe® to raise selenium levels and prevent white muscle disease in kids and retained afterbirth in dam. Get local veterinary advice because the need and dosage level depend on how much selenium is in the soil in the region, as well as on the dietary supplementation.

Kid - birth to first week

Tetanus antitoxin (250 IU) if the colostrum intake was inadequate or if the source of the colostrum had not been vaccinated against tetanus within four weeks of kidding. BoSe® + vitamins A&D - use depends on soil in the region and the diet of the dam.

Kid - 3 weeks - begin coccidiosis prevention

4-8 weeks - Begin CDT series. Revaccinate every 3-4 weeks for 3 doses.
4-8 weeks - BoSe® - repeat if in selenium deficient area.
6-8 weeks - begin deworming, especially if kid has access to outdoors.

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