



Sheep Fattening: A Training Manual for Livestock Farmers and Extension Workers in Ethiopia

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Cover photo: Rams feeding on the native forage, *Brugmansia suaveolens* in Bonga, Ethiopia @Bonga/Muluken Zeleke

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1. Introduction

Sheep fattening has long been a practice in Ethiopia specifically geared towards demand, which typically increases during festive seasons. It is considered to be low-risk and more profitable than rearing large ruminants. The traditional sheep fattening cycle can last six months or more. Farmers attribute the long fattening period to a lack of sufficient and high-quality forage, poor management due to a lack of skills and knowledge of improved fattening practices, and complementary feeding methods. Therefore, the improvement of the feed and nutritional aspects of the small ruminant value chain became one of the core intervention areas of the

International Center for Agricultural Research in Dry areas, ICARDA. The focus is on market-oriented sheep fattening, under a semi-intensive system, which includes short-term intensive feeding of rams with formulations partly from locally available feed sources and partly grazed, before they are sold.

This manual provides simple and tested practical guidelines for sheep fatteners and extension workers in Ethiopia. It contains information on feeds and feeding management options that can be applied by small-scale producers and extension workers.



Session 1. Getting Started with Sheep Fattening

Session objective

This session aims to provide sheep fatteners with introductory information about sheep fattening and its importance. In this session, trainees will address the concept of sheep fattening, its features and importance.

After this learning session, trainees will be able to:

- Define sheep fattening.
- Determine the importance of sheep fattening to smallholder livelihoods.

Pre and post evaluation questions:

1. What are the key aspects of sheep fattening?
2. How does sheep fattening compare to fattening other livestock?

What is sheep fattening?

Sheep fattening is described as the feeding of nutrient-rich feed to stimulate rapid growth and fat deposition for targeted carcass growth and quality. A sheep fattening program aims to achieve the highest growth rate and carcass yield in the shortest possible time (75-90 days) and to increase production per unit of resource. Sheep fattening has proven to be profitable as it has relatively lower investment costs compared to that of larger ruminants, has faster economic returns, has reduced associated risks and allows the business to expand rapidly.



Session 2. Selection of Sheep for Fattening

Session objective

In sheep fattening, the selection of rams is important to achieve high performance, productivity and profit. In this session, the trainees are given knowledge and skills on the criteria to be used when selecting the ram.

After this session, the trainees will be able to:

- Understand the importance of selection.
- Identify the characteristics to look for when selecting fattening sheep.
- Become familiar with age determination of sheep.

Pre and post evaluation questions:

1. Why is it important to select rams for fattening?
2. What criteria is used to select sheep for fattening?
3. How do you determine age of sheep?

Figure 1. Sheep of different ages.



8 months



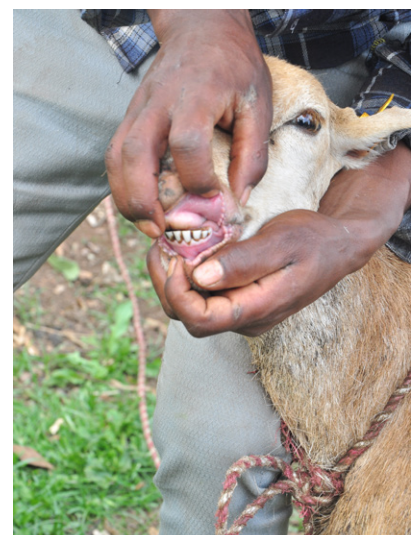
1.5 years



2 years



3 years



4 years

Selection criteria of sheep for fattening

Age: In Ethiopia, there is no uniform age for sheep fattening due to breed differences. However, to meet market demand, it is advisable to select sheep for fattening between 4 and 12 months, depending on the breed. At this age, weight gain capacity and feed conversion ratio are very high. Daily weight gain and feed efficiency deteriorate in older animals, making fattening uneconomical. A sheep's dentition is a good indicator of its age (Figure 1).

Health status: When buying a ram, one should examine the animal closely, without disturbing it, to observe its behavior. These include restlessness, alertness, aggressiveness, tremors, breathing condition (normal or stressed), and normal movement. A closer examination of the nose (to check for discharge), mouth (to check for bad breath, abnormal salivation, ulcers around the

lips, gums, tongue), and eyes (to check for discharge). The skin should be examined for spots or swelling. Rams in poor health due to illness or stunted growth due to malnutrition prior to weaning will perform comparatively poorly. Weak, emaciated, undersized, underweight, sick and physically deformed ram lambs should not be selected for fattening.

Body condition: The weight of sheep does not always reflect their condition, i.e. a large-build animal may have a higher body weight with low body reserves than another animal with a small build but plenty of reserves. Very thin/emaciated and fat/larger rams should be avoided. Rams with average body condition (neither emaciated nor greasy) are preferable, because they respond faster to feeding and achieve better yields within a short period of time than fat rams that are already well nourished. Assessing the condition of a sheep can be done simply visually or by touching the body parts in the lumbar area, rib cage and sternum. Very thin and emaciated animals often take a long time to recover. It is not recommended to buy a ram intended for fattening that weighs less than 15kg.

Breed: The selection of breed types for fattening is mainly based on the breed available in a particular location. This applies to rural smallholders, small-town, suburban and cooperative sheep fatteners. Many lack knowledge of breeds from other regions. There is currently no breed in Ethiopia that is preferred nationwide due to its superior value in terms of performance, quality traits or fattening potential.

Color: Choose white or two-tone coated sheep. Black coat color is not preferred by consumers in most parts of the country, so profit margins may drop.

Sex: Males are mainly used for fattening and are preferred for religious purposes. Females are mostly kept for reproduction.



Session 3. Management of Sheep Under Fattening

Session objective

The aim of this session is to highlight some of the husbandry practices that are used in sheep fattening. This section provides trainees with an understanding of good husbandry practices that should be followed for a successful fattening operation. These include deworming, vaccination, castration, housing, disease control and management as they have implications for sheep fattening.

At the end of this learning session, trainees will be able to:

- Identify husbandry practices used in sheep fattening.
- Understand the importance and methods of quarantine, deworming and vaccination.
- Understand castration and its importance.

Pre and post evaluation questions:

1. What are the major husbandry practices in sheep fattening?
2. What is the importance of quarantining sheep for fattening?
3. Why should we deworm and vaccinate fattening rams?
4. What are the advantages of castration?
5. What are methods of disease control, prevention and monitoring?
6. What are the most common diseases in sheep fattening?

Husbandry practice of fattening sheep

After fattening rams are selected and purchased, it is important to understand the following management practices.

Quarantine: Newly purchased rams should be kept separate for a few days to identify diseases that were not obvious at purchase. If symptoms appear during this time, it is important to treat them as soon as possible.

Deworming and Vaccination

Deworming: In sheep fattening, the infestation with roundworms, tapeworms and lungworms can lead to considerable financial losses, so deworming should

always be carried out at the beginning of the fattening period. The commonly used drugs for deworming include the following:

Albendazole: a broad-spectrum dewormer, used for the removal and control of tapeworms, stomach worms (including 4th stage inhibited larvae of *Ostertagia ostertagi*), intestinal worms, and lungworms in sheep.

Ivermectin: is used for the treatment of infections and infestations due to gastrointestinal roundworms, lungworms, grubs and external parasites like sucking lice and mange mites.

Fasinex (Triclabendazole): a narrow spectrum benzimidazole with highly flukicidal efficacy. It is highly effective against adults of the common liver fluke (*Fasciola hepatica*) as well as all immature stages, i.e. *early immature larvae* (1 to 6 weeks old) and *immature larvae* (6 to 9 weeks old). It is the only flukicide effective against all early immature liver fluke larvae. Efficacy against these early immature larvae is important because these larvae cause significant damage to liver tissue as they migrate to the bile ducts.

Resistance to dewormers is a growing problem for the sheep industry and as dewormers lose their effectiveness, there are fears that economic losses due



to parasitic infections will increase. Therefore, rational use of anthelmintics is required to prevent further increases in resistance.

Vaccination: It is one of the most effective means of controlling diseases on the farm. Vaccination schedules can be determined in consultation with the local veterinarian based on the threat of diseases in an area, season or part of the year when fattening a flock of sheep. Sheep are often vaccinated against *Pasteuriosis*, *Pleuropneumonia* and *Anthrax*. Multi-vitamin injections are important because they contains a wide array of trace elements and vitamins. They are consist of Vitamin A, Vitamin D3, Vitamin E, Vitamin B1, Vitamin B2, Vitamin B6, Nicotinamide, Pantothenol and Vitamin B12.

Disease management: A disease plan includes the following practices:

Sheep monitoring and record keeping: As a sheep fattener, it is recommended that you regularly inspect your sheep for any signs of disease or abnormalities so that you can maximize the health and productivity of your business. When examining sheep, look for normal sheep behavior (alertness, freedom of movement, and active eating and ruminating) as well as abnormal sheep behavior and signs of illness (lameness due to infected feet, abscesses, wounds or injuries, abnormal posture or behavior,



diarrhea, persistent cough, rapid weight loss and loss of appetite). In addition to inspection, it is important to document general health information such as type of illness, date and type of treatment, type and amount of medication.

Prevention and Control: Sheep fatteners are encouraged to follow the Ethiopian treatment calendar. The treatment calendar for the Small Ruminant Value Chain Sites of Menz, Bonga and Doyogena is outlined in Table 1.

Castration: This is the removal of testicles from the rams to make them docile so that they can grow faster

Table 1. Ethiopian treatment calendar for the Small Ruminant Value Chain sites.

Herd health interventions	Menz	Doyogena	Bonga
Deworming small ruminants for gastrointestinal (GI) parasites and lungworms	October, January, February, June	October, January, February, June	October, March, June
Training farmers on control of GI parasitosis	September, November, December	December, January, April	December, May
Vaccination for ovine pasteurellosis	October, March/April	February, August	November, April
Vaccination for PPR	September, October, November	December	December
Vaccination for sheep pox	September, October	April	April
Training farmers on control of sheep respiratory diseases	March	December, May	March

and thicker. When fattening, faster weight gain and fat accumulation is important, as the animals are not used for mating. When castrating rams, it is important to use modern methods such as burdizzo with the help of veterinarians. Some farmers use traditional methods, such as crushing the testicles with stones. This can cause serious damage to the testicle and can lead to death of the ram.

To avoid unnecessary breeding, it is recommended to castrate ram lambs earlier than 3 weeks of birth. However, farmers castrate at 9-15 months, due to prevailing myths that castration at an early age inhibits growth of the animal. These myths should be discouraged.

Housing System: Being social animals, sheep must always be transported and housed in groups or at least in pairs so that they can always see a different sheep. Without this social contact, sheep can quickly become agitated and distressed. If necessary, sheep can be kept in front of a full-length mirror for short periods of time in order to avoid isolation stress, but it is important to emphasize that this is only a short-term (hours maximum) solution. It is advisable to house fattening rams separately from other sheep. In general, the purpose of housing includes protection from climatic stresses (extreme heat, cold, rain, wind, etc.), thereby creating an environment suitable for the physiological condition of the animals; It protects against losses from predators and theft; and facilitates management and saves labor. To avoid additional costs, the barn/shed can be built with locally available materials (wood, clay). It should be kept clean, well ventilated (to remove heat, moisture and pollutants so that animals stay cool, dry and clean) and disinfected regularly. In the fattening operation, animals should efficiently convert the feed so as to the market weight. Therefore, shelters should prevent unnecessary movements of the animals during the fattening period and allow them only limited movements. The space requirement per animal is approximately 2 m².

Further reading:

Mekonnen, M., Assefa, A., Nane, T., Ayele, F., Arke, A., Elias, B. and Wieland, B. 2019. Small ruminant health intervention calendar in Ethiopia. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/107144>



Session 4. Feed and Nutrition for Fattening Sheep

Session objective

Feed is the main limiting factor in sheep fattening. Feed availability (quantity), nutritional value (quality) and price should all be considered to meet the maintenance and production requirements of sheep. As a sheep fatterer, you have to be aware of what, how and when to feed fattening sheep. This session aims to provide important information on the nutritional needs of fattening sheep.

At the end of this learning session, trainees will be able to:

- Understand the meaning of nutrition.
- Become familiar with nutritional requirements of sheep.
- Identify feed resources for sheep fattening.
- Learn about improved forage production systems.

Pre and post evaluation questions:

1. What is nutrition?
2. What are the nutritional requirements of fattening sheep?
3. What are the available feed resources for sheep fattening?
4. What is the best feeding method for sheep fattening?
5. What are the types of improved forage production systems?

Part 1. Nutritional requirement of fattening sheep

Nutrition is the process of providing feed necessary for the health and growth of sheep. It plays a major role in the overall productivity, health and wellbeing of fattening sheep, so it is important that sheep fatterers give nutritional management the highest priority. There are five main categories of nutrients required by sheep. These are water, energy, protein, vitamins and minerals.

Water: Water is a major component of the body of animals and is affected by several factors such as species, age, and dietary conditions that affect the amount in the body. Animals are more sensitive to lack of water than to food. If the water intake is restricted, the first sign is reduced feed intake. When water intake is severely restricted, weight loss is rapid, and the body becomes dehydrated. Dehydration with a 10 percent

loss is considered severe. Water quality is extremely important and can affect feed intake and animal health. Poor quality water usually results in lower water and feed consumption. The three sources of water are drinking water, water contained in food, and metabolic water.

Energy: Lack of energy (total digestible nutrients, TDN) is the most common deficiency in fattening animals. Carbohydrates are the major source of energy. If the TDN of fattening rams is below their requirement, they use the available energy for maintenance at the expense of growth and mutton production. It is therefore important to provide enough energy to obtain maximum production through fattening. Common and economical sources of energy are wheat bran, maize bran, oat grain and enset leaves.

Protein: When an animal is deprived of energy, a lack of protein in its diet makes the condition worse. Rams need a high amount of protein for their normal growth and maintenance. In addition to the basic requirement of 7%, they require an additional amount in the ration for optimal meat production. It is the total amount of protein that matters, not the source. This is because rams have microorganisms in their rumen that supply most of the amino acids they need. The protein requirement is calculated based on the digestible protein (DP). Table 2a shows the contribution of various feed resources to dietary protein in selected locations along the Ethiopian small ruminant value chain. The extent of protein supplementation beyond the existing availability is, therefore, site specific.

Urea is very rich in synthetic protein and can be safely used in fixed amounts to feed ruminants. Urea should only be added to the concentrate if the digestive protein does not meet the requirements of the ram. The amount added via concentrated feed should never exceed 1.5% (15 g) of the daily ration. Dissolve urea completely in clear water first, and then soak the premixed concentrate in urea water. Never mix urea into molasses as mixing by hand will never make a correct molasses/urea mixture. Mixing by hand is a common cause of urea poisoning in rams.

Figure 2. The contribution of feed resources to metabolizable energy content of diets in Doyogena (a) and Menz (b).

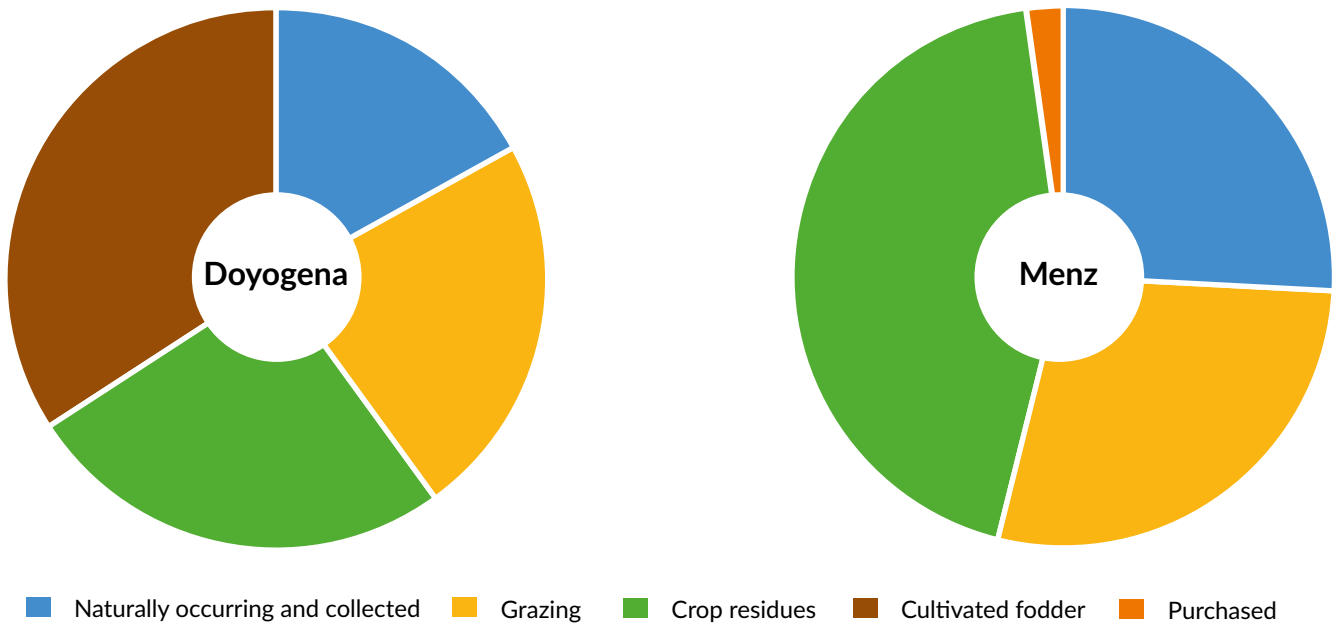
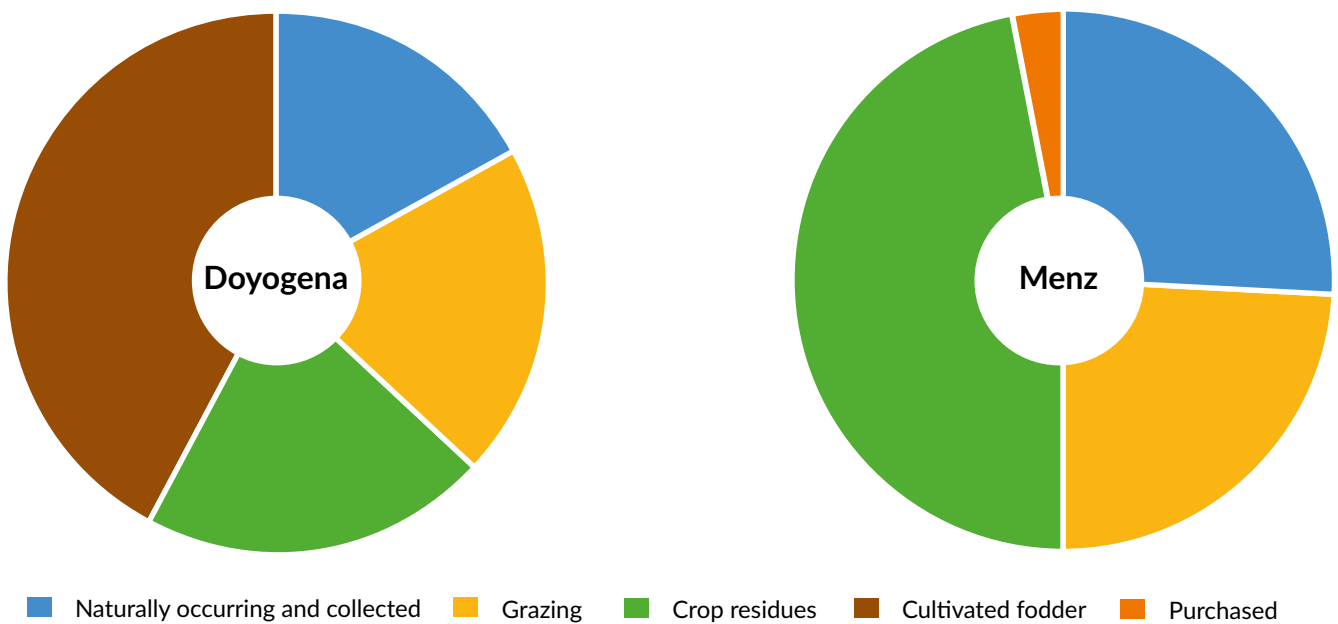


Figure 3. The contribution of feed resources to total crude protein content of diets in Doyogena (a) and Menz (b).



Proportion between digestible protein and total digestible nutrients:

The daily requirement of TDN for fattening rams is approximately 3-4% of their body weight. The proportion between the daily requirement for DP and TDN is about 1:4-4.5. A narrower proportion of DP:TDN does not increase meat/mutton production, but instead the surplus of protein supply is wasted by conversion to carbohydrates or excretion into urea.

Fibre should also be considered in the diet. Large amounts of straw or hay lead to fast satiation and consequently

decrease the intake of nutritive substances via concentrates.

Minerals: Calcium (Ca) and phosphorous (P) are the most important minerals for fattening rams. They are responsible for many metabolic functions of the animal. They are stored in bones and teeth where they can be withdrawn if needed. At least 5-8% P and 10% Ca can be added as mineral supplements. The desired proportion of Ca:P in fattening rations is 1.5:2.1. Improper ratios can lead to formation of bladder stones. Deficiency of Ca and P lead to stiff joints, weakened

bones and teeth, impaired energy utilization, reduced feed intake, low weight gain, chewing of wood, metal and wool.

Sodium (Na) and chlorine (Cl) are essential in semi-intensive fattening systems especially on poor natural pastures. Na and Cl are needed in quantity higher than available in most feed rations, therefore salt licks offered *ad libitum* are recommended. Signs of deficiency of Na and Cl include continuous shivering and a wavering walk, no appetite, reduced weight gain, rough and loose stool, and chewing of metal, wood and wool.

Most other minerals are available in sufficient quantities in feed rations.

Vitamins: The three main vitamins A, S and E are required in sufficient quantities. They are usually available in green fodder/grasses. If green fodder is not available, vitamins A, D and E must be mixed in the concentrate ration. Signs of Vitamin A, D, E deficiency include coughing, nasal discharge, watery eyes, scaly skin, pneumonia, diarrhea and staggering gait.

Tables 2a and 2b show a guide for nutrient requirements of rams in tropical environments.

Part 2. Feed stuffs

The performance in ram fattening is based on the maximum daily weight gain from feeding the least cost ration according to nutritional requirements of the ram. Apart from being adequate in amount and composition to meet requirements for protein and energy, feed for sheep should also satisfy a set of interrelated behavioural and physiological factors. Ruminants have cyclical activities geared towards water and feed needs, as well as rest periods necessary for rumination and digestion processes. Sheep exhibit an impressive array of behavioural adaptations to their herbivorous mode of life. The major sources of feed for fattening sheep are roughages, agro-industrial by-products, local brewery by-products, household food leftovers and screenings from cereals.

Roughages: These are bulky feeds containing relatively large amounts of indigestible material, that is, more than 18% crude fiber. They can be of two categories, namely dry and succulent based on their moisture content.

The common roughages for fattening sheep are natural pasture, crop residues, green forage chops and hay. The level and utilization of these roughages vary depending on the localities, crops grown in the area and availability. Crop residues are fibrous materials that are by-products of crop cultivation. Crop residues have low crude protein content in the range of 3–13% of the dry matter. Crop residues are becoming increasingly important as sources of roughage in feedlots. Major field crops produce large quantities of crop residues (straws, stovers and haulms) in addition to grain. These include cereal straws (e.g. straws of tef, wheat, barley, maize, sorghum), grain legume haulms of (e.g. haricot beans, field peas, chickpeas, lentils, groundnut etc.).

Concentrates: A feed or feed mixture which has high amounts of protein, carbohydrates and fat, contains less than 18% crude fiber and is usually low in moisture. Concentrates are rich in either energy or protein and are thus expensive. Agro-industrial by-products result from the processing of agricultural produce such as wheat bran, oilseeds (cotton seed cake, noug cake), sugarcane and citrus. Compared to crop residues, these products are very good in terms of their composition of useful nutrients and digestibility. The feeding value of such by-products varies considerably. A concentrate feed mixture should not contain ingredients which are too ground, as they lead to a low feed intake by lambs. A typical concentrate mixture suitable for fattening rams weighing between 10-45kg should contain the following:

Dry matter: 80-90%
 Digestible protein: 14-16%
 Total digestible nutrients (TDN): 63-75%
 Calcium: 0.7-0.8%
 Phosphorus: 0.5-0.6%

Forages: Overgrazing of native pastures is one of the most serious problems in Ethiopia's livestock farming. Pastures become so intensively grazed that plant vigor declines and the less productive and less palatable species begin to dominate. Soil erosion and reduced soil fertility are the result.

Backyard cultivated forages: Backyard forage production is the cultivation of forage in home enclosures. Forage plots or hedges in farmhouse backyards are an easy and quick way to increase forage production. Backyard soil fertility is usually high, so forage plots can be very productive. The feed is produced near where the animals

Table 2a. Daily nutrient requirement of rams 5-30kg for maintenance and growth.

Body weight (kg)	Gain or loss (kg)	Dry matter intake (kg)	% live weight	Diet density (Mcal/kg)	Energy (Mcal)	TDN (kg)	FU (kg)	Protein Total (g)	Digestible (g)	Calcium (g)	Phosphorus (g)	Vitamin A (1000 IU)	Vitamin D (IU)
5	50	0.10	2.0	4.3	0.44	0.12	0.15	36	29	1.8	1.3	0.50	35
	100	0.12	2.3	4.3	0.50	0.14	0.18	45	36	1.8	1.3	0.50	35
	150	0.13	2.7	4.3	0.57	0.15	0.20	48	38	1.9	1.3	0.50	35
	200	0.15	3.0	4.3	0.64	0.17	0.22	54	43	1.9	1.3	0.50	35
	250	0.16	3.2	4.3	0.69	0.19	0.24	58	46	2.0	1.4	0.50	35
	300	0.18	3.6	4.3	0.77	0.21	0.27	65	52	2.0	1.4	0.50	35
10	50	0.18	1.8	4.0	0.73	0.20	0.26	61	49	2.1	1.5	0.85	67
	100	0.21	2.1	4.0	0.84	0.23	0.30	70	56	2.1	1.5	0.85	67
	150	0.24	2.4	4.0	0.96	0.27	0.34	80	64	2.2	1.5	0.85	67
	200	0.27	2.7	4.0	1.07	0.30	0.38	90	72	2.3	1.6	0.85	67
	250	0.30	3.0	4.0	1.18	0.33	0.42	99	79	2.4	1.7	0.85	67
	300	0.32	3.2	4.0	1.20	0.36	0.46	108	86	2.5	1.7	0.85	67
15	50	0.26	1.7	3.8	0.99	0.27	0.35	82	66	2.6	1.8	1.28	98
	100	0.30	2.0	3.8	1.14	0.31	0.40	95	76	2.7	1.8	1.28	98
	150	0.34	2.3	3.8	1.30	0.36	0.46	109	87	2.7	1.9	1.28	98
	200	0.38	2.5	3.8	1.45	0.40	0.51	121	97	2.8	2.0	1.28	98

Body weight (kg)	Gain or loss (kg)	Dry matter intake (kg)	% live weight	Diet density (Mcal/kg)	Energy		Protein		Calcium (g)	Phosphorus (g)	Vitamin A (1000 IU)	Vitamin D (IU)
					ME (Mcal)	TDN (kg)	FU (kg)	Total (g)				
250	0.42	2.8	3.8	1.60	0.44	0.57	134	107	2.9	2.0	1.28	98
300	0.46	3.1	3.8	1.75	0.48	0.62	146	117	3.0	2.1	1.28	98
20	100	0.41	2.0	1.42	0.39	0.50	119	95	3.1	2.2	1.70	133
150	0.46	2.3	3.5	1.61	0.44	0.57	135	108	3.2	2.2	1.70	133
200	0.51	2.6	3.5	1.80	0.50	0.64	150	120	3.4	2.4	1.70	133
250	0.57	2.8	3.5	1.99	0.55	0.71	166	133	3.5	2.4	1.70	133
300	0.62	3.1	3.5	2.18	0.60	0.77	182	146	3.6	2.5	1.70	133
25	100	0.47	1.9	1.47	0.41	0.52	122	98	4.0	2.8	2.12	168
150	0.55	2.2	3.1	1.69	0.47	0.60	141	113	4.0	2.8	2.12	168
200	0.62	2.5	3.1	1.91	0.53	0.68	160	128	4.1	2.8	2.12	168
250	0.69	2.8	3.1	2.14	0.59	0.76	179	143	4.2	2.9	2.12	168
300	0.76	3.0	3.1	2.36	0.65	0.84	198	158	4.3	3.0	2.12	168
30	100	0.64	2.1	1.92	0.53	0.68	161	129	4.6	3.2	2.55	200
150	0.73	2.4	3.0	2.18	0.60	0.77	182	146	4.7	3.2	2.55	200
200	0.81	2.7	3.0	2.44	0.67	0.87	204	163	4.8	3.3	2.55	200
250	0.90	3.0	3.0	2.69	0.74	0.95	225	180	4.9	3.3	2.55	200
300	0.98	3.3	3.0	2.95	0.81	1.05	248	198	5.0	3.3	2.55	200

Note: Mcal, megacalorie; ME, metabolizable energy; TDN, total digestible nutrients; FU, feed units; IU, International unit. Source: Kearl, 1982.

Table 2b. Daily nutrient requirement of rams 30-90kg for maintenance and growth.

Body weight (kg)	Gain or loss (kg)	Dry matter intake (kg)	% live weight	Diet density (Mcal/kg)	Energy (Mcal)	TDN (kg)	FU (kg)	Protein Total (g)	Digestible (g)	Calcium (g)	Phosphorus (g)	Vitamin A (1000 IU)	Vitamin D (IU)
30	120	1.15	3.8	2.25	2.59	0.72	0.92	113	62	5.9	3.2	3.2	185
40	110	1.43	3.6	2.15	3.07	0.85	1.09	137	74	6.3	3.5	4.2	222
50	100	1.69	3.4	2.05	3.48	0.96	1.23	159	84	6.8	3.8	5.2	277
60	100	1.94	3.2	2.05	3.99	1.1	1.41	181	96	7.2	4	6.3	333
70	80	2.18	3.1	1.9	4.08	1.13	1.45	194	98	7.5	4.3	7.3	388
80	80	2.41	3	1.9	4.51	1.25	1.6	212	108	7.9	4.4	8.3	444
90	80	2.63	2.9	1.9	4.92	1.36	1.74	231	118	8.3	4.7	9.3	499

Note: Mcal, megacalorie; ME, metabolizable energy; TDN, total digestible nutrients; FU, feed units; IU, International unit. Source: Kears, 1982.



are normally tethered. A small plot of 100sqm can supply up to 150 kg dry matter of biomass per year.

Undersowing and interplanting with legumes: Undersowing involves the planting of forage legumes into another crop after the main crop is established. The legumes are usually seeded during the final weeding of the main crop. However, they can be sown earlier if the weeding is not thorough and weeds can simply be cut off rather than cultivated out. Typical in Ethiopia are oats-vetch and oats-faba bean.

Forage strips: Forage strips are narrow lines of forage established between arable crops. Planting forage strips between arable crops is a useful method of forage production. The forage strips have several uses; They provide forage for cut and carry, prevent soil erosion and improve soil fertility, provide wood for fuel and shelter belts if tree legumes are used. Examples include



© Habite Tilaye: Oat-vtech mixture in a field in Doyogena.



© ICARDA/Habite Tilaye: Enset in Doyogena.

desho (*Pennisetum pedicellatum*) and tree lucerne (*Chamaecytisus palmensis*).

Indigenous forages: Naturally occurring fodder constitutes up to a quarter of feed available to livestock in rural smallholder farms. However, information on the animal performance of these species is lacking. Agronomic and animal performance data of these species need to be generated, to be used by stakeholders to promote research and cultivation. Preliminary results generated from such forages namely *Bothriocline Schimperi*, *Brugmansia suaveolens bercht*, *Basella alba* and *Erythrina abyssinica*, indicate that they are promising substitutes for concentrate feeds for improved performance in weight gain, testicular parameters and seminal properties in ram rearing and flushing in ewes.

Majority of these indigenous forages contain anti-nutritive factors, necessitating some form of processing before



© BARC/Muluken Zeleke: Processing foolish flower, *Brugmansia suaveolens* bercht, by boiling and feeding to sheep.



Collecting Momordica (*Foetida Schumach*).



© BARC/Muluken Zeleke: Collecting, drying and feeding korch, *Erythrina abyssinica*, in Bonga.

feeding them. Therefore, indigenous forages of Ethiopia need to be identified, evaluated, and characterized.

Feedstuffs need to be analysed in a laboratory to determine the chemical/nutrient composition. Chemical/nutrient composition of typical feedstuffs and recommended combinations of feedstuffs for selected locations are shown in Table 3.

Part 3: Ration balancing

Ration formulation involves the selection and allocation of feed ingredients in such a way that the cost of the ration is kept low while the animal is supplied with sufficient nutrients for its maintenance and the desired level of production. A ration is the amount of feed that is fed to an animal during a 24-hour period. Sheep should be fed rations that have been properly balanced for energy, protein, minerals (especially calcium and phosphorus), and vitamins. If sheep are not fed balanced rations, they may not be able to meet their nutritional requirements, or the nutritional needs may be exceeded. Ration balancing helps determine the least cost feeding options. Cost is very important in the economics of fattening.

There are five steps to balancing a ration.

- Describe the ram you are feeding in terms of age and weight,
- Look up their nutrient requirements,
- Determine what feedstuffs are available,
- List the nutrient composition of the feedstuffs,
- Balance the ration by hand or use a computer software. Formulation is a complex exercise and is very difficult to work it out manually.

Further reading:

Ashraf Alkhtib, Jane Wamatu (12/2/2020). Least Cost Ration Formulation Tool for Sheep <https://hdl.handle.net/20.500.11766/10787>

Kearl, L. 1982. Daily nutrient requirements of ruminants in developing countries. Utah State University.

Feeding regime

The composition of a well-balanced feeding regime for fattening rams should consist of approximately 70% concentrate mixture to 30% roughages as follows:

- 70-80% concentrate mixture

Table 3. Typical Ethiopian feedstuffs in Menz, Bonga and Doyogena.

Location	Feedstuffs	DM (%)	Ash (%)	OM (%)	N (%)	CP (%)	NDF (%)	ADF (%)	ADL (%)	ME (MU/kg)	IVOMD (%)
Bonga	Roasted ground bean	89.2	4.0	96.0	4.5	28.0	30.9	17.9	1.3	9.1	64.3
Bonga	Roasted ground barley	90.4	3.5	96.5	1.7	10.4	37.6	10.3	2.3	10.6	72.5
Bonga	Ground wheat	84.9	2.4	97.6	1.9	11.8	17.6	4.0	0.9	3.8	28.7
Bonga	Ground maize	82.6	2.0	98.0	1.5	9.5	18.7	4.9	0.8	11.9	78.5
Bonga	Catecala atela	95.5	13.6	86.4	3.9	24.1	46.2	22.3	5.3	5.3	60.2
Doyogena	Wheat bran	89.3	5.1	94.9	2.7	16.6	47.0	15.7	4.1	9.9	68.0
Doyogena	Noug cake	91.2	9.5	90.5	5.1	32.1	36.4	31.2	12.5	8.5	64.0
Doyogena	Local mineral soil (<i>bole</i>)	82.1	14.9	85.2	0.2	1.0	4.4	13.2	2.2	3.2	24.0
Menz	Wheat bran	88.9	4.9	95.1	2.5	15.6	46.3	15.3	3.2	8.7	60.6
Menz	Noug cake	91.8	11.4	88.6	5.7	35.8	30.6	24.8	9.0	8.4	64.8
Menz	Lentil elite	90.2	5.4	94.6	4.3	27.0	30.4	24.8	4.5	6.8	52.2

Note: DM, Dry matter; OM, Organic matter; N, nitrogen; CP, crude protein; NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignin; ME, metabolizable energy; IVOMD, in vitro organic matter digestibility.





- 15-20% fresh roughage
- 10% dry roughage

In a semi-intensive feeding system, rams get most of the roughages from grazing. It is estimated that farmers can save 30% of the production cost by grazing rams. Concentrate feed mix should preferably be given in sheds mixed with a small amount of straw. Salt in form of salt licks is given to meet the animal's sodium and chlorine needs.

Part 4: Feed quality control

Besides a balanced ration, feed should be of good quality. The following quality parameters must be taken into account:

Visual appearance: Feed ingredients should have the correct colour and have no admixtures such as gravel, insects, dust, mould or fungus and other foreign matter.

Finger test: Feed ingredients should have the required moisture content, not too moist and not too dry. High humidity would result in fermentation and mould. Dry conditions can either be because the feed is too old or has been stored for too long.

Smell: The typical smell of a feed ingredient changes because of fermentation, stuffy storage, high humidity, extreme dryness, animal excrement. It is therefore very important to check the feed ingredients by smell, as most ingredients do not always show a change of colour even when their quality is reduced.

Taste and palatability: Ingredients that are of poor quality or spoiled can be easily identified by animal rejection.

Chemical control: This is carried out only in a specialized laboratory.

Storage: Perishable feeds should be stored for a short period. All feed bags must be tied up even if used and checked for humidity, presence of rodents etc. They should be placed off the ground. Storage rooms should be well ventilated.

Fresh and green fodder must be procured or collected and fed fresh daily.

Session 5. Making Sheep Fattening a Business

A study conducted by ICARDA revealed four main types of sheep fattening systems in Ethiopia: commercial, urban and peri-urban, smallholders, and cooperatives. However, commercial, and cooperative sheep farming are not widely practiced in the highlands of Ethiopia. The study revealed that sheep fattening cooperatives mainly for the youth, initiated by local governments across the country were barely in existence because of insufficient training and funding opportunities for youth members. Lack of coordination among government bureaus exacerbated the constraints, further creating a stifling business environment. Since 2017, ICARDA has facilitated the formation of youth groups to promote market-orientation in sheep fattening.

Session objective

Sheep fatteners use different sets of skills to market their fattened sheep. Marketing skills provide more opportunities to get the best price on the market. Therefore, the aim of this session is to enable fatteners understand the concept of market orientation and incorporation of the concept of collective fattening and its importance.

At the end of this learning session, trainees will be able to:

- Define and understand the concepts of entrepreneurship, financial literacy, and collective marketing.
- Describe the character and behaviors of financially literate people.
- Identify group member characteristics, institutional, product characteristics and external factors that are important in determining performance of collective actions.

Part 1: Entrepreneurship

A lack of entrepreneurial and managerial skills are among the limiting factors for farmers engaging in commercial sheep farming. Small ruminant interventions in Ethiopia by the International Center for Agricultural Research in Dry Areas (ICARDA), that targeting sheep fattening, have shown that fattening rams using commercial techniques accrue higher net profit compared to fattening using traditional techniques. However, there has been minimum progression by farmers towards commercial-

based fattening. This session aims to building the capacity of sheep farmers, fattening individually or in groups/cooperatives to effectively plan, organize, lead, implement, monitor and evaluate their business activities.

Discussion points

- List all the things that are holding you back from making sheep fattening a business.
- Make definite solutions for each of the things listed above.
- What are characteristics needed to have a successful business.
- What skills are needed to have a successful business.

Biased attitudes or the way events are interpreted affect the reality and shift it in unnecessary directions. Therefore, attitudinal changes help to manage any incident (phenomenon) and to shape occurrences towards individual interests.

Success is possible for everyone, no matter where they come from, but it can be difficult to achieve. However, there are characteristics that are associated with success. These include setting goals, planning, looking for opportunity, endurance, commitment, self-confidence, networking, willingness to face risks, persuasion skills and searching for information.

The first step in successful entrepreneurship is to creating the right business idea. A successful entrepreneur should be able to see the problems that other people can't see. The big business challenge is to match the business idea with the available opportunities and turn it into reality. For beginners, finding new capital is the main challenge after the initial idea and the development of a business proposal. The process from production to delivery of the product or service to the customer is known as marketing. In order to get the best price, it is important to know how and where to sell fattened sheep.

It is useful to develop a business canvas, like the one below for the sheep fattening business, as it will help you define and communicate your business idea.

Figure 4. Business model canvas for sheep fattening.

Problem <ul style="list-style-type: none"> Poor market linkage Poor bargaining power Poor input access and provision Limited skill and knowledge 	Solution <ul style="list-style-type: none"> Collective fattening and marketing 	Unique Value Proposition <ul style="list-style-type: none"> Supply of quality product with reasonable price 		Solution <ul style="list-style-type: none"> Traders, butcheries, hotels and direct consumers
Existing Alternatives <ul style="list-style-type: none"> Improved fattening skill and technology Cooperative fattening 	Key Metrics <ul style="list-style-type: none"> Quality fattened sheep No. of trained members 	High Level Concept <ul style="list-style-type: none"> Job creation opportunity and sustainable financial security 	Channels <ul style="list-style-type: none"> Direct channels 	
Cost Structure <ul style="list-style-type: none"> Feed cost, financial recording and taxation 		Revenue Stream <ul style="list-style-type: none"> Profit from sheep sales, members transaction payment, saving 		

Further reading:

Esayas Mulatu, Jane Wamatu. (1/10/2020). Entrepreneurship and Business Skills Development Training Manual. Beirut, Lebanon: International Center for Agricultural Research in the Dry Areas (ICARDA). <https://hdl.handle.net/20.500.11766/12542>

Esayas Mulatu, Jane Wamatu. (23/12/2019). Ethiopian Micro-Finance Landscape Report, updated Oct. 2020. <https://hdl.handle.net/20.500.11766/10765>

Part 2: Financial literacy

Financial literacy refers to a set of skills and understanding that enables individuals to make informed and effective decisions about money matters. It is a combination of financial responsiveness, knowledge, skills, attitude, and behavior required to make informed financial decisions and ultimately achieve individual economic well-being. In general, the cognitive insight into financial modules and skills such as budgeting, saving, investing, borrowing, taxation, and personal finance management is referred to as financial literacy. Lack of these skills is known as being financially illiterate.

Pre and post evaluation questions:

1. What is the importance of financial literacy?
2. What is budgeting and what does it entail?
3. What can you do to make your own financial plan?
4. What are the options for improving money management through budgeting?
5. What do you have to consider before you decide on your savings options?
6. What are the reasons or times for taking loans or credit?
7. Why should we invest?
8. When is the best time to invest?
9. What are the sources of danger in your locality and business?
10. What is insurance and why is it important?
11. Why and how do you practice financial management as a member of a cooperative.

Sheep fattening farmers, both individual and cooperatives, need financial literacy because, it enables them to:

- Understand key financial services and products such as personal or enterprise financial management, budgeting, saving, investing and lending.

Table 4. Towards financial literacy: differentiating needs and wants.

Needs	Wants
<ul style="list-style-type: none"> ■ Refuse to look into financial affairs and access financial services ■ Mistrust for financial services and experts ■ Live on a day-to-day basis ■ Saving is not related to financial goal and generally borrows for emergencies ■ Can't choose the right investment ■ Unable to track processes, income and expenses and do not forecast the future 	<ul style="list-style-type: none"> ■ Access financial services confidently ■ Ask for advice and counseling from experts when it comes to financial services ■ Make a spending and budget plan and adopt it to manage his/her business ■ Have a savings plan with clear objectives and maintains an emergency savings fund ■ Choose the right investment ■ Keep records to track progress, income and expenses and capable to forecast the future

- Change the way they think about financial services
- Access and benefit from financial services.
- Have knowledge and skills that enhances understanding of personal finance issues and the ability to apply financial literacy knowledge to manage personal finances.
- Predict future spending and investments by setting financial goals.
- Make good financial decisions about spending and saving and investing throughout their life or to keep their business running and optimize its performance.
- Keep proper records of financial transactions to manage their income and expenses.
- Respond competently to changes and risks that could affect the daily financial well-being of their households and businesses.

Further reading: Financial literacy for smallholder sheep farmers: <https://hdl.handle.net/20.500.11766/12629>

Part 3: Marketing and Collective marketing

Pre and post evaluation questions:

1. What is marketing?
2. What is collective marketing?
3. Highlight the importance of collective actions to make farmers more competitive in markets.

Marketing and market orientation: Market, in its physical or conceptual term, is a place where exchange takes place. Marketing is the performance of all business activities involved in the flow of goods and services from initial production to the final consumer. Marketing involves the

transformation of goods in space, time and form from producers to consumers. These transformation processes should be efficient, i.e., accomplished at the lowest possible cost consistent with consumer preferences and incomes.

For successful marketing, it is important to note the following:

- Market your sheep during high demand seasons.
- Gather appropriate market information.
- Create good linkages with traders. Avoid brokers from the market whenever possible and preferably supply fattened sheep directly to consumers, including wholesalers.
- Practice collective marketing to improve bargaining power and get higher price.

Collective Marketing: Farmers typically bring their sheep to market a few at a time, conducting deals themselves against brokers and traders. They often lack market information on fattened sheep and typically engage in distress sales as their cash demands are very immediate with little or no option of postponing their transactions. The limited market surplus of individual small farmers inflates marketing costs, increases transaction costs and unit costs of assembly, handling and transportation.

Collective action has been identified as one of the interventions that help farmers to compete effectively in the markets. Collective action requires the participation of a group of people, common interests within the group, and involves commitment to the common interest on a voluntary basis. Collective action

is an instrumental strategy that enables individuals to efficiently access and use goods and services that might have been very costly to individuals. Compared to individual marketing, collective approach is recommended as it has several advantages for farmers, including:

- Collective bargaining and improved price.
- Improved knowledge and information sharing.
- Ease networking with buyers.
- Sustained improvement in price.
- Better linkage and information.

The most common forms of collective action for agricultural marketing in Ethiopia are marketing or service cooperatives. Sheep fattening cooperatives are set up to market fattened sheep produced by their members. These cooperatives are common in the highlands among youth producers. Service cooperatives are set up solely for the purpose of marketing inputs and outputs in order to reduce the transaction costs of individual members. Marketing cooperatives engage in any of the following operations:

- Supplying of selected improved forage seeds or planting material, veterinary drugs, tools and equipment, animal feed and supplements.
- Provision of financial means through credit schemes – cash or commodity based – and arrangements for their repayment
- Marketing of fattened sheep in domestic and international markets.

The key factors that determine the performance of a cooperative can be divided into four categories. These are characteristics of the group members, institutional arrangements, the products and markets for which collective action is designed, and the external environment in which collective action operates.

Discussion points

- What challenges do you face in the markets when you are trying to sell your fattened sheep?
- What are the weaknesses and strengths of the collective actions in your localities.
- What do you think should be changed to make the cooperatives more useful to their members?
- Explain the difference between individual and group interests and its impact on collective action.

- Do you understand all the rules and regulations of the cooperatives or groups you belong to.
- Do you think the support of government agencies will be useful to make collective actions successful? Why?
- What do you think should be done to make members of a collective group equally feel responsible and contribute to what is being required of them?
- In your opinion, what do you is the most important factor that determines the sustainability of collective actions? Why?

Further reading: Kassie, G. T. Asnake, W. Haile, A. Getachew, T. Wamatu, J. 2020. Collective action for agricultural marketing - Training manual. International Center for Agricultural Research in the Dry Areas (ICARDA), Addis Ababa, Ethiopia: ICARDA. <https://hdl.handle.net/20.500.11766/12629>



© Bonga ARC: Buta Ganiti sheep fattening and improved forage seed multiplication cooperative.



© BARC/Muluken Zeleke: Shaya Women's Cooperative, Bonga.



© Bonga ARC: Buta Ganiti sheep fattening and improved forage seed multiplication cooperative.

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