

## Nutrient Requirements for Sheep

by Dr. Donald G. Ely

The sheep's requirement for energy, protein, minerals, and vitamins varies with weight, age, stage of production, and level of production. With all characteristics being equal, except weight, heavier animals require greater amounts of nutrients than lighter weight individuals. Immature animals require a greater percentage of their daily diet as energy, protein, minerals, and vitamins than older ones. While the nutrients for maintenance may be similar for the immature and the mature, the immature animal may require extra nutrients for growth. Dry, open ewes may only have minimal requirements whereas the same ewes nursing twins have significantly greater requirements for all nutrients. In addition, when comparing ewes nursing singles vs. those with twins and early-weaned lambs gaining .5 lb/hd/d vs. those gaining 1.0 lb/hd/d, significant differences in daily energy, protein, mineral, and vitamin requirements become obvious to the producer. Although maximum performance of sheep is governed by heredity, the daily supply of dietary nutrients dictate whether an individual will ever reach its genetic potential for performance.

### The Ewe

The requirements for energy, protein, minerals, and vitamins by mature ewes are based on weight, stage of production, and level of production (performance). Table 1 shows how the daily requirements for ewes at maintenance vary with weight. Ewes in each weight category are expected to gain only .02 lb/hd/d. All requirements, except phosphorous (P), increase in approximately equal increments for each 22-lb increase in body weight, so the 198-lb ewe requires approximately 40% more of each nutrient daily than the 110-lb ewe. An important principle to remember when evaluating the daily nutrient requirement is: Percentage of the nutrient in the daily

TABLE 1. DAILY NUTRIENT REQUIREMENTS OF DRY, NONBRED MATURE EWES AT MAINTENANCE

Ewe weight <sup>a</sup> (lb)	DM <sup>b</sup> (lb)	Energy		CP (lb)	Ca (g)	P (g)
		TDN <sup>c</sup> (lb)	DE (Mcal)			
110	2.2	1.2	2.4	.21	2.0	1.8
132	2.4	1.3	2.7	.23	2.3	2.1
154	2.6	1.5	2.9	.25	2.5	2.4
176	2.9	1.6	3.2	.27	2.7	2.8
198	3.1	1.7	3.4	.29	2.9	3.1

<sup>a</sup>Values apply to ewes in moderate condition. Feed fat ewes according to next lower weight category and thin ewes to the next higher.

<sup>b</sup>To convert dry matter to an as-fed basis, divide DM values by the percentage DM in a particular feed. Example: 2.2 lb divided by forage DM (30%) = 7.3 lb of as-consumed forage required/d.

<sup>c</sup>1.0 lb TDN (total digestible nutrients) = 2 Mcal DE (digestible energy).

ration dry matter (DM) remains the same, even if the amounts of dry matter and nutrients increase or decrease. For example, the crude protein (CP) content of 2.2 lb of dry matter fed to the 110-lb ewe each day is 9.5% (.21 divided by 2.2 times 100). Although the 198-lb ewe consumes 3.1 lb of dry matter, which contains .29 lb CP, the percentage CP in the dry matter remains approximately 9.5. Therefore, percentages remain the same even though absolute weights vary when different amounts of the same ration are fed.

Stages of production include maintenance, flushing/breeding (F/B; 2 weeks prebreeding and first 3 weeks of breeding), first 15 weeks of gestation (EG), last 4 to 6 weeks of gestation (LG), and first 6 to 8 weeks of lactation (L). Daily nutrient requirements for the 154-lb mature ewe as she works through the different production stages of the year are presented in Table 2. All requirements are lowest at maintenance because the ewe is required to simply maintain her weight during this period (weaning to flushing). To flush ewes (have them in a rising body condition at breeding), dry

matter and all nutrients offered to the ewe are increased so she gains .2 to .25 lb/d. This rate of gain during F/B may increase the lambing rates of ewes in moderate condition by 15 to 20%. This period extends from 2 weeks before turning in the ram through the first 3 weeks of the breeding season. Daily dry matter intake is increased 50% over maintenance. This dry matter should be composed mainly of energy dense feeds because the energy requirements in F/B are 55% greater than maintenance, whereas CP is only 45% greater. Approximately 2.3 times as much calcium (Ca) is required in F/B, but only 30% more P is needed. After the breeding season (first 15 weeks of gestation; EG), requirements are reduced to almost maintenance levels (daily gain = .07 lb/hd/d). Because of the low requirements, cheap by-product feeds can be used efficiently.

On the contrary, the last 4 to 6 weeks of gestation (LG) are nutritionally critical to the production of large and vigorous lambs at birth. Because two-thirds of the birth weight of lambs occur in this period and to prevent metabolic disorders

**TABLE 2. DAILY NUTRIENT REQUIREMENTS FOR 154-LB MATURE EWES IN DIFFERENT STAGES OF PRODUCTION**

Production stage <sup>a</sup> (lb)	DM (lb)	Energy		CP (lb)	Ca (g)	P (g)
		TDN <sup>b</sup> (lb)	DE (Mcal)			
M <sup>c</sup>	2.6	1.5	2.9	.25	2.5	2.4
F/B <sup>c</sup>	4.0	2.3	4.7	.36	5.7	3.2
EG <sup>c</sup>	3.1	1.7	3.4	.29	3.5	2.9
LG <sup>c</sup>	4.2	2.8	5.4	.47	7.6	4.5
L <sup>c</sup>	6.2	4.0	8.0	.92	11.0	8.1

<sup>a</sup>Values apply to ewes in moderate condition.

<sup>b</sup>1.0 lb TDN (total digestible nutrients) = 2 Mcal DE (digestible energy).

<sup>c</sup>M = maintenance; F/B = flushing/breeding; EG = early gestation; LG = late gestation (180 to 225% expected lambing rate); L = first 6 to 8 weeks lactation suckling twins.

(ketosis) at lambing, daily nutrient intakes are increased over EG so the ewe gains .50 lb/d. An illustration of the fetus growth during the entire 147-d gestation period is shown in Table 3.

**TABLE 3. GROWTH OF THE UNBORN LAMB DURING PREGNANCY**

Days of pregnancy	Single (lb)	Twins (lb)
30	ND <sup>a</sup>	.5
60	.5	.8
90	1.0	3.0
120	4.5	8.0
147	12.0	24.0

<sup>a</sup>Nondetectable.

The fact that daily dry matter intake in LG is only one-third more than in EG, whereas TDN, CP, Ca, and P requirements are 165, 160, 220, and 155% of those in EG, points to the necessity of feeding more energy dense rations (increased grain) in LG. The main reason why this type of ration is needed in LG is the competition for space between the fetuses and the digestive tract (rumen) inside the body of the ewe. Since the fetuses grow so much in LG, they reduce the capacity of the rumen. If only roughage is fed, the "fill" of the rumen may be reached before adequate nutrients are consumed. Voluntary feed intake will be reduced and the ewe may not consume enough daily amounts of nutrients (primarily energy) to maximize fetus growth and prevent ketosis.

The greatest demand for daily nutrients occurs during lactation (especially in the first 6 to 8 weeks). Dry matter and energy requirements are 150 to 160% greater than in LG. The daily CP needs are almost doubled. Calcium and P are also increased in lactation. These increases point to the need to feed the highest quality feed in greatest amounts during lactation. To further illustrate how the daily nutrient requirements change

with production stage, the daily TDN needs of the 154-lb ewe are presented in Table 4.

**TABLE 4. DAILY TDN REQUIREMENTS OF 154-LB MATURE EWES IN DIFFERENT STAGES OF PRODUCTION (365 Days)**

Production stage	No. Days	TDN/day(lb)
M	80	1.5
F/B	35	2.3
EG	95	1.7
LG	40	2.8
L (twins)	60	4.0
PW <sup>a</sup>	10	1.4
M	45	1.5

<sup>a</sup>Post-weaning.

The third factor affecting daily nutrient requirements of the ewe is level of production. Maintenance requirements of moderately conditioned ewes will be the same regardless of how their lactation performance was or what their predicted future performance will be. However, if ewes come out of lactation in above moderate condition, their maintenance requirements should be reduced. Conversely, if they are excessively thin, their maintenance requirements may need to be increased to

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prepare for F/B. The success of flushing is dependent on the ewe's condition – especially over conditioned ewes. Efforts to flush ewes that are excessively fat are useless ventures.

If ewes enter EG in optimum condition, daily requirements will be low (Table 2). Whether they are carrying single or multiple fetuses cannot be accurately determined until 60 to 90 d post-breeding. Therefore, requirements will be the same for all ewes in the same body condition in EG.

When the producer predicts (by pregnancy diagnosis or previous record analysis) equal weight ewes are carrying different numbers of fetuses, they should be fed differently because they have different requirements. The TDN values in Table 5 are used as an example to show how nutrient requirements of 154-lb ewes vary depending on the level of performance. A similar table can be constructed for DM, CP, DE, Ca, and P. All requirements (dry matter, energy, CP, Ca, and P) are higher in LG for ewes with higher predicted lambing rates. Likewise, those nursing twins have higher requirements than those with singles.

### Replacement Stock

Nutrient requirements of replacement ewe and ram lambs, from weaning until first breeding, are not clear-cut because the amount of research conducted with replacements has been much less than with mature ewes. Requirements for these young animals are based only on weight (Table 6). Daily gains (ADG) are inversely related to actual weight. Consequently, daily dry matter, energy, and CP requirements of ewe lambs weighing 110 to 154 lb remain relatively constant. Daily requirements for Ca are lower for the heavier ewe lambs.

Daily gains of genetically similar ram lambs should decrease as they increase in weight. This is brought about by holding daily CP intake constant (.54 to .58 lb/hd/d) as dry matter and energy requirements increase with weight. Calcium and P requirements are fairly constant.

Ewe lambs expected to lamb first at 12 to 14 mo of gain steadily, according to the requirements in Table 6, through breeding. Daily nutrient requirements in EG are based on body weight (Table 7). Weight gains should be lower for heavier ewes than for lighter weight ones (assuming all ewes are the same frame size, genetically, etc.). These differences are brought about by holding daily CP and Ca requirements constant, while the dry matter, energy, and P requirements increase linearly.

Requirements in LG are dependent on body weight and lambing rate expected (100 to 120% vs. 130 to 175%). Lactation requirements also vary according to body weight and whether suckling singles or twins. The

**TABLE 5. DAILY TDN REQUIREMENTS OF 154-LB MATURE EWES WITH DIFFERENT LEVELS OF PERFORMANCE-MODERATE CONDITION (LB)**

Production stage	No. days	Expected LR, % <sup>a</sup>		First 60 d lactation	
		130 to 150	180 to 225	Singles	Twins
M	80	1.5	1.5	1.5	1.5
F/B	35	2.3	2.3	2.3	2.3
EG	95	1.7	1.7	1.7	1.7
<b>LG</b>	<b>40</b>	<b>2.3</b>	<b>2.8</b>	---	---
<b>L</b>	<b>60</b>	---	---	<b>3.6</b>	<b>4.0</b>
PW <sup>b</sup>	10	1.4	1.4	1.4	1.4
M	45	1.5	1.5	1.5	1.5

<sup>a</sup>Lambing rate.

<sup>b</sup>Post-weaning.

**TABLE 6. DAILY NUTRIENT REQUIREMENTS OF REPLACEMENT EWE AND RAM LAMBS**

Body weight (lb)	ADG (lb)	DM (lb)	Energy		CP (lb)	Ca (g)	P (g)
			TDN (lb)	DE (Mcal)			
<u>Ewe lambs<sup>a</sup></u>							
66	.50	2.6	1.7	3.4	.41	6.4	2.6
88	.40	3.1	2.0	4.0	.39	5.9	2.6
110	.26	3.3	1.9	3.9	.30	4.8	2.4
132	.22	3.3	1.9	3.9	.30	4.5	2.5
154	.22	3.3	1.9	3.9	.29	4.6	2.8
<u>Ram lambs<sup>a</sup></u>							
88	.73	4.0	2.5	5.0	.54	7.8	3.7
132	.70	5.3	3.4	6.7	.58	8.4	4.2
176	.64	6.2	3.9	7.8	.59	8.5	4.6
220	.55	6.6	4.2	8.4	.58	8.2	4.8

<sup>a</sup>Intended for breeding; thus, maximum weight gains and finish are of secondary importance.

**TABLE 7. DAILY NUTRIENT REQUIREMENTS OF EWE LAMBS IN EARLY GESTATION**

Body weight (lb)	ADG (lb)	DM (lb)	Energy		CP (lb)	Ca (g)	P (g)
			TDN (lb)	DE (Mcal)			
88	.35	3.1	1.8	3.6	.34	5.5	3.0
110	.30	3.3	1.9	3.9	.35	5.2	3.1
132	.30	3.5	2.0	4.1	.35	5.5	3.4
154	.28	3.7	2.2	4.4	.36	5.5	3.7

**TABLE 8. DAILY NUTRIENT REQUIREMENTS OF EARLY-WEANED LAMBS: MODERATE GROWTH POTENTIAL<sup>a</sup>**

Body weight (lb)	ADG (lb)	DM (lb)	Energy		CP (lb)	Ca (g)	P (g)
			TDN (lb)	DE (Mcal)			
22	.44	1.1	.9	1.8	.38	4.0	1.9
44	.55	2.2	1.8	3.5	.37	5.4	2.5
66	.66	2.9	2.2	4.4	.42	6.7	3.2
88	.76	3.3	2.6	5.1	.44	7.7	3.9
110	.66	3.3	2.6	5.1	.40	7.0	3.8

<sup>a</sup>Maximum weight gains expected.

**TABLE 9. DAILY NUTRIENT REQUIREMENTS OF EARLY-WEANED LAMBS: RAPID GROWTH POTENTIAL<sup>a</sup>**

Body weight (lb)	ADG (lb)	DM (lb)	Energy		CP (lb)	Ca (g)	P (g)
			TDN (lb)	DE (Mcal)			
22	.55	1.3	1.1	2.1	.35	4.9	2.2
44	.66	2.6	2.0	4.0	.45	6.5	2.9
66	.72	3.1	2.4	4.8	.48	7.2	3.4
88	.88	3.3	2.5	5.0	.51	8.6	4.3
110	.94	3.7	2.8	5.7	.53	9.4	4.8
132	.77	3.7	2.8	5.7	.53	8.2	4.5

<sup>a</sup>Maximum weight gains expected.

same principle discussed for LG and L requirements of mature ewes (Tables 2, 3, 4) apply to ewe lambs.

A nutritionally critical period for the ewe lamb is immediately after weaning her first set of lambs. Even if fed the highest quality ration possible during L, she will still likely lose up to .25 lb/d of body weight during this period. If she is fed to gain back the weight lost in L, to the point of being in moderate condition when entering the next F/B phase, conception problems may arise, especially if the interval from weaning to F/B is only 2 to 3 months. Although there are no published requirements for this ewe during this interim, experience has taught some producers to feed so she will be in above moderate condition when re-bred to have her second set of lambs at 2 years of age.


### ***Finishing Lambs for Slaughter***

Lambs weaned at 60 days of age and finished for the slaughter market at 4 to 7 months are divided into moderate and rapid growth potential categories. Those with moderate growth potential are usually smaller frame, gain at rates of .4 to .7 lb/hd/d, and should be slaughtered at 100 to 120 lb. Rapid growth potential lambs are large frame, gain from .5 to 1.0 lb/hd/d, and can be slaughtered at 120 to 140 lb.

Daily nutrient requirements of both groups of lambs are based on body weight and expected daily gain and are shown in Tables 8 and 9. All nutrient requirements increase as weight increases to 110 (moderate) and 132 lb (rapid). If lambs are kept beyond these weights, do not increase the supply of daily nutrients. The outcomes of an excessive nutrient supply after attainment of these

weights, include slow gains, poor feed conversion, and excessively finished lambs.

### ***Summary***

The nutrient requirements for sheep consider the class of animal (mature ewe, replacement stock lambs), body weight, stage of production, and level of production. The mature ewe nutrient requirements are greatest during late gestation and lactation. Replacement stock requirements remain relatively high from weaning to first breeding because of the growth requirement. Ewe lambs bred to lamb first at 12 to 14 mo of age require greater amounts of nutrients than mature ewes during early gestation, late gestation, and lactation because of their continual growth plus these productive requirements. Lambs finished for slaughter require increasing amounts of nutrients as weight and gain increase to the point when they can become over-finished. One key to economic efficiency in the sheep business is feeding to meet nutrient requirements. Over or under feeding can result in decreased performance, metabolic disorders, reproductive problems, and reduced net profit. 

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