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Considerations in buying feeds for sheep and goat production

ESGPIP

ETHIOPIA SHEEP AND GOAT PRODUCTIVITY IMPROVEMENT PROGRAM

Further information:

Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP)
Tel. +251 011 416 6962/3
Fax: +251 011 416 6965
E-mail: *pvamrf_ethiopia@ethionet.et*
Website: http://www.esgpip.org

Foreword

This Technical Bulletin titled " *Considerations in buying feeds for sheep and goat production* " is the 39th produced by the Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). The ESGPIP is a USAID funded Project with the objective of improving the productivity of Ethiopia's sheep and goats.

Generally, feed constitutes 60-70% of the production cost of any animal production enterprise. It is, therefore, very important that utmost care be taken in the decisions made regarding the purchase of feeds. This decision can make the difference between profit and loss of an animal production operation.

This technical bulletin presents the points that need to be given due consideration in the purchase of different types of feed. The underlying principles apply to all animal enterprises eventhough the presentation in the bulletin makes reference to sheep and goats.

At this juncture, I would like to thank all those involved in the preparation and review of this technical bulletin.

Desta Hamito (Prof.),
Chief of Party,
ESGPIP
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Considerations in buying feeds for sheep and goat production

Prepared by: Alemu Yami Edited by R.C. Merkel and A.L.Goetsch

1. INTRODUCTION

When buying stock feed, the most obvious information affecting the decision to buy is 'Birr per Kilogram or quintal'. This figure, however, can be misleading. The moisture content of the feed and its nutrient concentration must be taken into consideration to make sense of the price per Kg or quintal. The amount of moisture is accounted for by determining the dry matter percentage (DM %) of the feed, and nutrient concentration should be expressed per kilogram of dry matter for corrrect comparisons of feedstuffs. There are other practical considerations as well. These are presented in detail in this technical bulletin. The information contained in the bulletin can be used by KDAs to advise producers. Private producers can also use the information as a buying guide for their enterprises. Completed examples and exercises are included to assist in understanding the information.

2. THE DECISION TO BUY

The decision to buy or not to buy feedstuffs depends on how much of that feed is available and also on how long that amount can meet the needs of animals on the farm at the prevailing rate of daily consumption. The producer can determine this by taking an inventory of available feed and calculating a feed budget or the feed requirements.

2.1. FEED INVENTORY

Taking a feed inventory establishes the current stock of various feed ingredients available. With inventory management, you can predict how long an ingredient will be available to feed and make adjustments accordingly. If the projected date of feed depletion occurs before a new supply comes in, you need to take appropriate action based on the information. You may consider reducing the rate of consumption so that the feed ingredient lasts longer, purchase more of that feed, substitute an existing feed ingredient into the ration, buy additional feed or a combination of these choices.

The projected time the available feed lasts can be calculated as:

$$\textit{Projected time to depletion} = \frac{\text{Feed Inventory (Kg or Quintals)}}{\text{Consumption Rate}\left(\text{Kg or}\frac{\text{Quintals}}{\text{day}}\right)}$$

For example: If an inventory count indicates that 100 quintals of concentrate feed is available and that the daily consumption rate is 2 quintals; how many days will the available feed last?

$$\textit{Number of days available feed can last} = \frac{100\text{ quintals}}{2\text{ quintals}\frac{\text{fed}}{\text{day}}} = 50\ \textit{days}$$

This means that the available feed will last for 50 days or meets the requirements for 50 days. Decisions on the amount of feed needed to meet feed required at a given consumption rate and the amount of feed that needs to be purchased can be projected as follows:

Inventory (quintals) – (**Consumption Rate** (quintals/day)) X **Time until next supply** (days)

Example: Based on the above example, the available feed covers the requirement for 50 days. How much more feed should a producer buy if the next supply of concentrates is available only after 70 days?

- Available feed (inventory) = 100 quintals
- Consumption rate = 2 quintals/day
- Time until next supply = 70 days

The amount of feed that needs to be purchased to cover the requirements for 70 days can be calculated as follows based on the above formula:

$$\textit{Amount of feed to be purchased} = \mathbf{100q - (2q\ per\ day \times 70days) = -40}q$$

This shows that there is a deficit of 40 quintals that needs to be purchased to fill the gap. ***A negative value means purchase and a positive value means excess.***

If you, according to the results of the calculation, have to purchase feed, you need to proceed as indicated below to optimize your benefits.

2.2. CALCULATING FEED BUDGET (FEED REQUIREMENTS)

In a planned sheep and goat operation, it is possible and useful to calculate a feed budget or total feed requirements for a feeding operation for any length of time. This can be done in many ways. The choice of approach will depend on the circumstances. Some of the approaches are illustrated as follows.

Develop a balanced daily ration for each group of animals. The amount of feedstuffs making up this ration are multiplied by the number of animals to be fed and the number of days these animals are to be fed the ration.

A less complicated approach can be followed to calculate a feed budget for a finishing operation if the total amount of gain and feed requirement per unit of gain are known. This is demonstrated in the following example:

EXAMPLE: In a sheep finishing operation, a farmer wants to finish 100 lambs of 30 Kg average body weight to a finished weight of 50 Kg. The lambs are to be fed a complete ration of the following composition:

Ground native grass hay	20%
Ground corn	65%
Molasses	4%
Noug seed meal	10%
Trace mineralized salt	1%
Total	**100%**

If the farmer knows from experience that an average of 5 Kg of the above ration is required per Kg of gain:

- What is the total quantity of feed and the quantity of each feed ingredient needed for finishing the batch of lambs?
- What will be the cost of feed for the batch if the price of Ground native hay, Ground corn, Molasses, Noug seed meal and Trace mineralized salt is 120, 250, 100, 200 and 400 Birr per quintal, respectively

From the information given, 20 Kg (50 kg – 30 kg) of gain is to be put on each lamb. This is equivalent to 20*100 =2000 Kg of gain for the whole batch.
Five Kg of feed is required for each Kg of gain, which means 10,000 (5*2000) Kg (100 quintals) of feed will be required for the whole operation.

To calculate the requirements of the various ingredients and total feed:

Ground native hay	=	20%*10,000	= 2,000 Kg (20 quintals)
Ground corn	=	65%*10,000	= 6,500 Kg (65 quintals)
Molasses	=	4%*10,000	= 400 Kg (4 quintals)
Noug seed meal	=	10%*10,000	= 1,000 Kg (10 quintals)
Trace mineralized salt	=	1%*10,000	= 100 Kg (1 quintal)
Total feed required			**= 10,000Kg (100 quintals)**

To calculate the cost of the various ingredients and total feed cost:

Feed ingredient	Amount required (q)	Cost (Birr/q)	Total cost (Birr)
Ground native hay	20	120	2,400
Ground corn	65	250	16,250
Molasses	4	100	400
Noug seed meal	10	200	2,000
Trace mineralized salt	1	400	400
Total	**100**		**21,450**

3. CONSIDERATIONS IN BUYING FEED INGREDIENTS

Feed is the major item of expense in animal production, accounting for about 60% of production. It is important to carefully consider cost while buying or selecting feeds. Therefore, successful feed buying requires knowledge of the factors that affect ultimate net returns. Consideration of the following is useful:

- **The nutritive requirements of the animal to be fed:** The buyer needs to have an idea about the nutrient requirement of his/her animals. It should be noted that nutrient requirements of animals are influenced by class of animal age, sex, weight, type of production and environment.

- **Different feeds have different nutrient contents:** Feeds are not always priced in accordance with their nutritive value even though they have different nutrient contents. Some feeds may be cheaper sources of nutrients than other feeds with any set of prices. To compare feeds as economical sources of nutrients, it is not sufficient to compare them in terms of price per kilo or quintal. The best feed to use is the cheapest source of nutrients. Simple comparison of feeds as nutrient sources is presented in section 4.

- **Season of purchase:** Feed ingredient prices are lowest during the harvest season. It is, therefore, advisable to buy ingredients at this time if storage facilities are available.

- **On-farm production versus Purchase:** A question asked often is whether to produce feed (for example hay, corn, etc.) on the farm or to purchase. When making this decision, one should compare the economics of producing the feed on the farm with buying of ingredients. Moreover, there should be an assessment of whether one has the necessary land and other required resources for raising feedstuffs on farm and if these resources are better used for other purposes.

- **Moisture content of feeds:** It is advisable to buy feeds on a moisture-free basis because the moisture content of feedstuff has a lot of significance in the purchase of feed ingredients. Assistance for determining the moisture content of feeds can be obtained from research institutes, universities etc nearby especially if a large consignment is to be purchased. The importance of moisture level can be illustrated by the following example.

  For instance, if Ato Bekele bought 50 quintals (5,000 Kg) of 12% moisture corn and Ato Kebede bought the same quantity of 16% moisture grain from another dealer for the same price, Ato Kebede bought 4% (16-12%) of 5,000 Kg or 200 Kg of water. At whatever price, this means a big loss to Ato Kebede. Under such circumstances, purchases have to either be on dry matter basis or based on a reduction in price proportional to the moisture content. It is therefore, important to note that it is bad business to pay feedstuff prices for water. Section 4.2 presents how to change the expression of the moisture contents of feed ingredients from one basis to another.

  Moisture content is an issue in feed storage. Moisture must be at a sufficiently low level for safe storage of feeds. Excessive moisture is the most important of all the factors that contribute to loss of value in stored feedstuffs. Mould growth in cereals, overheating in hay, etc., are encouraged by excessive moisture. Moisture content in ingredients is, therefore, a factor to monitor closely to avoid storage and handling headaches. A program to ensure that ingredients are adequately dry when they go into storage is essential. It is generally recommended that grains should be below 14% moisture and loose hay below 25% moisture for safe storage.

  Storage and handling concerns often are time dependent. Feeding value is reduced proportional to length of storage. Potential for development of mould, insect problems, loss of vitamin potency, etc., is greatly limited if turnover of ingredients is fast enough.

- **Transportation costs:** Transportation costs can account for a large proportion of feed costs. The cost of transportation is determined by distance, bulkiness, and ease of handling. For instance, one can transport baled hay at a lower cost than loose hay. Certain feeds like molasses require special containers for transportation.

- **Available storage:** Storage is one of the important factors that needs serious consideration in the purchase of feeds. The volume of available storage space determines the amount of feed that can be purchased at any one time. It also determines the form of a feed purchased among a set of choices. For example, one should go for baled hay rather than loose hay if there is limited storage space.

- **Additional processing requirement:** Certain feeds may require further processing before use. The producer needs to take the access to such facilities and the added cost of processing after purchase into account while buying.

4. COMPARISON OF FEEDS FOR PURCHASE

4.1. Comparison based on nutritional value

Feeds are not always priced according to their nutritional value. Some feeds may be cheaper sources of nutrients than other feeds. To compare feeds as economical sources of nutrients, it is not sufficient to compare them in terms of price per kilo or quintal since different feeds have different nutrient contents. The best feed to use is the feed that gives the best value for money. To determine this, a producer must calculate the cost of the feed per unit of nutrient provided.

High-energy feeds are usually compared on the basis of the cost per unit of energy, usually expressed as Total Digestible Nutrients (TDN) per Kg. High protein feeds are usually compared based on the cost per Kg of either total protein or digestible protein. For example, shelled corn, sorghum grain and barley grain could be compared as sources of TDN as shown in Table 1, with prices of sorghum, corn and barley listed as 330, 350, 400 Birr/quintal and of TDN as 78, 85, 73% (kg TDN per quintal), respectively:

Table 1. Comparison of grains as sources of TDN.

INGREDIENT	PRICE per Quintal (Birr) - (A)	Kg TDN per Quintal (or % TDN)-(B)	COST /Kg TDN (Birr) - (A/B)	Rank
Sorghum	330	78	4.23	2
corn	350	85	4.12	1
Barley	400	73	5.48	3

Corn will be the best buy according to the above calculation since it is the lowest in cost per kg of TDN; it would be the cheapest (Rank 1) source of energy at the prevailing set of prices. Note that this is despite the higher cost of corn/quintal (350 Birr) compared, for example, to sorghum (330 Birr). Sorghum would be second choice and barley the third.

The following should be noted when using this comparison:

- Care should be exercised in establishing the prevailing price. One should make sure that the price used is corrected to include all costs to the buyer's farm;
- The feeds are in comparable physical form, i.e., not requiring additional cost of processing. If so, this needs to be included in the cost;

- The composition of the feeds that should be expressed on the same basis, i.e., "moisture-free basis" for fair comparison. This is treated in more detail in section 4.2.

For feeds that are intermediate in protein and energy content between that of high protein feeds, on the one hand, and high energy feeds, on the other, the above procedure will not suffice. For such feeds, a more complicated method known as the "Peterson method" of evaluating feeds is recommended. In the Peterson method, appropriate weight is given to both the protein and energy contents of a feed in establishing feeding value. This method is beyond the scope of this technical bulletin and, thus, not discussed.

The principle of evaluating feeds using the cost per unit of nutrient can also be used for nutrients other than energy and protein. For instance, let us assume that the main need is for phosphorus and that we wish to compare mineral sources 'x' and 'y'. Brand 'x' contains 12% P and costs 35.00 Birr/Kg, whereas brand 'y' contains 10% P and costs 32.00 Birr/Kg. Based on this information, one can compare the worth of the two sources as follows:

Brand "X" contains 12% P and costs 35.00 Birr/kg.

1,000 g of product contains 12/100=120 g of P, which costs 35.00 Birr
cost of P/g is, therefore, 35.00/120 = **0.29 Birr**

Similarly, for brand "Y": -

1,000 g of product contains 10/100=100 g of P, which costs 32.00 Birr
Cost of P/g would be 32.00/100 = **0.32 Birr**

Hence, brand "X" is the better buy even though it costs more per ton.

4.2. Monetary Valuation of Common Feedstuffs:

A comparative monetary value of some common feedstuffs can be obtained by using the factors in Appendix Table 1. The feed evaluation factors consider energy and protein from corn and soybean meal for all feeds and fiber from alfalfa hay for forages as standards. To obtain an estimated monetary value of a feed on the list:

1. Multiply the current price of corn (Birr/quintal) by the evaluation factor for the feed listed in the corn column.

2. Multiply the current price of soybean meal (Birr/quintal) by the evaluation factor for the feed listed in the soybean meal column.

3. If the feed to be evaluated is a forage, multiply the price for alfalfa hay (Birr/quintal) containing approximately 16 percent CP and 38 percent ADF by the factor listed in the alfalfa hay column.

4. Add figures from 1 and 2 or 1, 2 and 3 (for forages). All Birr values will be on an as-fed or wet basis.

Example —Corn silage, well eared

Shelled corn = Birr 350/quintal

Soybean meal = Birr 550/quintal
Alfalfa hay = Birr 100/quintal

Corn silage, Birr/quintal = (.190 x 350) + (-.059 x 550) + (.262 x 100) = Birr 60.25 @ 35% DM

Example —Sunflower meal (28% CP)

Shelled corn = Birr 350/quintal
Soybean meal = Birr 550/quintal

Sunflower meal, Birr/quintal = (-.325 x = Birr 350) + (.638 x = Birr 550) = Birr 237.15 @ 90% DM

4.3. Need for comparison on the same basis

Nutrient content of feeds in different feed composition tables may be expressed on an *"as-fed"*, *"air-dry"*, "*moisture-free"*, or *"100% dry matter"* basis. In ration formulation, the simplest approach to avoid errors and make life easy is to convert the compositions of feeds of various moisture contents to a 100% dry matter (moisture-free) basis. Conversion table for feeds of various moisture contents to a 100% dry matter (moisture-free) basis is presented in Appendix Table 2.

The dry matter composition of feeds is very variable. This makes it very difficult to compare the nutritive value of feeds unless they are expressed on the same moisture (DM) basis.

The usual practice is to express feed composition as percent of the DM to have a common benchmark for comparison of different sources of nutrients.

The significance of the water content of feeds while expressing the nutrient composition of feeds is obvious. Using TDN as a measure of energy value, some of the high-energy tubers show almost the same feeding value per unit of their dry matter content as the cereal grains.

TABLE 2. TDN content of feeds on as-fed and moisture free basis

Feed	Water%	DM%	Energy content (TDN%)	
			AS-FED	DM BASIS
Corn, grain	10	90	80	90
Barley, grain	10	90	77	85
Melons, whole	94	6	5	80
Potatoes, tubers	79	21	18	85

As shown in the table above, dry matter becomes a common denominator for the comparison of nutrient composition of feeds. Generally, composition figures expressed in one of the bases (e.g., moisture-free) can be converted to the other (as-fed) or vice versa by using the following relationship: -

$$\frac{\text{\% of any component in a feed on as-fed basis}}{\text{\% of DM in the feed on as-fed basis}} = \frac{\text{\% of the component in the feed on moisture-free basis}}{\text{\% DM in that feed on moisture -free basis}}$$

Example: What will the crude protein content of Noug meal on dry matter basis be if it contains 32% CP and 90% dry matter on as-fed basis? Using the above formula;

$$\frac{32}{90} = \frac{X}{100}$$

$\Rightarrow$ 90 X =32*100
$\Rightarrow$ 90 x = 3200
$\Rightarrow$ **X = 35.6% (Crude protein on DM basis)**

Alternatively, the conversion table in the Appendix (Table 2) can be used. As indicated in the table, to convert the nutrient composition of 10% moisture feed to a 100% DM (moisture-free) basis, the multiplier is 1.1111. (Conversion factor = 100 / % DM as fed basis)

Therefore, using this factor in our example should give the same result: -

32*1.1111 = 35.5552
= **35.6%**

5. APPENDIX

Appendix Table 1. Feed evaluation factors for estimating monetary value of feeds based on energy (corn), protein (soybean meal) and fiber (alfalfa hay) prices on as-fed or wet basis

Feed	DM	FACTORS		
		Soybean meal	Corn	Alfalfa hay
DRY FORAGES:				
Alfalfa – medium quality hay	89	-0.071	-0.080	1.146
Corn - cobs	90	-0.279	0.149	0.982
stover	87	-0.276	0.079	1.059
Oat hay - mature	91	-0.187	0.221	0.912
Rhodes grass - average	89	-0.168	0.038	1.127
Sudan grass - dough	89	-0.174	0.046	1.141
Soybean stover	88	-0.365	-0.147	1.498
Straw - oat/wheat	89	-0.355	-0.066	1.400
Clover hay	87	-0.001	-0.063	0.880
SILAGES:				
Corn - few ears	35	-0.050	0.113	0.282
stunted	35	-0.046	0.091	0.282
GRAINS & BYPRODUCTS:				
Brewers grains - dry	92	0.473	0.324	
wet	24	0.123	0.085	
Corn, shelled	89	0.000	1.000	
Corn, ear	87	-0.001	0.882	
Corn screenings	90	0.184	0.700	
Cottonseed meal	93	0.949	-0.042	
Distillers - dry gr/sol.	92	0.514	0.531	
Linseed meal	91	0.773	0.122	
Molasses, cane - wet	75	-0.085	0.761	
Oats	89	0.110	0.751	
Sorghum/milo	88	0.068	0.847	
Soybean hulls	91	0.081	0.821	
Soybean meal - 44%	89	1.000	0.000	
Sunflower meal - 28%	93	0.638	-0.325	
Wheat - grain	89	0.110	0.849	
bran	89	0.239	0.603	
middlings	90	0.251	0.667	

Appendix Table 2. Conversion table for feeds of various moisture contents to the amount of the feed that needs to be offered to supply 1 Kg of dry matter

Moisture (%)	Dry Matter %	Offer in KG to supply 1Kg of dry matter	Moisture (%)	Dry Matter %	Offer in KG to supply 1Kg of dry matter	Moisture (%)	Dry Matter %	Offer in KG to supply 1Kg of dry matter
0	100	1.000	29	71	1.408	58	42	2.381
1	99	1.010	30	70	1.429	59	41	2.439
2	98	1.020	31	69	1.449	60	40	2.500
3	97	1.031	32	68	1.471	61	39	2.564
4	96	1.042	33	67	1.493	62	38	2.632
5	95	1.053	34	66	1.515	63	37	2.702
6	94	1.064	35	65	1.538	64	36	2.778
7	93	1.075	36	64	1.563	65	35	2.857
8	92	1.087	37	63	1.587	66	34	2.941
9	91	1.090	38	62	1.613	67	33	3.030
10	90	1.111	39	61	1.639	68	32	3.125
11	89	1.124	40	60	1.667	69	31	3.226
12	88	1.136	41	59	1.695	70	30	3.333
13	87	1.150	42	58	1.724	71	29	3.448
14	86	1.163	43	57	1.754	72	28	3.571
15	85	1.177	44	56	1.786	73	27	3.704
16	84	1.190	45	55	1.818	74	26	3.846
17	83	1.205	46	54	1.852	75	25	4.000
18	82	1.220	47	53	1.887	76	24	4.167
19	81	1.235	48	52	1.923	77	23	4.348
20	80	1.250	49	51	1.961	78	22	4.545
21	79	1.266	50	50	2.000	79	21	4.762
22	78	1.282	51	49	2.041	80	20	5.000
23	77	1.299	52	48	2.083	81	19	5.263
24	76	1.316	53	47	2.128	82	18	5.556
25	75	1.333	54	46	2.174	83	17	5.882
26	74	1.351	55	45	2.222	84	16	6.250
27	73	1.370	56	44	2.273	85	15	6.667
28	72	1.389	57	43	2.326			