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Nutritional Requirements of the ANGORA GOAT

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Contents

Preface

Angora goat production holds a prominent position in Texas agriculture. Most of the goat industry is located in the area of the state characterized by complex and often dense, browse vegetation. Much of the justification for including goats in the ranch enterprise is due to the fact that goats consume plants not preferred by cattle and sheep and that they help control noxious plants. Many of the problems in Angora goat production are caused by a lack of understanding of the fluctuations that exist both in the goat's diet and in the nutritional requirements imposed. This publication presents research data and related discussion on (1) the kinds and required amounts of nutrients for Angora goats, (2) their diets and likely nutrient deficiencies and (3) suggested means for supplying proper nutrition.

Nutritional Requirements of the ANGORA GOAT

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The Angora goat industry is an important one in Texas, providing a source of income to producers and assisting in brush control through preferential utilization of plants not readily accepted by other livestock. Producers of Angora goats face many challenging problems, not the least of which is erratic mohair price. However, production problems such as low fleece weights; poor reproductive performance; and high incidence of death losses from predators, disease, internal parasitism and low temperature stress adversely affect the status of the industry. Underlying and contributing to each of these problems is the poor nutritional state of most flocks. Notwithstanding this, little definitive information is available on nutrient requirements of this species.

A systematic approach to the feeding of any species requires the following steps or processes: 1) a knowledge of the nutrient requirements of the species involved; 2) an understanding of nutrients obtained from forages being consumed; 3) a determination, by a direct comparison of the two preceding, of the supplemental nutrients required for optimum or maximum performance; and 4) a thorough knowledge of nutrients in available feedstuffs and how these may be economically provided for the animal. This report attempts to provide some of this information as it applies to Angora goats.

NUTRIENT REQUIREMENTS

The nutrients required by all higher forms of animals can be classified broadly as energy (carbohydrates, fat or degraded protein), protein, minerals, vitamins and water. Body metabolism involves transforming these nutrients into the forms required for maintenance, body activity, growth and production of such desired products as milk and fiber. The various nutrients are used for different functions, and the amounts required vary greatly; but all are totally interrelated, and life cannot exist for long in the absence of any one.

Energy is required to produce body movement through voluntary muscle contraction; it provides for essential involuntary muscular activity, such as heart beat, and the driving force for chemical reactions leading to maintenance of body tissues, growth and so forth. Energy may be measured or expressed in a number of ways — two are used in this report to allow for broader application. The older system of expressing available energy is as Total Digestible Nutrients (TDN) which estimates the amount (pounds) or percent of the consumed feedstuff which is available for metabolic uses. A more modern approach is to express available energy as Digestible Energy (DE) which is simply the megacalories of energy digested.

Dietary energy requirement for an animal is the level of consumed energy required to maintain normal health and vigor and to promote the desired level of production. From this definition it can be seen that animals have "basal requirements" (often called maintenance) to maintain

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health and vigor during a nonproductive state and additional requirements to support productive functions. However, in fiber producing animals, such as the Angora, these functions cannot be separated. The maintenance requirements are related to body size since the amount of maintenance metabolism (basal metabolic rate) increases as the animal becomes larger. However, this increase in basal metabolic rate is more proportional to a fractional power of body weight. For Angora goats, the relationship for energy requirements has been determined by Brody (2) to be: Basal Metabolic Rate of Angora Goat $= 126 \times W^{.55}$ kilocalories/day in which $W =$ body weight in pounds; and kilocalorie = a measure of energy approximately equal to 0.0005 pounds of total digestible nutrients (TDN).

As indicated by this relationship, as a goat becomes larger, its maintenance requirements increase but at a reduced rate (Appendix Figure 1). This is reflected in the requirements table (Table 1) in that energy requirement of a 100-pound doe is less than twice that of a 50-pound doe. In contrast, energy requirements above the maintenance level for productive purposes are characteristic of the product and vary directly with the level of production. For example, the energy required above the maintenance level to produce 1 pound of milk per day is constant and is one-half the energy required to produce 2 pounds without regard to animal size.

Unfortunately, only a portion of the energy consumed is later available in such a way that it can be utilized. Large portions of the consumed energy are lost in feces, urine or gas and are never available for use by the animal's metabolic processes. When the terms DE or TDN are used as a measure, the loss through the feces is corrected for since it represents largely undigested material. For a grazing animal, the loss through the urine and rumen gases are relatively constant, and an estimate of this is considered in the calculations. The energy which is digested and does become available for metabolism is again less than 100-percent efficient in supplying useful energy. The efficiency with which this "metabolizable energy" is used depends upon type of diet and function for which the energy is expended (growth, lactation, and so forth). If we assume that the goat's diet is composed totally of range forage, the efficiencies of utilization of metabolizable energy for the various functions are closely estimated by the following:

Function	*Efficiency of utilization of metabolizable energy (%)*
Maintenance	80
Growth at weights (lb.)	
20-30	65
30-60	55
60-100	45
Above 100	40
Pregnancy	40
Lactation	70
Activity (body movement)	40
Fiber production	Not known — probably less than 20

The balance of the energy is expended as heat. T relative magnitude of these efficiency factors provide explanation for the large differences in energy requ ments for animals in the various stages of producti Once the energy requirement for maintaining body ti is met, additional energy is used relatively inefficie with the greater efficiency realized in milk production growth of the young animal. Although the energy reta by the doe and fetus during pregnancy is very small w calculated for the total gestation period, the energy requ ment can be quite large during the last 30 days (Fig 1), and this often represents a stress period for the anim

A major energy cost which an animal has and which is often overlooked is the energy required for acti Cory (3) studied the activity of range animals monthl the Texas A&M University Agricultural Research Stati at Sonora and observed that goats traveled an average 6.0 miles per day compared with 3.3 miles for cattle a 3.8 miles for sheep. Consistently, goats traveled farth and on the average traveled 82 percent and 58 perc farther than cattle and sheep, respectively. Even this es mate of increase in energy cost of goats over sheep f activity may be low because of the goat's characteristic movement in foraging and play, neither of which wo be evident in a recording of miles traveled. This increa activity cost over that of sheep is a major cause of t higher energy estimates for Angora goats than the ge erally accepted values for sheep. Likewise, goats on a l extensive range or in confinement can be expected to h lower energy requirements than those tabulated, but s will be higher than most other species on a per-unit weig basis.

Protein from the diet serves to maintain or repl the protein in body tissues, provides for carriers of oth nutrients and is a major component of various produ such as meat, milk and fiber. Protein requirements for t different functions can be partitioned as was done wi energy. The amount of digestible protein required f zero protein balance (consumed protein is equal to excret protein) is related to the basal energy requirement f maintenance. Animals receiving basal energy requireme and sufficient protein for zero protein balance can be co sidered in equilibrium provided they are in a nonacti nonproductive state and all other nutrients are adequa As mentioned, mohair growth cannot be completely stopp therefore, an animal in zero protein balance is depriv other tissues of protein in order to maintain a level mohair growth.

A choice of protein level for Angora goats is a economic as well as a nutritional question. Mature A gora goats can be maintained on rations as low as 7 pe cent protein. However, mohair production at this level very poor, and goats will respond with increased moh production as protein level is increased. Although th protein level of a ration consumed is not as important

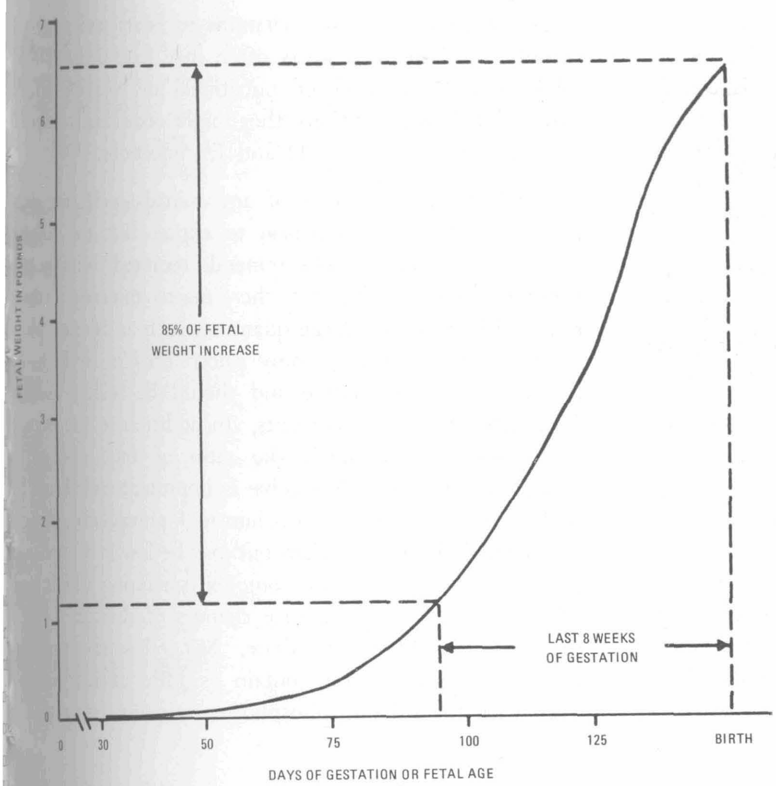
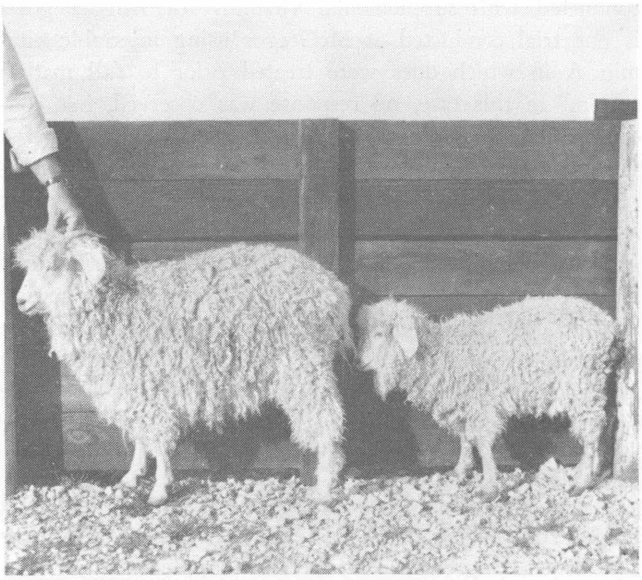


FIGURE 1. RELATION OF FETAL AGE TO EMBRYO WEIGHT OF ANGORA KIDS. The relation of fetal weight to age is curvilinear. The increase in body size is geometric in nature and approximates very closely the theoretical curve based on unlimited population increase in fetal cells. A restriction to rate of development appears to begin only after approximately 130 days. After this age, sex of the kid or uterine environment (single or multiple embryos, size of doe, level of nutrition, and so forth begins to influence rate of development. These data indicate the relative nutrient requirements for fetal development. Approximately 85 percent of fetal weight increase occurs during last 8 weeks of pregnancy (6, 12, 11).

total protein intake, there is a relationship between protein level and ration balance. Thus, it is logical to be concerned with the answers to several questions: What is the minimum level of protein necessary to maintain health and vigor of various classes of goats? What is the maximum level of protein which can be fed with an expectation of increased mohair weight? What is the optimum level of protein for maximum return on investment of supplemental protein? What is the influence of protein level on mohair quality? Complete and final answers to these questions are not available as they will vary with conditions such as age and prices. However, research has given several indications, discussed in the following.

The minimum levels of protein and energy necessary to maintain health and vigor and a moderate level of mohair production are those given as the lower range in Tables 1 and 2. Experiments at the Texas A&M University Agricultural Research Center at McGregor have shown responses in mohair growth from increasing ration protein level from 16 to 20 percent (kids), from 15 to 18 percent (yearling billies) and from 6.5 to 10.5 percent (mature does). Although these experiments do not establish maximums, they do indicate that Angora goats respond to unrealistically high protein intake. Thus, the final decision depends on the relative prices of feed ingredients, mohair and slaughter value of surplus breeding animals.

Appendix Tables 2 and 3 provide some data on economic response to supplementation. Generally these data support the following conclusions: If goats are worth keeping at all, they are worth supplementing to the level required to maintain health and vigor. In one experiment, protein supplementation returned $4 to $5 for each dollar invested in the supplement. However, this response resulted from reduced death losses of does and kids rather than increased mohair weight (Appendix Table 3). Improved nutrition through provision of supplemental protein above the level required to maintain health and vigor can be



Angora kids should be supplied their nutrient requirements at all times and protected against internal parasites as much as possible in order that they may reach a large mature size.

justified for the increased mohair obtained only when mohair prices are reasonably high (Appendix Table 2). It is not possible to say exactly what the price is due to variations in feed costs, mohair prices and the genetic capability of the goats to produce mohair. If the goats are being fed their entire ration, the break-even price of mohair would be at least $1.50 per pound (adult hair) at the present. When protein is being fed as a supplement to range forage and the latter is charged to the animal at a substantially cheaper cost than harvested feeds, the break-even mohair price for increased protein supplementation would likely be in the order of $1 per pound.

It is generally accepted that increased protein feeding results in increased diameter of mohair fibers (coarser hair). Research data confirm this (Appendix Table 1) but also indicate that the difference is usually small except when comparing extremes. Mohair quality can be improved by protein deprivation, but to do this intentionally is false economy. Thus, decisions concerning level of protein supplementation should probably be made without reference to mohair quality. An exception to this might be for those attempting to produce show fleeces in which case the protein level should be held to an intermediate level for the age group concerned.

Vitamins comprise a group of compounds required by the animal in minor amounts but essential for proper function of the body tissues. Almost no research has been conducted on the vitamin requirements of the Angora goats. There is little basis for thinking that vitamin requirements of the Angora goat differ greatly from those of the other ruminant species except as related to size. Thus, it would be inefficient to attempt to duplicate the extensive work already done with other species.

The only experimental work known to have been conducted with supplemental vitamins for Angora goats is one trial conducted at McGregor using injectable vitamin A in which does were treated prior to fall mating season. In this case, no response was observed, but conditions at that time would not suggest the existence of a vitamin A deficiency. Actually, the probability of occurrence of a vitamin A deficiency in adult animals on range is remote provided there are occasional seasons when green growing plants are available to the animal. Deficiencies are likely to develop in adult animals only during severe, extended dry periods when little or no green forages are available. Young animals may become deficient if they have not had the occasion to graze during at least one season when green forage is available and, consequently, have not built up body vitamin A stores.

The routine addition of vitamin A to supplemental rations for goats is probably advisable because of the low cost of this ingredient and because supplements are frequently used in a variety of conditions not generally known at time of formulation. There does not appear to be a basis for providing other vitamins to goats under no[rmal] conditions. However, goats often may have reduced f[eed] intake due to unthrift of nutritional or parasitic ori[gin] and under these conditions, they might occasionally resp[ond] to multiple vitamin (A, D and E) injections.

Mineral requirements of any animal species are co[m]plex, and there is no reason to expect that the Ang[ora] goat is an exception. The minerals required fall into t[wo] general classifications. Of the "macro minerals" (th[ose] required in relatively large quantities such as calcium, ph[os]phorus and potassium), only phosphorus is likely to [be] deficient in range forage and should be widely used [in] formulated range supplements. In addition to the amo[unt] of phosphorus provided, the ratio of total calcium [to] phosphorus the animals receive is important and should [be] within the range of 1.5-4 calcium to 1 phosphorus. Fora[ges] are normally high in calcium but may be low in phospho[rus]. Thus, supplying a mineral complex containing a high le[vel] of calcium will only increase chances of deficiency sym[p]toms and should not be done. Mineral supplements f[or] ranging animals should contain as little calcium as po[s]sible with the calcium:phosphorus ratio not larger tha[n] ... to 1.

Requirements for "micro minerals" or "trace mi[n]erals" (those required in small amounts) may be sligh[tly] higher for Angora goats than for other species because [of] the higher basal metabolic rate. Also, Angoras relative [to] other species have a high proportion of their body weig[ht] as physiologically active tissue due to the smaller amou[nt] of body fat. However, little evidence is available to in[di]cate that forages of typical Angora goat range are deficie[nt] in trace minerals. It is possible that areas with sandy ty[pe] soil and the higher rainfall areas may have plants deficie[nt] in one or more of the trace minerals; in these cases, [a] broad base trace mineral supplement could be benefic[ial].

Water is of immediate and critical importance, b[ut] it seems a safe assumption that all producers know th[is]. Water should be clean, well distributed and plentiful. [A] failure to meet these requirements will result in low[er] water intake with correspondingly lower feed intake a[nd] reduced productivity. Because Angora goats can be ve[ry] finicky in consumption of food or drink, it may be mo[re] important that they be provided clean water than is tr[ue] with other species.

RECOMMENDED NUTRIENT ALLOWANCES

Table 1 contains the recommended nutrient allow[w]ances for the different classes of Angora goats at t[he] various weights and stages of production. Calculations [of] these values were based on a number of assumptions a[nd] determined constants which are summarized in the Appe[n]dix. These recommended values are compromise valu[es] higher than bare minimum nutrition for life and lower th[an] allowances which would support high but uneconomi[c]

TABLE 1. RECOMMENDED NUTRIENT ALLOWANCES FOR ANGORA GOATS

Classes and weights (lb.) of goat	Gain (lb.)	DM (lb.)	DE (Mcal)	DP (lb.)	Vit A[1] (mcg)	P[1] (lb.)
		Recommended intake/day				
Wethers and dry does						
50	0-.15	2.1-2.7	2.5-3.2	.13-.17	146	.006
60	0-.10	2.4-2.8	2.8-3.3	.14-.17	176	.006
80	0-.05	3.1-3.3	3.3-3.4	.17-.18	246	.006
100	0	3.8	3.7	.19	293	.006
120	0	4.0	4.0	.21	350	.006
Pregnant does (last 8 weeks)						
50	.30-.45	3.1-3.5	3.8-4.4	.20-.24	488	.006
60	.30-.40	3.3-3.8	4.0-4.5	.21-.24	585	.006
80	.30-.35	4.0-4.3	4.5-4.7	.24-.25	780	.007
100	.30	4.6	4.9	.26	976	.007
Lactating does (16 weeks)						
50	−.05-.00	3.1-3.7	4.1-4.7	.23-.28	488	.007
60	−.05-.00	3.5-3.9	4.4-4.8	.25-.28	585	.008
80	−.05	4.0-4.2	4.8-5.1	.27-.29	780	.008
100	−.05	4.4	5.3	.30	976	.009
Growing kids and yearlings						
20	.30	1.8	2.4	.16	100	.004
40	.25	2.5	3.1	.18	200	.005
60	.20	3.2	3.7	.20	292	.006
80	.10	3.3	3.8	.19	390	.007
Developing billies						
80	.30	3.7	4.8	.26	390	.007
100	.20	4.2	4.9	.25	488	.007
120	.10	4.4	4.7	.24	585	.007

Gain—Expected weight change in pounds.
DM—Dry matter in pounds.
DE—Digestible energy in megacalories.
DP—Digestible protein in pounds.
Vit A—Vitamin A in micrograms.
P—Phosphorus in pounds.
[1]Vitamin A and P allowances taken from National Research Council's recommendations for sheep.

production. Individual producers may wish to shift above or below these values depending on their conditions and goals.

Recommended allowances for the lighter animals range from allowances for maintenance and mohair production (lower range) to increased nutrition allowing for development of underdeveloped goats (higher range). These extra allowances are considerable, and it is doubtful that extremely underdeveloped Angoras can consume a level of nutrients high enough in typical feedstuff to perform all the functions of maintenance, high level production (such as mohair growth, pregnancy or lactation) and growth. This points out the desirability that kids make good early development while nursing or during their first season in order that does reach optimum size before the burden of pregnancy or lactation is imposed (Figure 2).

Table 2 presents recommended nutrient composition in diets of goats. These values are based on the same assumptions used to construct Table 1, but they may be more valuable to some ranchers who have obtained composition data on their range forage.

DIET AND ITS INFLUENCE ON DEFICIENCIES

Although a knowledge of the nutrient requirements of animals is essential for proper management, it is of little use to producers unless nutrient consumption can be estimated with reasonable accuracy. Deficiencies may occur due to low quality of forage available to the animal or to an inability of the animal to ingest and utilize (lack of size or ill thrift) an adequate total amount. Fraps (4) studied the feeding habits of goats and determined that with only a few exceptions, goats could meet their nutrient

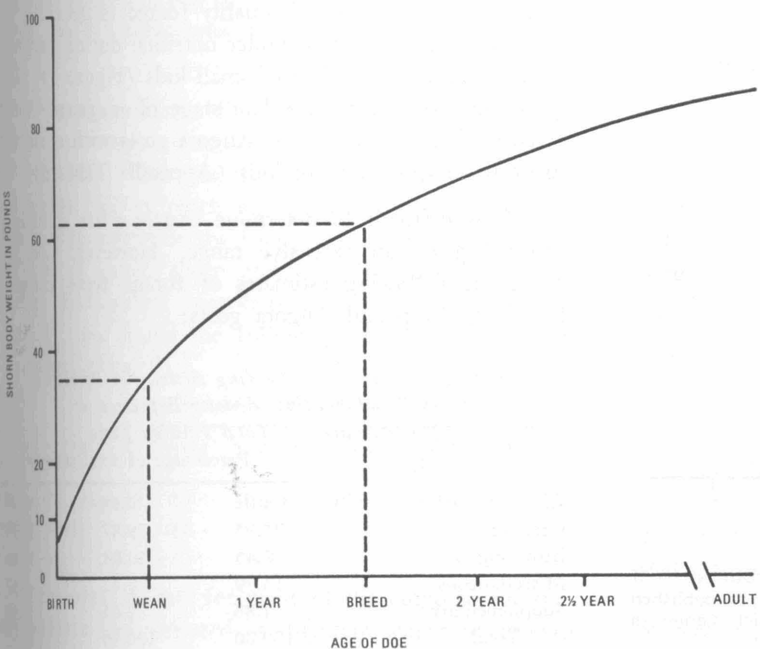


FIGURE 2. OPTIMUM GROWTH CURVE FOR ANGORA FEMALES. The curve represents a theoretical curve since it does not provide for seasonal fluctuations. The values were obtained from reports of Shelton (11) and (12) and Menzies (6). These represent minimum sizes to provide for maximum reproductive efficiency and survival in times of stress. Actually, these values represent approximate physiological maturity for populations from which these data were obtained and would theoretically differ for animals with different genetic mature size.

TABLE 2: REQUIRED COMPOSITION OF DIETS FOR ANGORA GOATS

Classes and weights (lb.) of goats	TDN (%)	DE (Mcal/lb.)	CP (%)	P (%)
Wethers and dry does				
50	50-60	1.0-1.2	9.0-10.4	.21
60	50-58	1.0-1.2	9.0-10.4	.19
80	50-54	1.0-1.1	9.0- 9.7	.17
100	50	1.0	9.0- 9.5	.16
120	50	1.0	9.0	.16
Pregnant does (last 8 weeks)				
50	54-62	1.1-1.2	10.0-11.1	.18
60	54-60	1.1-1.2	10.0-10.5	.17
80	54-56	1.1	10.0	.16
100	54	1.1	10.0	.16
Lactating does (16 weeks)				
50	58-65	1.2-1.3	11.0-12.0	.22
60	58-62	1.2	11.0-11.5	.21
80	58-60	1.2	11.0-11.2	.20
100	58	1.2	11.0	.20
Developing billies				
80	65	1.3	11.4	.19
100	60	1.2	10.5	.16
120	55	1.1	9.8	.14
Growing kids and yearlings				
20	68	1.4	13.3	.19
40	65	1.3	11.6	.18
60	60	1.2	10.6	.18
80	58	1.2	10.0	.18

TDN — Total Digestible Nutrients
DE — Digestible Energy
CP — Crude Protein
P — Phosphorus

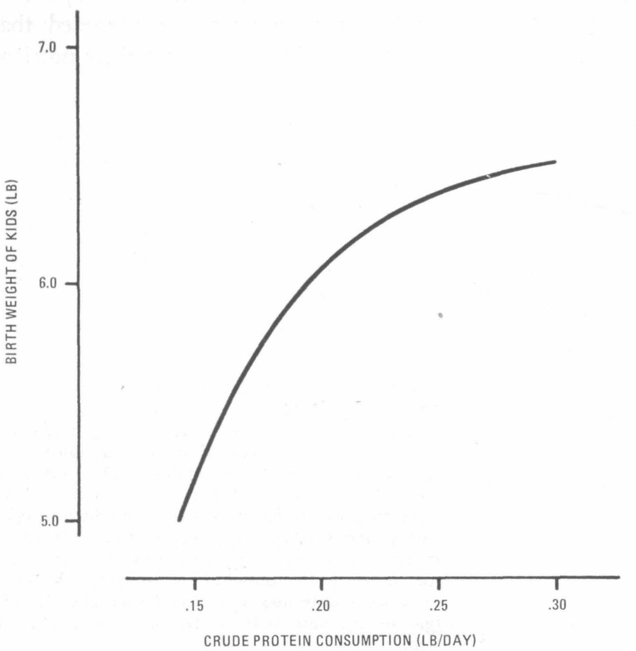


FIGURE 3. INFLUENCE OF PROTEIN INTAKE BY DOE DURING LAST 8 WEEKS OF PREGNANCY ON BIRTH WEIGHT OF KIDS. (Unpublished data from Texas A&M University Agricultural Research Center at McGregor).

Well-bred and well-fed Angora does produce an abundance quality mohair and give birth to strong, vigorous kids.

requirements when grazed freely on ranges having compl vegetation.

Situations in which requirements may not be met a when forage is limited in quantity such as under conditions of drouth and overgrazing; when there is a limit array of forage species resulting in seasons when the is no high quality, green forage available; and duri states of high nutritive requirements (growing kids, lact ing does, and such). One of the more serious deficien periods is during late gestation which falls in the win months when green, high quality forage is generally lim ited. The usual result of under nutrition during pregnan is either abortion or birth of small kids (Figure 3). Th poor nutrition during the late stage of pregnancy can b a cause of low birth rate by Angora goats with an increa in death loss of newborn kids (Appendix Table 3).

It is difficult to determine exactly what animals a consuming on an extensive range. However, Cory (3 made the following estimates of forage types consum by cattle, sheep and Angora goats:

Average of Classes of Feeding Activity in Percentages of Total Feeding Activity Expressed as Percentages of Total Feeding Time

	Percentage of total activity		
Class of feeding activity	Cattle	Sheep	Goats
Grazing	75.95	79.87	38.18
Browsing	8.45	10.08	53.10
Miscellaneous	13.79	7.42	5.87
Supplementary	1.86	2.61	2.85
Total	100.00	100.00	100.00

TABLE 3. PROTEIN, DIGESTIBLE ENERGY, AND PHOSPHOROUS COMPOSITION OF VARIOUS RANGE PLANTS AS INFLUENCED BY STAGE OF MATURITY[1]

Plant and stage of growth	Date collected	Protein		Energy		P
		crude	digestible	% TDN	DE[2]	%
Curly mesquite and buffalograss						
Green growth	4/30	12.0	7.8	60	1.2	.11
Partly cured forage	8/31	8.8	4.8	54	1.1	.09
Cured forage	2/25	5.3	1.5	47	0.9	.06
Gramas (blue, black and sideoats)						
New growth		11.5	8.7	56	1.1	.14
Fruiting	8/31	7.7	3.8	52	1.0	.12
Mostly mature	12/19	6.4	2.5	49	1.0	.09
Mature and weathered		3.5	0.0	40	0 8	.05
Bluestems						
Very young		14.5	9.5	68	1.4	.14
Green growth	7/13	10.4	6.3	57	1.1	.08
Past maturity	11/11	3.7	0.0	44	0.9	.04
Threeawn (purple)						
Past maturity	9/26	5.5	1.7	49	0.9	.06
Mixed cured and green	12/14	6.1	2.3	48	0.9	.08
Rescue grass						
Foliage, preheading	2/24-3/23	17.0	12.6	70	1.4	.28
Plants in head	5/1	11.7	7.6	60	1.2	.14
Texas wintergrass						
Luxuriant green growth	12/12	14.4	10.1	65	1.3	.17
Green growth		10.0	5.9	56	1.1	.12
Green growth, mature plants	6/2	7.2	3.3	50	1.0	.08
Live oak leaves						
New foliage	4/28	17.7	5.4	55	1.1	.26
Foliage, mostly mature	10/18	8.9	2.7	51	1.0	.12
Foliage	1/24	9.6	2.9	50	1.0	.10
Shin oak leaves	8/29	9.4	2.9	50	1.0	.15
Various forbs						
Winter and spring		16.0	12.2	65	1.3	.20
Summer and fall		18.0	14.2	45	0.9	.15

[1]Compiled from values reported in Fraps (4), Morrison (8) and Schneider (10) and from unpublished data obtained at the Texas A&M University Agricultural Research Center at McGregor, Texas.

[2]Digestible energy (DE) in megacalories per pound of dry matter was calculated from the relationship that 1 pound of TDN is approximately equal to 2 megacalories of DE.

A most significant finding of this early study was that browse forage composed such a large proportion of the goat's diet. This has since become a well-established and useful tool in ranch management. Fraps (4) later attempted to determine the forage species which composed the diets of cattle, sheep and goats by months and to measure the nutrient contribution of each forage to the total diet. He found the following consumption pattern for Angora goats:

Forage type	Percent composition of diet by season				
	Spring	Summer	Fall	Winter	Average
Grass or grass-like plants	23	32	43	31	32
Browse plants	22	55	53	65	49
Forbs	55	13	4	4	19

Compositional data for many of the range forage species collected and analyzed at different stages of growth are reported in Table 3. This table has been compiled from results in Fraps (4), Morrison (8), Schneider (10) and from more recent unpublished data obtained at the Research Center at McGregor. Values for plants where no date of collection is indicated are estimated relative to other values.

MEETING THE ENERGY AND PROTEIN REQUIREMENTS

The tendency of Angora goats to consume a wide variety of plants increases the probability of meeting their requirements in comparison with livestock which consume fewer plant species. Table 4 contains examples of diets grazed by goats from complex vegetation throughout the year. Seasonal shifts in consumption favoring the more nutritious plants are evident. Therefore, the contribution of certain plants to the total diet has a great influence on

TABLE 4. COMPOSITION OF AN EXAMPLE DIET FROM AN AVERAGE RANGE[1]

	Season			
	Spring	Summer	Fall	Winter
Buffalo grass and curley mesquite	10	12	23	16
Grama grasses	5	10	10	5
Bluestems	3	10	10	
Texas wintergrass				5
Rescue grass	5			5
Liveoak leaves	15	30	43	65
Shin oak leaves	7	25	10	
Various forbs	55	13	4	4
Total	100	100	100	100
Total diet composition				
% crude protein	15.3	11.0	8.3	9.5
% digestible protein	10.0	5.2	3.1	3.7
% TDN	64.0	58.8	49.5	50.9
DE (Mcal/lb.)	1.3	1.2	1.0	1.0
% phosphorus	0.20	0.13	0.11	0.11

[1]These example diets were formulated using observations made by Fraps and Cory (4) and are expressed as the percent of each of the various forages contributed to the total seasonal diets. They are based on the assumption that the animals are able to consume all the forage desired and are not restricted by quantity available or time required for foraging.

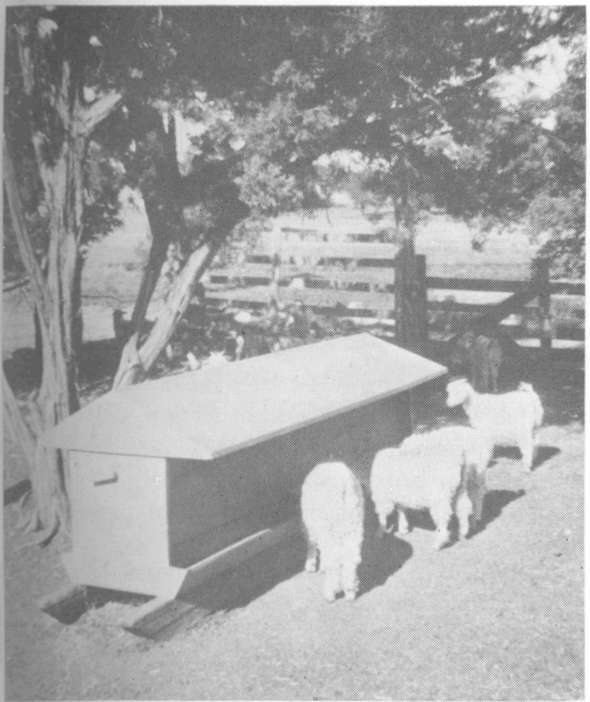
the necessity of supplemental feeding. For example, if Texas wintergrass and rescue grass are totally absent from the example diets, a deficiency of protein and energy is much more likely in the winter months. The tendency of goats to prefer browse aids them in meeting their nutrient requirements, and pastures devoid of browse species should probably not be used extensively by Angora goats. However, due to the low digestibility of liveoak protein, liveoak alone will not provide adequate digestible protein (Huston and Shelton, 5). It should be pointed out that these diets are only simplified examples of the very complex actual diets, but they do contain the most important plants. If it is assumed that these diets are representative of an average range, likely deficiencies can be calculated using the requirements table (Table 1) and the composition of each of these diets.

If, on the other hand, the range is so bare that animals are limited in the amount of forage available, any such calculations of nutrient intake would be in error. For general application, two situations will be considered. In situation 1, the amount of forage available is not limiting and voluntary dry matter consumption equals that predicted in Table 1. The adequacy of the diet depends only on quality of available forage. In situation 2, animals are grazing a devoid range, and the amount of forage available will not meet predicted dry matter consumption. The severity of this situation depends on both how much forage is available and its quality. These will vary from case to case. However, if quantity is limited, quality likely will be low. For this example, it will be assumed that the goats are able to consume one half their predicted dry matter consumption of forage having 3 percent digestible protein, .05 percent phosphorus and containing 0.8 megacalories of digestible energy per pound. Examples of calculating likely deficiencies for breeding does by season and stage of production follow.

Examples of Calculating Deficiencies in Diet

	DM (lb.)	DE (Mcal.)	DP (lb.)	P (lb.)
1. Dry does and muttons in July on average range (80 lb.)				
Requirements (Table 1)	3.3	3.3	.17	.006
Furnished by diet (Table 3)	3.3	3.3	.17	.004
Deficiency	0.0	0.0	0.0	.002
2. Pregnant does in January on average range (80 lb.)				
Requirements	4.1	4.5	.24	.007
Furnished by diet	4.1	4.1	.15	.005
Deficiency	0.0	0.4	.09	.002
3. Dry does in July on average range (50 lb., developing)				
Requirements	2.7	3.2	.17	.006
Furnished by diet	2.7	2.7	.14	.004
Deficiency	0.0	0.5	.03	.002
4. Pregnant does in January on average range (50 lb., developing)				
Requirements	3.5	4.4	.24	.006
Furnished by diet	3.5	3.5	.13	.004
Deficiency	0.0	0.9	.11	.002
5. Does in early stage of pregnancy in November on devoid range (80 lb.)				
Requirements (Table 1)	3.3	3.3	.17	.006
Receiving from diet	1.65	1.3	.05	.001
Deficiency	1.65	2.0	.12	.005
6. Pregnant does in January on devoid range (80 lb.)				
Requirements	4.3	4.5	.24	.007
Receiving from diet	2.15	1.7	.06	.001
Deficiency	2.15	2.8	.18	.006

Similar calculations can be made for goats in the other productive states. Table 5 summarizes the probable deficiencies for all classes of Angora goats at the indicated weights provided they are consuming the diets given in Table 4. It is not likely that deficiencies will occur in the spring because of the abundance of high quality forages especially forbs. Normal summer grazing should be adequate for mature goats but inadequate for growing kids and billies. The period from late fall through the winter months is the most likely time for a deficiency to occur with the most detrimental time being in the adverse winter months. Requirements for replacement kids should be me



Occasional supplemental feeding of Angora goats fills the nutrition gap left by forage quality fluctuations.

at all times in order to bring the kids to as large a mature size as possible. Shelton (11) shows that the weight of a replacement doe when it is placed in a breeding flock has a high positive correlation with lifetime productivity in both kid production and fleece weights. However, goats

TABLE 5. SUMMARY OF LIKELY DEFICIENCIES ON AVERAGE RANGE (LB. MCAL/DAY)

	Season			
	Summer	Fall	Winter	Spring
Breeding does (80 lb.)				
Productive state	dry	dry	pregnant	lactating
Digestible energy (Mcal)			0.40	
Digestible protein (lb.)		0.07	0.09	
Phosphorus (lb.)	0.002	0.002	0.002	
Breeding does, developing (50 lb.)				
Productive state	dry	dry	pregnant	lactating
Digestible energy (Mcal)	0.50	0.50	0.90	
Digestible protein (lb.)	0.03	0.09	0.11	
Phosphorus (lb.)	0.002	0.003	0.002	0.001
Dry does and wethers (80 lb.)				
Digestible energy (Mcal)				
Digestible protein (lb.)		0.07	0.05	
Phosphorus (lb.)	0.002	0.002	0.002	
Growing kids and yearlings (60 lb.)				
Digestible energy (Mcal)	0.50	0.50	0.50	
Digestible protein (lb.)	0.03	0.10	0.08	
Phosphorus (lb.)	0.001	0.001	0.001	
Growing billies (80 lb.)				
Digestible energy (Mcal)	1.10	1.10	1.10	
Digestible protein (lb.)	0.07	0.15	0.12	
Phosphorus (lb.)	0.002	0.003	0.003	

TABLE 6. SUMMARY OF LIKELY DEFICIENCIES ON DEVOID RANGE (LB. OR MCAL/DAY)

	Season			
Productive state	Summer dry	Fall dry	Winter pregnant	Spring lactating
Breeding does (80 lb.)				
Digestible energy (Mcal)	2.10	2.10	3.00	3.40
Digestible protein (lb.)	0.13	0.13	0.19	0.23
Phosphorus (lb.)	0.005	0.005	0.006	0.007
Breeding does (50 lb., maintenance)				
Digestible energy (Mcal)	1.40	1.40	2.40	2.70
Digestible protein (lb.)	0.09	0.09	0.15	0.18
Phosphorus (lb.)	0.005	0.005	0.005	0.006
Breeding does (50 lb., developing)				
Digestible energy (Mcal)	2.10	2.10	3.00	3.20
Digestible protein (lb.)	0.13	0.13	0.19	0.22
Phosphorus (lb.)	0.005	0.005	0.005	0.007

should not be fed at a high level in an attempt to increase production above their genetic potential.

Predicted deficiencies when goats are grazed on devoid range are given in Table 6. Necessarily, these deficiencies are in direct relation to requirements since the content of consumed forage is assumed constant. Comparing Table 5 with Table 6 illustrates the consequences of overgrazing. Situation 1 allows for maximum utilization of range forage, and supplemental feeding only fills gaps due to forage quality variation. In contrast, overgrazing requires supplying a substantial portion of the animal's requirements. Ranchers should avoid routine occurrences of situation 2. Average mohair prices will not support large scale supplemental feeding of Angora goats. Since a major reason for maintaining Angoras is to promote range improvement, goat numbers should be held sufficiently low to avoid frequent periods of overgrazing. However, occasional unavoidable periods of forage shortage such as during severe, temporary drouth may justifiably demand supplemental feeding during situation 2.

Any of a number of protein and energy sources can be used to supplement possible deficiencies in range forage. Many excellent commercially prepared feeds which generally fall into one of three general types are available. "Protein blocks" are popular with many producers because of their convenience. They generally contain high levels of protein and include a feed limiter (usually salt). These are usually best suited for supplying protein when energy is not deficient. "Liquid supplements" contain urea as the crude protein source and are good sources of supplemental energy. Many different formulations are available, and, again, convenience of distribution is a real advantage. However, no research information is available on the value of these urea-containing liquid supplements for Angora goats. Commercial "range cubes" are still popular with many ranchers and provide excellent nutrition. They have the disadvantage of requiring hand feeding, which not only necessitates large investments in labor but also results in the "bully" effect in the flock in that the more timid goats are dominated and thereby underfed.

Some of the more basic or homegrown feeds also can be used to meet requirements. Table 7 contains most of the more common concentrate feedstuffs and their compositions. Since only a low level of consumption is usually necessary to supply the deficient nutrients, palatability of the supplemental feed is of minor importance. A series of supplemental feeding studies using Angora wethers at the Research Center at McGregor has shown little or no difference in the value of cottonseed meal, hydrolyzed feather meal and blood meal as supplemental protein sources. There is no clear evidence that any of the listed concentrates should be considered better than others when included in a protein supplement to range forage. Their value should be indicated by their digestible protein and digestible energy contents only. Urea, on the other hand, does not supply protein but is a protein substitute and should not replace more than one-third of the supplemental protein in dry feed mixtures.

A method of limiting consumption of a supplement to a determined level is very desirable. Salt has been used for this purpose with variable results. Although the effects of high levels of salt consumption are still in question, it is recommended that the practice be used provided forage is available at all times. A level of one part salt to four parts dry supplement is commonly used. Producers should experiment with other levels in order to determine what level will satisfactorily limit supplement consumption under their conditions. Gypsum has also been used successfully as a feed limiter when included in supplements at about half the level required for salt.

Feeding goats during periods of forage shortage is a little different from supplementing range forage deficiencies. A minimum level of roughage should be supplied in order to avoid gastrointestinal disturbances or nutrient deficiencies associated with concentrate feeds only. However, feeding of roughages should not be considered mandatory as healthy goats will usually consume a limited amount of roughage even if it is necessary that they chew bark from trees. Actually, these conditions best allow goats to perform their important function of controlling undesirable plants, although such continued management would be extremely detrimental to the desirable range vegetation. Roughage should be fed only to provide some nutrient not included in concentrates or during extremely low-temperature stress periods.

Table 7 contains the more common roughage feedstuffs and their nutrient contents. When fed in drylot, it is advisable that a complete feed contain not less than 20 percent of a poor quality roughage (cottonseed hulls), 25 percent of a medium quality roughage (sorghum hay) or 30 percent of a high quality roughage (alfalfa hay). When hay and roughage are fed separately as total diet, hay should

TABLE 7. APPROXIMATE COMPOSITION OF SOME AVAILABLE FEEDSTUFFS[1]

	Protein		Energy		P
	CP %	DP %	TDN %	DE Mcal/lb.	%
High protein feedstuffs					
Blood meal	82.2	58.4	60.4	1.21	.25
Cottonseed meal	41.6	33.3	71.7	1.42	1.11
Feather meal (hydrolyzed)	87.4	61.2	63.8	1.28	*
Guar meal	38.7	36.4	68.0	1.36	*
Linseed meal	35.2	30.6	75.5	1.60	.86
Peanut meal	45.3	40.3	76.0	1.52	.54
Soybean meal	44.0	37.0	77.9	1.56	.63
Urea (45% N)	281.0	220.0			
High energy feedstuffs					
Barley	11.8	9.2	75.6	1.51	.35
Corn	8.7	6.7	80.1	1.60	.27
Corn and cob meal	7.4	5.4	73.2	1.46	.22
Molasses, cane	3.0	0.0	53.7	1.08	.08
Oats	12.0	9.4	70.1	1.40	.33
Sorghum grain (milo)	10.9	8.5	79.4	1.59	.28
Wheat, hard winter	13.5	11.3	79.6	1.59	.42
High roughage feedstuffs					
Alfalfa, dehydrated	17.9	12.3	54	1.1	.26
Alfalfa hay	15.3	10.9	51	1.0	.24
Cottonseed hulls	3.9	0.0	44	0.9	.06
Oat hay	8.2	4.9	47	0.9	.19
Peanut hay	10.0	5.4	47	0.9	.13
Peanut hulls	6.7	1.6	19	0.4	.06
Prairie hay	7.4	3.7	46	0.9	.17
Sorghum hay	8.8	4.3	49	1.0	.27

	Calcium %	Phosphorous %	Trace minerals
High mineral feedstuffs			
Bone meal, steamed	29	14	+++[2]
Phosphate, deflourinated	33	18	
Phosphate, dicalcium	22	18	
Limestone, ground	34		
Oyster shell flour	38		

[1]Assembled from values appearing in National Research Council Handbook for sheep (1968) and Morrison (8) and from digestion experiments conducted at the Agricultural Research Center at McGregor, Texas.

*Phosphorous content unknown.

[2]Present in adequate amounts.

be fed at a minimum level of one percent of the animal's body weight per day. Drylot feeding of Angora goats has little justification since mohair and goat meat prices make the practice impractical. There is some justification for drylot feeding of males as a selection tool. However, it seems obvious that selections made under these conditions may adversely affect the adaptability of the breed to the unfavorable environmental conditions under which they are raised.

If it is assumed that a 100-head flock of 80-pound breeding does has access to the diet given in Table 4, the does will be consuming a deficient diet from about October 15 through about March 15. During this period, they should be supplied 0.08 pounds of digestible protein per head per day or about 8 pounds of digestible protein each day for the 100 head. The amount of a feed ingredient necessary to supply this amount of protein can be calculated by the following equation:

$$\frac{\text{Amount of nutrient required}}{\text{Percent of nutrient in feedstuff}} \times 100$$

If cottonseed meal is the most economical available protein source, the amount necessary to meet requirements would be

$$\frac{8 \text{ lb. DP/day}}{32\% \text{ DP}} \times 100\% = 25 \text{ lb./day}$$

or about 175 pounds per week. However, feeding cottonseed meal alone is often inadequate when other nutrients are likely deficient. The following example supplements were formulated to demonstrate the relative value of various supplements for different situations.

Examples of Recommended Range Supplements Under Average Conditions

	Ingredients	Percent composition	Pounds /ton
Supplement 1 (40%)			
	Sorghum grain	25	500
	Cottonseed meal	70	1400
	Urea	3	60
	Dicalcium phosphate	2	40
	Vitamin A[1]	+	+
	Total	100	100
Supplement 2 (30%)			
	Sorghum grain	58	1160
	Cottonseed meal	37	740
	Urea	3	60
	Dicalcium phosphate	2	40
	Vitamin A[1]	+	+
	Total	100	2,000
Supplement 3 (20%)			
	Sorghum grain	82	1640
	Cottonseed meal	14	280
	Urea	2	40
	Dicalcium phosphate	2	40
	Vitamin A[1]	+	+
	Total	100	2,000

Approximate nutrient composition

	Protein		Energy		
	Crude (%)	Digestible (%)	TDN (%)	DE (Mcal/lb.)	P[2] (%)
Supplement 1	40	32.0	70	1.40	.77
Supplement 2	30	24	72	1.45	.65
Supplement 3	20	16	75	1.50	.55

[1]Including Vitamin A is optional but if included should provide 2500 IU per pound of supplement or 5 million IU per ton.

[2]Phosphorus content of supplements is an estimate of available phosphorus.

A high protein supplement should be used when the animal's energy requirement is being met or almost met by the natural diet. If protein is the only nutrient limiting, the animal would benefit only slightly from being fed high energy, low protein feedstuff such as molasses and so forth. The high protein supplements are usually best suited to animals which have reached their mature weight. On the other hand, young animals in the process of growing are often limited by the amount of digestible energy which they consume. Feeding a little more of a higher energy, lower protein supplement would be a much better investment than feeding a high protein supplement. Table 8 contains a recommended schedule for supplementing Angora goats on either an average range (Table 4) or a devoid range. It is assumed that the producer is interested

TABLE 8. RECOMMENDED SCHEDULE FOR SUPPLEMENTING ANGORA GOATS

On average range

Class and weight	Period	Supplement	Pounds /day /100 head
Wethers and dry does			
50-80 lb. (developing)	July 15-Nov. 15	3	20
	Nov. 15-Mar. 15	2	40
Above 80 lb.	Nov. 15-Mar. 15	1	20
Breeding does			
50-80 lb. (developing)	July 15-Nov. 15	3	20
	Nov. 15-Mar. 15	2	32-50
Above 80 lb.	July 15-Nov. 15	3	5-10
	Nov. 15-Mar. 15	1	20-30
Growing kids and yearlings			
Below 40 lb.	July 15-Nov. 15	3	35
	Nov. 15-Mar. 15	2	40
Above 40 lb.	July 15-Nov. 15	3	20
	Nov. 15-Mar. 15	2	40
Developing billies			
80-120 lb.	July 15-Nov. 15	3	40
	Nov. 15-Mar. 15	2	50

On devoid range

Class	Hay and Concentrate: Hay	Hay and Concentrate: Concentrate[1] (lb./head /day)	Concentrates Only: Supplement 1 (lb./head /day)	Concentrates Only: Grain (lb./ head /day)
Wethers and dry does	1% of body weight	.75	.3	1.0
Breeding does				
Dry	do.	.75	.3	1.0
Pregnant	do.	1.50	.3	1.6
Lactating	do.	1.50	.3	2.0
Growing kids and yearlings	do.	1.25	.3	1.0
Developing billies	do.	1.75	.2	1.5

[1]The type of concentrate used will depend on the hay fed. If alfalfa (or other high quality legume hay) is fed, corn (or other high energy grain) is adequate, but Supplement 3 should be fed if the hay is some type of grass hay.

in getting increased development in the underdeveloped does and muttons. Alternatively, the lighter animals should be fed similar to the goats weighing more than 80 pounds.

It is important to consider the quality of hay being fed to animals on devoid range. A high quality hay such as alfalfa when fed in combination with some grain is quite adequate provided phosphorus is made available (free-choice bone meal). However, poor quality hay with grain would not provide adequate protein. Supplement 3 in combination with a fair to poor quality hay would provide good nutrition.

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APPENDIX

Methods of Calculating Nutrient Allowances for Angora Goats (References)

Energy — Digestible Energy (DE) was calculated as

$$DE = \frac{\text{Metabolizable Energy (ME)}}{.8}$$

1. Maintenance

$$ME = \frac{126 \times W_{lb.}^{.55}}{f_1} \times 1.5 \text{ Kcal/day}$$

Assumptions:

a. Resting metabolism of Angora goats (BMR)

$$BMR = 126 \times W_{lb.}^{.55} \text{ Kcal/day} \qquad (2)$$

b. Efficiency factor $f_1 = \frac{NE}{ME} = 0.80$ (1)

c. Practical maintenance = 1.5 × BMR (2, 3)

2. Growth

$$ME = \text{Maintenance} + \frac{\text{Retained Energy}}{f_2}$$

Assumptions:

a. RE = Retained Energy of growth at weights: (7)

f_2 = Efficiency factors of $\frac{NE}{ME}$ at weights: (1)

Weight (lb.)	RE/lb. gain	f_2
20	1,500 Kcal	.65
40	1,600 "	.55
60	1,700 "	.45
80	1,800 "	.45
100	1,900 "	.40
120	2,000 "	.40

3. Pregnancy

$$ME = \text{Maintenance} + \text{Growth} + \frac{\text{Increased BMR}}{f_1} + \frac{\text{Fetus Energy}}{f_3}$$

Assumptions:

a. Total gain of pregnant doe = 25 lb. (2)

b. Fetus weight = 9 lb. (Considering 6 lb. kids at 50% incidence of twins)

c. Fetus growth = 90% in last 8 weeks of gestation (2)

d. Composition of fetus: (2)
3.3% fat = 0.30 lb. fat = 1,226 Kcal
18.9% protein = 1.70 lbs. = 4,362 Kcal

e. Maternal tissue growth = 50% in last 8 weeks (2)

f. Composition of maternal growth: (2)
0.4% fat = 0.06 lb. fat = 256 Kcal
6.5% protein = 1.04 lb. = 2,628 Kcal

g. Retained energy during last 8 weeks =

$$\frac{(2{,}924)\ (5) + (5{,}588)\ (9)}{56 \text{ days}} = 108 \text{ Kcal/day}$$

h. Increased body metabolism =
$126 \times 16^{.55} = 560$ Kcal/day

i. Efficiency factor f_3 of fetal growth = 0.40

4. Lactation

$$\text{ME} = \text{Maintenance} + \text{Growth} + \frac{\text{Milk Energy}}{f_4}$$

Assumptions:

a. Energy content of milk =
52.78(% fat + 2.44)Kcal (9)

b. Goat milk contains 4.5% fat (7)

c. Level of production = 1.5 lb./day

d. Energy content of milk = 870 Kcal/day

e. Efficiency factor f_4 for milk production
= 0.70 (1)

Protein—Digestible Protein (DP) was calculated as

$$\text{DP} = \left(\frac{\text{EUN} + \text{MFN} + \text{NB}}{\text{BV}} - \text{MFN}\right) \times 6.25$$

EUN (Endogenous urinary nitrogen)

$2 \times 126 \times W_{\text{lb.}}^{.55}$ mg/day

MFN (Metabolic fecal nitrogen)
0.52 gm N/100 gm dry matter intake

NB (Nitrogen balance) = Nitrogen
consumed − excreted

BV (Biological value) = 0.60

1. Maintenance

Assumptions:

a. NB = Mohair nitrogen + nitrogen
allowed for growth of underweight does

b. Composition of growth = 2.56%
N/lb. gain (7)

2. Pregnancy

Assumptions:

a. Same as under "Energy."

b. Requirement/day above maintenance

$$2.22 \times \frac{1}{.60} = 3.70 \text{ gm/day}$$

3. Lactation

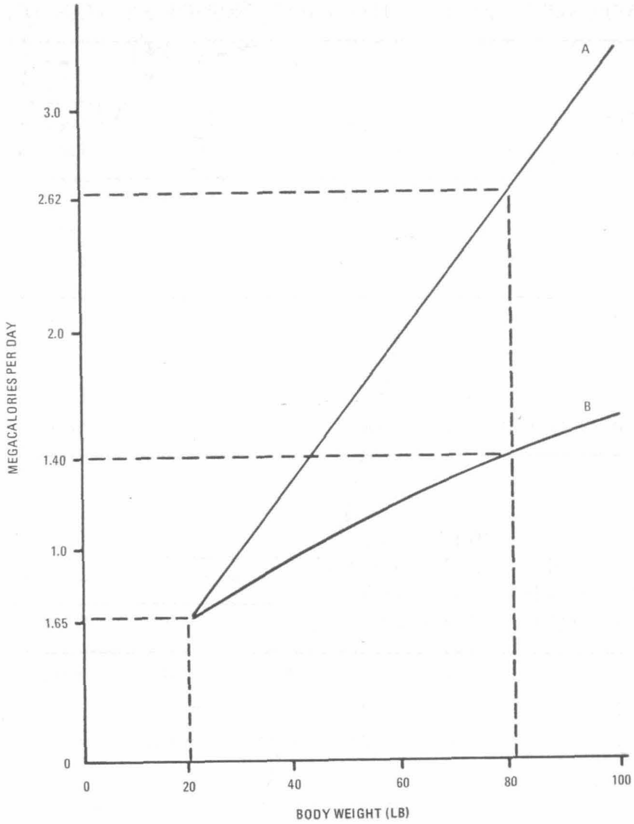
Assumptions:

a. Same as under "Energy."

b. Protein content of milk = 3.5% (7)

c. Requirements/day above maintenance

$$\frac{3.81}{.6} = 6.35 \text{ gm/day}$$



APPENDIX FIGURE 1. RELATIONSHIP BETWEEN BODY WEIGHT AND "BASAL METABOLISM" OF ANGORA GOATS. The graph shows theoretical values for "basal metabolism" assuming that basal energy requirements increase in relation to (A) body weight or (B) body weight to the 0.55 power. As the goat increases in size from 20 to 80 pounds, relationship A indicates that basal metabolism would increase fourfold:

$$0.65 \times \frac{80}{20} = 2.62 \text{ megacalories/day.}$$

Actually, basal metabolism increases in relation to body weight to the 0.55 power (relationship B). Increasing body weight from 20 to 80 pounds increased basal metabolism only from 0.65 to 1.40 megacalories per day:

4-fold-increase in body weight = 2.2-fold increase in basal metabolism.

APPENDIX TABLE 1. THE INFLUENCE OF PROTEIN ON PERFORMANCE OF YEARLING ANGORA BILLIES IN DRYLOT

Lot no.	Ration protein (%)	Total gain (155 days)	Daily feed intake	Fleece Data (6 month basis) Grease wt (lb.)	Yield (%)	Clean wt (lb.)	Length (cm)	Diameter (microns)	Pounds feed per lb. mohair
1	12	46.3	4.3	9.3	80.4	6.5	14	36	84.4
2	15	56.1	4.5	10.6	73.4	7.8	13½	37	75.9
3	18	54.3	4.6	13.3	74.8	9.9	14	38	61.1

APPENDIX TABLE 2. INFLUENCE OF LEVEL OF PROTEIN ON ECONOMIC RESPONSE OF YEARLING BILLIES IN DRYLOT

Lot no.	Ration protein (%)	Total feed cost ($/head)	Feed cost per lb. mohair ($)	Per-head returns in dollars at mohair prices: $0.50 Gross	$0.50 Net	$0.75 Gross	$0.75 Net	$1.00 Gross	$1.00 Net	$1.25 Gross	$1.25 Net	$1.50 Gross	$1.50 Net
1	12	13.44	1.45	4.63	−8.81	6.94	−6.50	9.26	−4.18	11.57	−1.87	13.89	0.45
2	15	15.38	1.46	5.29	−10.09	7.92	−7.46	10.57	−4.81	13.21	−2.17	15.86	0.48
3	18	17.06	1.28	6.64	−10.42	9.96	−7.10	13.29	−3.77	15.63	−1.43	19.96	2.88

APPENDIX TABLE 3. INFLUENCE OF LEVEL OF NUTRITION OF ANGORA GOATS IN LATE GESTATION ON SURVIVAL AND KID PRODUCTION (ALL DOES PLACED ON EXPERIMENT A MINIMUM OF 30 DAYS PRIOR TO KIDDING)

	Treatments[1]: 1 Ground sorghum hay	2 Ground sorghum hay + cottonseed meal	3 Ground sorghum hay + ground oats	4 Ground sorghum hay + cottonseed meal + ground oats
Adequacy of diet:				
Protein	inadequate	adequate	inadequate	adequate
Energy	inadequate	inadequate	adequate	adequate
Protein content (%)	6.5	10.8	7.5	10.5
Number of does	19	20	18	22
Average initial wt (lb.)	80	83	86	82
Daily feed intake (lb.)	1.8	2.9	2.5	2.8
Average weight loss (lb.)	−13	0	− 2	− 2
No. of does aborting	3	1	0	0
No. of live kids	4	19	20	21
Average kid weight (lb.)	4.9[2]	5.9	5.7	5.8
Death loss in does (no.)[3]	3	1	0	0
Live kids as[4]				
% of does in group	21.1	95.0	111.1	95.5
% of does kidding[5]	28.6	100.0	125.0	116.7

[1]Minerals and vitamin A were provided to each group.

[2]If the weights of the aborted kids were included, the average weight of the kids in this group would be 4.0 pounds.

[3]All death losses of does were from freezing after shearing.

[4]Represents kids that lived at least 24 hours.

[5]Aborters were included as kidding.