FEEDLOT FATTENING OF SHEEP & GOATS FOR QUALITY MUTTON PRODUCTION

TECHNICAL FEASIBILITY

Prepared by:

Prof. Dr. Talat Naseer Pasha
Department of Animal Nutrition
University of Veterinary and Animal Sciences, Lahore-54000
Tel: 042-9213528, Cell: 0300-8434215, Fax: 9211461,
Email: agrotech@brain.net.pk

Edited by:

Dr. Mohammad Afzal
Chief Executive Officer
Livestock and Dairy Development Board
Islamabad

Livestock & Dairy Development Board
Ministry of Food Agriculture & Livestock
Government of Pakistan
Islamabad

November - 2006

Table of Contents

INTRODUCTION

The population of sheep and goats in Pakistan during 2005-06 was 25.5 and 61.9 million, with the annual growth rate of 0.90 and 4.51%, respectively for the period of 2002-2006. There are twenty eight breeds of sheep and twenty five breeds of goats in Pakistan. The increase in goat population is higher than other livestock species indicating their economic importance and adaptation in the different agro-ecological zones of the country. Goats have a number of characteristics, such as high reproductive potential, short generation interval, ability to thrive on shrubs, bushes, and tree leaves, high digestive efficiency for cellulose and less susceptibility to infectious diseases that make them suitable as meat-producing livestock. It is the meat of choice and demand often exceeds supply. One of the main reasons for the growth of goat numbers is the increasing popularity of goat meat within the country. It is claimed that the profit margin in goat fattening is the best in comparison to other ruminants in Pakistan as goat meat has a higher market value domestically and in Middle Eastern countries, where some quantities of goat meat and live animals are exported. In some locations commercial goat fattening has started to coincide with the peak sales period of the Eid-ul-Azha festival.

The mutton production in Pakistan during 2005-06 was 782.1 thousand tons, the contribution of sheep and goats being 30 and 70%, respectively. Pakistan is 2nd largest goat meat production country of world after China. Sheep and goat production in Pakistan is mainly a small-scale rural activity that forms an integral part of an age-old system of mixed farming. The main production systems of sheep and goat rearing are nomadic, agro-pastoral, and sedentary. Mutton production in Pakistan is a secondary farm enterprise and its potential has not yet been fully exploited. The present methods used in sheep and goat farming, marketing, slaughter, processing and sale of meat, result in low carcass yield, large losses of by-products and supply of poor quality unhygienic meat to consumers. The lambs and kids are slaughtered at low body weights and in lean conditions. Fattening of these animals for 90-100 days could add 9-10kg weight per carcass and will also improve the quality of meat.

FARM STRUCTURE, FACILITIES AND EQUIPMENTS

A well designed working facilities and building reduces the work and physical exertion required to provide necessary care for sheep and goats. Stress on both sheep/goats and caretaker is reduced. Management jobs such as health care are scheduled and performed more timely and as a routine manner when good facilities are available, rather than being avoided or ignored due to lack of proper handling facilities such as corrals and chutes. Carrying out the various management jobs is possible in a more humane manner with less risk of injury to the animals and the caretaker.

i. Selection of Farm Site

The farm should be located preferably nearer to an all weather road. The following factors should be considered in deciding about the location of farm premises.

Topography: The topography should be high and level with no abrupt slopes. A relatively level area requires less site preparation, thus lowering the costs.

Water Supply: Water (sweet) should be available cheaply and in plenty. There should be availability of electricity for running of water pumps.

Drainage: The soil should be porous and the slope gently so that drainage is efficient and the farm premises remain dry. Since these animals has to spent most of the time at the farm, well drained area is necessary to maintain health of the animals.

Sun Exposure and Wind Protection: The farm should be designed in north south direction to obtain maximum sun exposure and protection from cold winds. Trees in east and west boundaries are ideal as the trees provide natural shade and cooling effect. In general, animal sheds should be located with the long axis north to south to get direct sunlight and yet face away from the direction of the prevailing winds, whenever possible. However, exact direction can be modified to suit local conditions at different regions.

ii. Design of Animal Shed for Sheep and Goats

The requirements of building units are more or less same for sheep and goats. The maximum number of animals suggested per pen are 75. The floor space requirement for covered area is 12 sq. ft. and for open paddock 25 sq. ft/animal each.

Design Considerations

The basic justification of livestock shelter is that it should alter or modify the environment for the benefit of animals enclosed in it. The animal shelter should normally buffer the extremes of climate to reduce peak stress in the housed animals. The main climatic factors from which protection is to be provided are high and low ambient temperatures,

environmental humidity, solar radiation, winds and rain. The goats are particularly protected from rain and wetness as these make them prone to pneumonia. The animal houses should be so designed that they are cheaper and provide protection from extreme weather conditions. Expensive fittings and designs on permanent basis should not be resorted to face only the brief periods of climatic extremes. It will be worthwhile to make temporary additions (like provision of curtains for goats as protection against bitter cold draughts on a very cold day/night) to protect animals against short period of inclement weather.

The shed should be made of cheap, durable and non-conducting material such as brick pillars to support mud plastered thatched roof of bamboo and sarkanda as shown in the picture below. The inclination of the roof should be made from back of roof. The height of the roof should not be more than 7-8 feet. Inside walls must be cemented upto 3 feet area. The floor of sheds with brick lining must be in a sloping position to avoid accumulation of urine and water. For 75 animals 10 feet long, 2 feet wide and 9 inches deep and 12" high water trough under shade near boundary wall is provided with sufficient drainage.

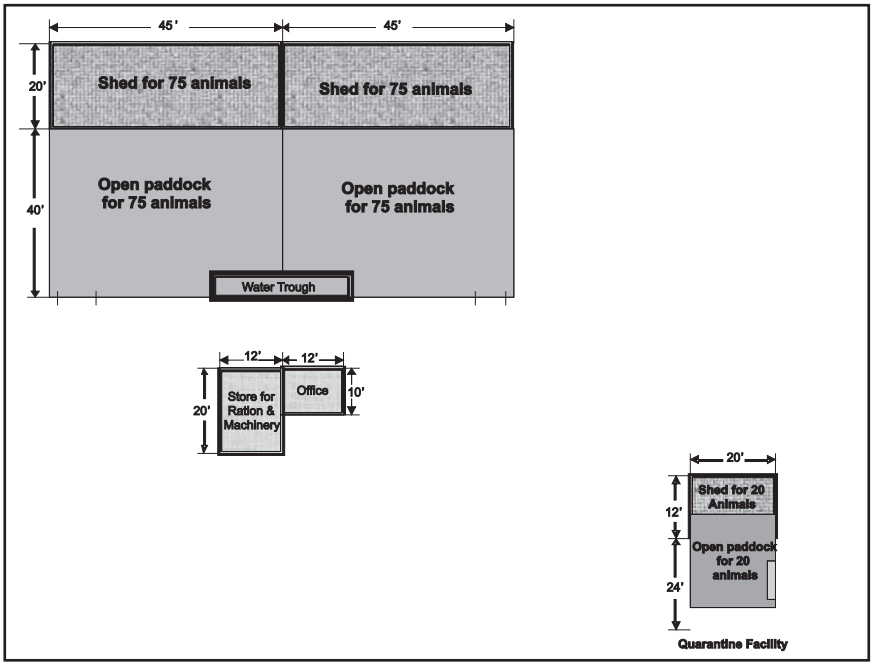


Fig. 1. Shed design and typical small farm layout facility, portable hay and concentrate mangers will be used for inside/outside the shed feeding.

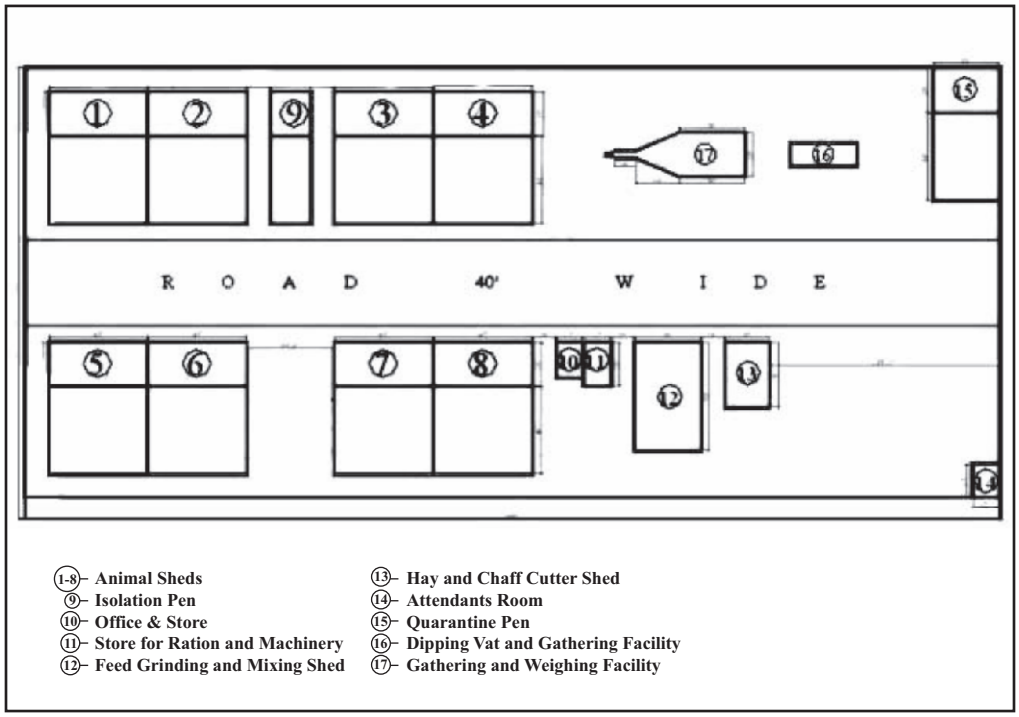


Fig. 2. A typical layout of Lead Farm for Fattening of Sheep and Goats.

Fig. 3. Low cost roof structure for sheep and goat sheds

iii. Concentrate Troughs

There are many types of troughs for feeding concentrate ration and hay to feedlot sheep and goats. When hay is fed in separate racks, feed troughs are usually 10 to 12 in. wide, 3 to 6 in. deep, with a throat height 10 to 15 in. from ground. These may be of any desired length. These should be placed so that these cannot be easily pushed over, and there should be a guard rail along the top to strengthen these and to keep sheep and goats from getting into these. The troughs should be easily cleaned.

Fig. 4. shows a desirable type of sheep and goat trough. These troughs are moveable and can be placed under the shed or in open area as per need/weather condition.

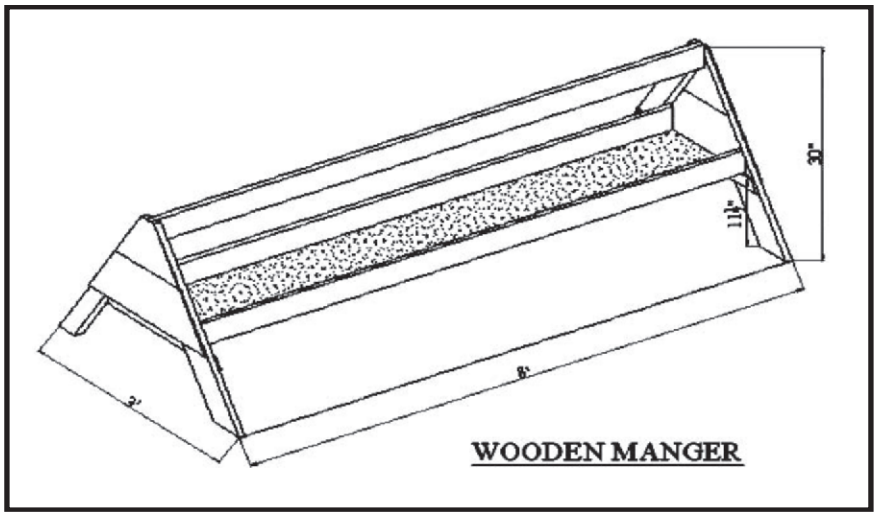


Fig 4. Concentrate feeders for lambs and goat-kids for fattening (From Sheep and Goat Science, Interstate Publishers, Inc. Danville, Illinois)

iv. Hay Racks

The essentials of a satisfactory hay rack for sheep and goats are (1) adequate capacity, (2) ready availability of feed to animals (3), minimum wastage of feed. The rack should be so designed that animals can eat conveniently but cannot enter into it.

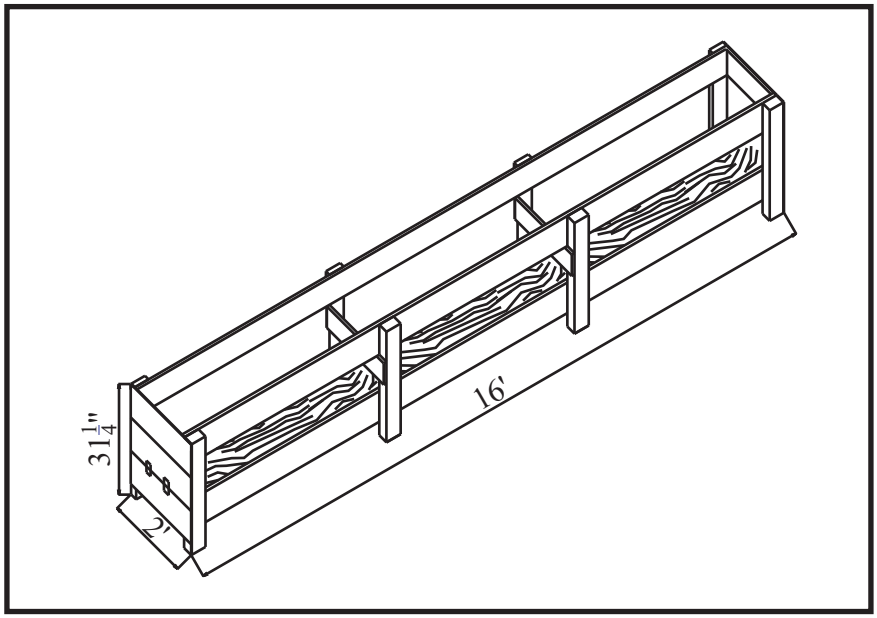


Fig. 5. Hay and concentrate bunk. (Sheep and Goat Science, Interstate Publishers, Inc. Danville, Illinois).

Fig. 5. shows a straightsided, flat bottomed rack. In this type of rack, the hay and concentrate ration are placed on the same bottom, but usually concentrate ration is consumed before the hay is fed. This kind of rack is one of the easiest to build and keep clean. It is also well suited to all kinds of feeds. These racks may be made of any desired length, and the sides may have one long, continuous opening or divided by upright slats into a series of 8-in. openings. A width of 24 in., out side measurement, is common.

v. Farm Facilities:

A small size flock of sheep/goats can be managed even without elaborate facilities. For medium or large size flocks more permanent facilities should be considered according to the required management jobs. At a lead farm following facilities are suggested beside the animal sheds for the feedlot fattening.

- Office and Store
- Quarantine Pen
- Dip Bath Facility (for sheep)
- Weighing Crate
- Isolation Pens
- Burial Pit

Office and Stores

A simple office, close to sheep/goat house makes many jobs easier. The office can serve focal point on the farm, where record, reference books and valuable equipment are kept. It is handy to have a store near office where bulky supplies and equipment such as feed and tools can be stored securely. It is an important management practice to keep good record of the stocks of materials in the store, so that these can be replenished in time and to devise an effective method of controlling their use. It is good to have a few simple visual displays about the farm in the office such as number of stocks, vaccination, deworming schedule etc. The size of the office cum store should be 12'x16'.

Quarantine Pen

This pen should be separated from the main farm facilities. All newly purchased stock should be kept in this pen to follow the standard procedure of quarantine, i.e. identification, vaccination, deworming, dipping, concentrate feed introduction. The size of this facility will depend upon the number of incoming animals, whereas, standard concentrate, hay troughs and watering facilities will be provided as per need of the stock.

Weighing Crate

Farms that need to weigh several sheep/goats as in the case of feedlot will need a weighing crate with suitable handling pens, to save workers' time. A swing gate at the end of pen can

help in sorting sheep/goats on the basis of weight. This will be useful to sell the animals when target weight has been reached.

Isolation Pens

It is good practice to have a few isolation pens where sick sheep and goats can be kept apart from the rest of the flock to avoid cross infection. Ideally, the pen should be quite separate from the main housing and grazing area, to avoid any chance of air-borne infection. Isolation pen should be made of such a material that these are easy to clean and disinfect after recovery or death of sick animals.

Burial Pens

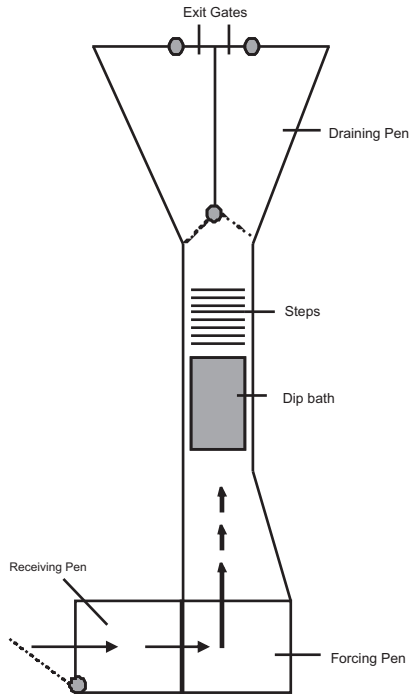
A deep pit should be dug, far away from the flock, for the disposal of carcasses. Carcasses should either be burnt or deeply buried and covered with soil and thorny bushes so that wild animals can be prevented from gaining access to the carcass and spreading infected material.

Dip Bath

This facility will be required at the lead farm, where large number of animals are regularly dipped to control external parasites, a cemented dip should be built away from the rest of the farm and should have soak away drain or septic tank to dispose off the waste dip-wash, without contaminating the adjacent pasture and water sources (see figures below). Ideally, it should be constructed close enough to a source of water to allow the easy filling of the trough. This dip is mainly needed for sheep.

vi. Establishment of Feedstuff Grinding and Mixing Unit

The feed mixing plant will be justified at lead farms. This will facilitate economized feed production. The feed for feedlot sheep and goats is manufactured with locally available feed resources rich in protein and carbohydrate which are mixed according to the nutritional formula in order to raise the livestock in such a manner that when fed to livestock, they get nutritionally balanced feed according



Top View of Dip Bath

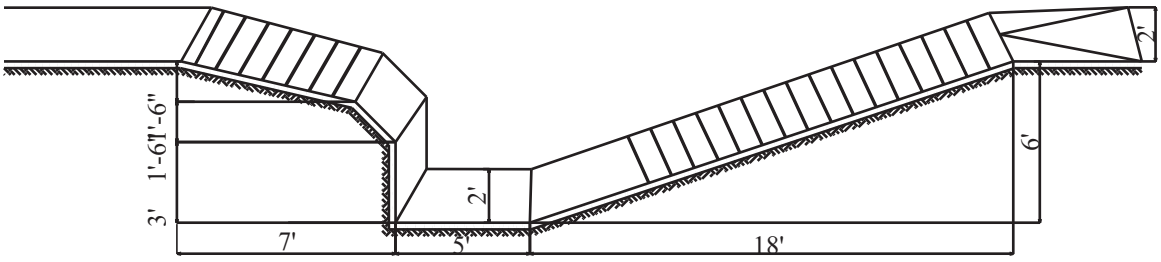


Fig. 6 A cross-section of permanent concrete dipping vat. The entry and exit ramps are created and on a 20-to25- degree angle. The steeper portion of the entry is hidden under the water and is at a 45-degree angle.

Building

A 30'x40' size shed is required for the installation of grinding unit and feed stuff mixing / packing plant. The height of this shed should be 30'. This shed / facility should have concrete floor. There is need of feed raw material storage room (30'x25') adjoining to this shed.

Machinery

The details of machinery required along with the estimated cost are given in table given below. The layout of the machinery is provided in Figures.

S.No.	Description	Number	Cost (Rs.)
1	Hammer Mill, 20"	1	45000
	Motor 20HP	1	22000
2	Screw conveyor 20'	1	40000
	Motor 2 hp	1	3500
3	Elevator, 40' height 8"x7" tube, 16 guage 6"x4½" bucket, 7" belt, SKF bearing	1	86000
	Gear motor 3hp	1	12000
4	Hopper 4'x4', 10 guage, alongwith fittings	1	16000
5	Mixer, capacity 500 kg, ribbon type 8 guage, drop bottom with chain wheel SKF bearing, molasses nozels, time switch	1	70000
6	Surge/packing hopper and fittings, 10 guage	1	20,000
7	Molasses day tank (double jacket) 4'x3'x30" + 4x1000 heaters	1	35000
	Molasses gear pump 2" and 5hp motor	1	23000
8	Molasses gear pump 1½"	1	9000
	I hp motor	1	2500
9	Electric panel	1	35000
10	Electric wires (internal)	1	20000
11	Bag closer	1	5000
12	Trolleys, drums, bins etc	3	9000
13	Molasses pipe line	1	10000
14	Molasses tank concrete, 10'x8'x7'	1	30,000
11	Weighing scale, 100kg	1	5000
	Total Machinery Cost, Rs.		**498000**

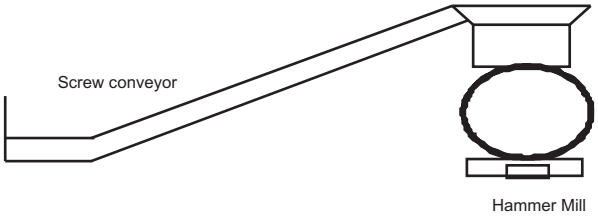


Fig. 7. Grinding Section

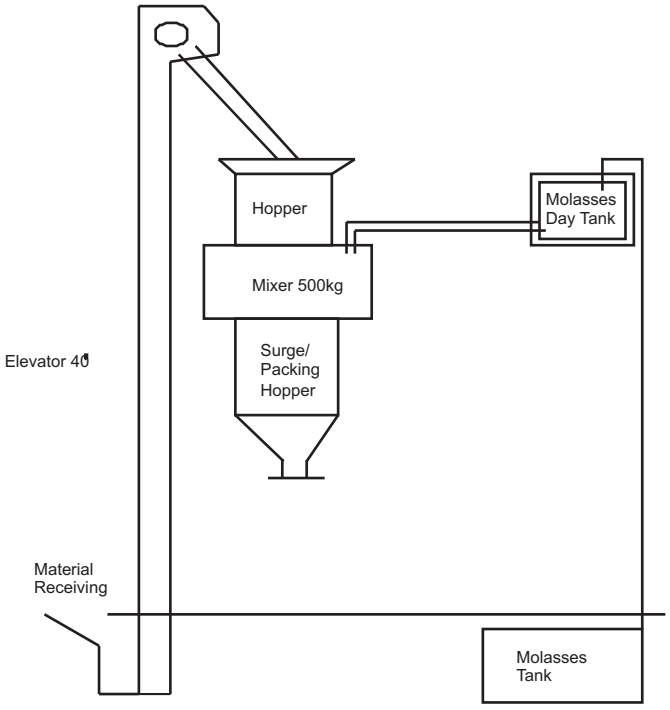


Fig. 8. Feed Mixing Plant

LIST OF MANUFACTURERS / SUPPLIERS OF FEED PLANTS

FOR LOCAL FEED PLANTS

- **Haque Bahoo Industries**, Near Lohianwala Nehr, Opposite Railway Line, G.T. Road, Gujranwala. Tel: 055-3891506
- **Rana Engineering Works**, Near Sialkot Bypass, Gujranwala.. Tel. 055-3200110, Cell: 0300-8740068
- **Bahoo Industries (Pvt.) Ltd.** 2-Jinnah Road, Gujranwala-52250, Tel: 055-3256382 & 3842835, Fax: 055-3257465, Email: bahoo_ind@yahoo.com
- **Universal Industries**, Pindi By Pass, Opp. Al-Rehmat Filling Station, G.T. Road, Gujranwala. Tel: 055-3891318, Fax: 055-3893437, Cell: 0300-6400442
- **Mansha Engineering Works**, Faisalabad Road, Near Madina Rice Mills, Arianwala, Sheikhupura. Tel: 030-4412597, 0300-4713981
- **Paster Feed Plant**, Near Toll Tax, Satyana Road, Faisalabad
- **Mirza Feed Plant**, Near Toll Tax, Satyana Road, Faiasalabad
- **Punjab Feed Plant**, 18-KM, Multan Road, Shahpur, Tel. 042-7510084, Cell. 0301-4136265, Lahore

FOR IMPORTED FEED PLANTS

- **UM Enterprises**, Plot No. 12, Sec.15, Korengi Industrial Area, Karachi-74900. Tel: 021-5050074-77, Fax: 021-5066552, Email: ummalik@khi.comsats.net.pk
- **Eastern Veterinary Services**, 7, 2nd Floor, Allied Plaza, Chandani Chowk, Murree Road, Rawalpindi. Tel: 051-4421771-2, Fax: 051-4421776

LIST OF LIVESTOCK FEED MANUFACTURER IN PAKISTAN

This information is provided for farmers who do not want to invest in the establishment of feed mixing plant and intend to purchase fattening feed from the market.

- **National Vanda**, 171-Shadman II, Lahore, Tel: 111-000-002, Fax: 042-7573045
- **Multan Vanda,** National Livestock Services, T-Block, Jinnah Market, Qazaffi Chowk, New Multan, Tel: 061-556171, 0320-4985470
- **Kahoot Feeds**, Dhon Road, Chakwal, Tel: 0573-571372, 0320-4985470
- **ICI-Vanda**, ICI-Pakistan Ltd., 63-Mozang Road, Lahore, Tel: 111-100-200
- **Al-Hilal Vanda**, 12-Allama Iqbal Shopping Center, Jihanian, Distt. Khenewal, Tel: 0699-210193
- **Dairy Mix,** Farooq Feeds and Allied Products, C-8, 9, Qasim Town, Landhi, Karachi, Tel: 021-4382514-6, Fax: 021-7768043
- **Hafiz Vanda,** Depalpur Road, Near Toll Tax, Okara, Tel: 0442-511643
- **Shukrana Feeds.** Shukrana Pvt. Limited, No. 18, First Floor, Regal Plaza, Circular Road, Quetta, Tel: 081-835274 & 844062, Fax: 081-823992
- **Asia Feeds,** Asia Feeds Pvt. Ltd., 359-Shams Abad, Humayun Road, Multan, Tel: 0610581814-5, Fax: 061-224414
- **Sona Vanda.** Vanda Pvt. Limited, Lahore Road, Sheikhupura.
- **Lahore Vanda**, Rehman Dairies, Near Hajveri Bridge No. 5, Harbanspura, Lahore, Tel: 042-654010 & 6823502
- **University Feeds**, Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Tel: 041-9201088
- **Anmol Vanda,** Animal Nutrition Research Center, Rakh Dera Chahl, Badian Road, Lahore. 042-5601162
- **Anmol Vanda,** Livestock Production Research, Institute, Bahadarnagar, Distt. Okara, Tel: 0442-661081 & 661181
- **Anmol Vanda.** Barani Livestock Production Research Institute, Rakh Khari Meurat, Distt. Attock, Tel: 05775-210781

FEEDS AND FEEDING SYSTEMS

Feeding and management techniques will help the sheep and goat farmers to feed the animals according to their needs. This will assist to reduce the feed costs by better utilization of feed resources relative to nutrient requirements of the flock for year round feeding. The system of feeding of animals for mutton production will vary in different agro-ecological zones of the country. It will depend upon the availability of resources in terms of grazing area, land for cultivation of fodders, facilities for hay making and provision of concentrate feed.

Grazing with Supplement Feeding

The objective of raising sheep and goats under feedlot system is to achieve maximum growth rate in minimum period of time. The sheep can easily adopt intensive system of production under feedlot system, whereas, goats which is basically a browser takes time in getting used to intensive systems of feeding. The best feeding option for both the species is grazing with supplement feeding of high energy concentrate ration. This system of production is close to the natural behaviour of these species. The available grazing areas are managed under rotational system. Electric fencing can be used for dividing the grazing area in small paddocks of one day need of the flock. It is advised that animals should consume 2 percent of their body weight dry matter from the grazing and rest of 1.5-2.0 percent body weight from supplement concentrate. This system has added advantage of protection of animals from certain diseases which are common under intensive system of production/feedlot fattening like coccidiosis and foot rot. The examples of supplement rations are provided below.

Total Mixed Ration

If land resources are not enough for grazing of sheep and goats, total mixed ration is provided to the animals. In this system of production, the sheep and goats are raised under intensive system of production fed on total mixed ration having dry roughages and concentrate (energy and protein sources) with little supplemented green fodder. In this system, the total mixed ration is formulated as per need of the animal based on nutrient specifications of the available dry roughages and concentrate feedstuff. This will provide balanced diet to the growing animals and will conserve the energy wasted by the sheep and goats during grazing. The feed additives like anticoccidials are incorporated in the ration to overcome coccidiosis problems. The green fodder is supplied to the animals in limited quantity just to fulfil their vitamin needs. The concentrate feedstuffs which are used for the feeding of livestock are described as under:

Concentrate

The cereal concentrates are those feeds which are low in fibre and high in energy. These are used for feedlot fattening and include grains, chiefly maize, barley, oats, sorghum, grams, matri and processed feeds as beet pulp/beet molasses and cane molasses. These feedstuffs

have 16% or less crude protein, rich in digestible carbohydrates and have low content of indigestible fibre. These are rich in energy and are highly palatable. The protein content of cereals is generally 8-10 percent and TDN 70-80 percent. In Pakistan cereals are not ordinarily used for feeding livestock except poultry because of their value as human feed. However, by products of the cereal milling industry, particularly, wheat, maize and rice bran and rice polishing, are used as protein concentrates.

The choice of particular feedstuff is determined primarily by availability, price, nutritional and antinutritional factors associated with these. The features of commonly used feedstuff in feed for fattening of sheep and goats are explained.

Maize

Maize is the most popular and palatable feedstuff for all kinds of livestock. Yellow maize is the only grain with appreciable carotene. It contains about 65% TDN, and about 11% protein. In addition to its high energy yield per acre, maize is the cereal with highest digestible energy contents for animals. It is very palatable, and contains no intrinsic toxic factor, thus it can be regarded as best feed grain for feedlot fattening.

Barley

Barley is a palatable but fibrous (7% Crude Fibre) feed. The grain may be used to replace up to one half of the maize in rations for fattening of animals without materially affecting their performance. The crude protein content of barley varies from 8-12%.

Sorghum

There are many varieties of sorghum but the composition of their grain does not differ enough to affect the feeding quantities to any great extent. Most common varieties are similar to shelled corn (maize grain) in chemical composition except that most sorghum is slightly higher in protein but low in oil than maize. The grains are ground before feeding to all classes of livestock except for sheep which like to masticate the grain more thoroughly.

Oats

Oats are higher than maize in crude fibre (10-18% vs. 2%) and accordingly lower in TDN (71 vs. 87%). Oats have highest protein content and quality of any cereal grain. It has low importance simply because the yield of energy per acre is much lower than other grains.

Bajra

Bajra is relished by all livestock. It resembles in feeding value to that of sorghum. Crude protein ranges from 10-12 % and is also rich in tannins.

Wheat Bran

Wheat bran which consists almost entirely of the coarse outer coating of wheat grain is one of the most popular and important livestock feeds. It has a protein content of 13 per cent and about 65 per cent TDN. Wheat bran is rich in niacin, vitamin B-1, phosphorus and iron.

Rice Polishing

Rice polishing is finely-powdered material obtained in the polishing of rice kernels after the hulls have been removed. The protein, fibre and fat content are 13, 12 and 14%, respectively. Due to high fat content, it tends to become rancid when stored for a longer period. However, this is excellent source of energy for feeding of sheep and goats and other livestock.

Cane Molasses

Molasses is the residual product after crystallisation of sugar from sugarcane crop. It is chiefly a carbohydrate feed and has value in increasing the palatability and utilisation of feeds, especially containing poor quality roughages. It can also be used with NPN sources such as urea, ammonium compounds and organic wastes in the form of poultry littler and droppings, to provide most of the require energy and protein for the fattening of sheep and goats. Cane molasses contains about 3% protein, 10% ash comprising excellent source of minerals except phosphorus. It is also rich in niacin and pantothenic acid.

Beet Molasses

The use of beet molasses is generally restricted to NWFP province, which produces most of this country's sugar beet. When properly used, this type of molasses has the same feeding value as molasses. However, care should be taken when using beet molasses because it has highly laxative properties due to its high mineral content. Total sugar content generally varies from about 48-53%, protein values are higher than cane molasses i.e. 6.6%.

Beet Pulp

It is residue remaining after sugar beets have been pressed to remove the sugar containing juice. Although it has a fairly high fibre content (approximately 16% crude fibre), the fibre is easily digested. It is a palatable feed and may be reconstituted with water to produce highly palatable moist feed. Often molasses is added back to it, which further increases its energy content and palatably.

Cottonseed Cake and Meal

The whole pressed cotton seed cake (undecorticated) and dehulled (decordicated) solvent extracted variety cotton seed meal, are protein source for ruminants. The cake contains about 20% and meals have about 40% crude protein. The free gossypol content of cottonseed cake contains 1000-5000 mg/kg. The cottonseed meal is a better ingredient and is economical on

per unit protein basis. Moreover, it has rumen bypass protein characteristics as well, which is beneficial for rapidly growing animals. However, its use in the ration is not recommended more than 15% due to presence of aflatoxins and pesticide residues.

Rapeseed Cake and Meal

Its use in livestock feed is limited up to 15% level. It has anti-nutritional factor cyanogenic compounds and slightly bitter taste which creates problem if used at higher levels. The crude protein contents are 36%.

Corn Gluten Feed and Meal

This is the part of commercial shelled corn that remains after the extraction of starch and germ by the wet milling manufacture of corn starch or corn syrup, and may contain either corn globules or corn oil meal. It is one of the important vegetable protein concentrate and is generally used for feeding of livestock. Corn gluten feed contains about 20 crude protein while corn gluten meal may contain 30-60 per cent crude protein depending upon the blending of the meal with maize bran.

Maize Oil Cake

This is residual by-product after the extraction of oil from corn germ. It contains about 18 percent crude protein and 7-8 percent oil and can be used as source of protein and energy for growing and fattening of sheep and goats.

Sunflower Meal

Sunflower meal contains phenolic compounds that have an adverse effect on palatability and may reduce protein digestibility. Moreover, it has high levels of mycotoxins, which limit its higher level use in livestock feed. Its protein content varies from 28 to 34 percent depending upon the presence of seed hulls.

Linseed Meal

Linseed meal has good reputation as feed for ruminants due to high content (3-10%) of mucilage. The compound is capable of absorbing large amounts of water which results in higher retention time in the rumen and gives better digestibility. It is a satisfactory source of protein (35%) with low TDN (65%) for sheep and goats.

Sesame Cake

Sesame cake, also know as 'til cake', contains 30-35 percent high grade protein and 0.5-10 percent oil, depending upon method of oil extraction. It is an excellent for growing lambs and fattening sheep.

Urea

Urea can effectively be used in livestock feed. It contains 288% crude protein. When urea enters the rumen it is rapidly hydrolysed to ammonia by bacterial urease and the ammonia thus produced can be utilised by rumen bacteria to synthesize bacterial proteins. However, urea does not contain any energy content of its own and best utilized along with readily available source of energy like molasses or grains in fattening diets to allow utilisation of the ammonia as it is released. Molasses and starch are most satisfactory sources of energy as they are fermented at similar rates as urea. A level of 1 kg of starch per 100 g of urea is often suggested. Its use in fattening ration should be limited to maximum of 2% due to its toxicity.

Wheat Straw

This by-product is available after harvesting the grain and forms the main bulk of roughages in Pakistan. It contains about 3% protein and 40% TDN. Its nutritional value can be improved by treatment with 4% solution of urea. This treatment enhances crude protein and dry matter digestibility of the straw. While incorporating wheat straw in the total mixed ration for sheep and goats, it should be grinded or finely chopped.

Feed Additives

These are not classified as nutrients but are added to various feeds to achieve better growth rate and feed utilization. The commonly used feed additives in the feed for fattening of sheep and goats are growth promoter antibiotics and anticoccidials. Both are organic compounds produced as a result of microbial fermentation. These are considered to stimulate growth, improve feed utilization and control coccidiosis.

The following feed formulae for total mixed rations are presented for guideline of the farmers.

Formula 1

Ingredients	**%**
Wheat Straw	20
Maize	14
Rice polishing	14
Rice bran	15
Cottonseed meal	15
Linseed meal	8
Molasses	12
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	60

Formula 2

Ingredients	**%**
Wheat Straw	20
Maize	10
Maize bran	20
Rice polishing	15
Cottonseed meal	6
Sesame cake	15
Molasses	12
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	65

Formula 3

Ingredients	%
Wheat Straw	25
Maize	10
Rice polishing	10
Wheat bran	13
Rapeseed meal	11
Sunflower meal	10
Corn gluten meal, 30%	12
Molasses	7
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	60

Formula 4

Ingredients	%
Wheat Straw	20
Maize	10
Rice polishing	11
Wheat bran	18
Rapeseed meal	15
Sunflower meal	12
Molasses	12
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	60

Formula 5

Ingredients	%
Wheat Straw	18
Maize	14
Rice polishing	10
Maize bran	9
Sunflower meal	12
Linseed meal	13
Molasses	10
Maize oil cake	13
Mineral mixture	1
Total	100
CP, %	14
TDN, %	60

Formula 6

Ingredients	%
Wheat Straw	20
Maize	10
Wheat bran	10
Rice polishing	13
Rice bran	10
Cotton seed meal	14
Corn gluten meal 30%	10
Molasses	12
Mineral mixture	1
Total	100
CP, %	14
TDN, %	64

Formula 7

Ingredients	%
Wheat Straw	20
Maize	14
Rice polishing	13
Rice bran	15
Cottonseed meal	14
Sunflower meal	10
Molasses	12
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	62

Formula 8

Ingredients	%
Wheat Straw	20
Maize	15
Rice polishing	10
Wheat bran	10
Rice bran	10
Cottonseed meal	15
Corn gluten meal, 30%	9
Molasses	10
Mineral mixture	1
Total	100
CP, %	14
TDN, %	65

Formulae for Supplementary Feeds

Formula 1

Ingredients	%
Maize	30
Rice polishing	19
Wheat bran	20
Canola meal	7
Rapeseed meal	10
Sunflower cake	4
Molasses	8
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	68

Formula 2

Ingredients	%
Maize	20
Rice polishing	25
Wheat bran	20
Rape seed meal	10
Canola meal	9
Sunflower cake	6
Molasses	8
Mineral mixture	1
Salt	1
Total	100
CP, %	15
TDN, %	68

Formula 3

Ingredients	%
Rice polishing	25
Wheat bran	25
Corn gluten meal, 30%	20
Cottonseed cake	5
Canola meal	15
Molasses	8
Mineral mixture	1
Salt	1
Total	100
CP, %	16
TDN, %	70

Formula 4

Ingredients	%
Corn gluten meal, 30%	15
Rice bran	20
Rice polishing	25
Wheat bran	20
Cottonseed meal	10
Molasses	8
Mineral mixture	1
Salt	1
Total	100
CP, %	16
TDN, %	70

Formula 5

Ingredients	%
Corn	10
Maize bran	25
Rice polishing	10
Wheat bran	10
Rice bran	20
Rapeseed meal	10
Rapeseed cake	6
Molasses	7
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	67

Formula 6

Ingredients	%
Maize bran	15
Rice bran	20
Wheat bran	20
Rice polishing	20
Corn gluten meal, 30%	5
Cottonseed meal	10
Molasses	8
Mineral mixture	1
Salt	1
Total	100
CP,%	15
TDN, %	68

Formula 7

Ingredients	%
Maize bran	16
Rice polishing	20
Wheat bran	20
Cottonseed cake	15
Rapeseed cake	10
Corn gluten meal, 30%	5
Molasses	12
Mineral mixture	1
Salt	1
Total	100
CP, %	14
TDN, %	67

Formula 8

Ingredients	%
Rice bran	20
Wheat bran	10
Rice polishing	20
Corn gluten meal, 30%	15
Cottonseed meal	10
Rapeseed cake	8
Sunflower meal	8
Molasses	8
Mineral mixture	1
Total	100
CP, %	17
TDN, %	68

The farmers interested in fattening of Sheep and Goats are suggested to contact, livestock and dairy development board, Islamabad or following institutions in the country to get further guidance and facilities for feed formulation based on the feedstuff available with them.

- The Programme Leader, Animal Nutrition Programme, National Agricultural Research Centre, Park Road, Islamabad, Tel:051-2242597
- The Chairman, Department of Animal Nutrition, NWFP Agricultural University, Peshawar. Tel:091-5701809
- The Director, Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Tel: 041-9201088
- The Chairman, Department of Animal Nutrition, University of Veterinary and Animal Sciences, Lahore, Tel: 042-9211449-50
- The Animal Nutrition Research Officer, Livestock Production Research Institute, Bahadarnagar, District Okara, Tel: 0442-661181
- The Senior Research Officer, Animal Nutrition Research Centre, Rakh Dera Chahl, Badian Road, Lahore, Tel: 042-5601162
- The Chairman, Department of Animal Nutrition, Sindh Agriculture University, Tando Jam, Sindh.

FODDER PRODUCTION PLAN

Green fodders form the most important feed for ruminants. The chemical composition and nutritional value of green fodders are variable and depends upon the species of the plant, stage of growth, soil condition, fertilizer application, availability of water for irrigation, and climatic conditions. At early stages of growth, dry matter (DM) and crude fodder (CF) are low, and digestible crude protein (DCP) and total digestible nutrients (TDN) are high. When fodders are harvested at later stages of growth, their DCP and TDN decrease while CF and lignin increase considerably, which adversely affects the digestibility of the fodders for livestock.

The fodders are of two types 'kharif' or summer crops, and 'rabi' or winter crops. The fodder calendar for summer and winter crops is suggested below along with practices involved such as preparation of soil, seed rate, sowing time, fertilizer application and production per acre. The desired changes in this plan can be made as per local soil and agro-climatic conditions.

SUMMER (KHARIF) FODDERS

Practices	Maize	Sorghum	Jumboo	Bajra	Cowpeas	Guara
Preparation of soil	Loomy soil. Ploughing for 3-4 time & planking	Loomy soil. Ploughing for 3-4 time & planking	Clayy soil. Ploughing for 3-4 time & planking	Fertile soil. Ploughing for 3-4 time & planking	Clay soil. Ploughing for 3-4 time & planking	Loomy soil. Ploughing for 3-4 time & planking
Seed / Acre, kg	40	30	8-10	5	20	20
Sowing time	Mar – Sep	Mar – May	Mar - May	Apr – Sep	Mar - Aug	Apr – Jul
Fertilizer / acre	3 bags SSP + 1.5 bag urea	3 bags SSP + 1.5 bag urea	3 bags SSP + 1.5 bag urea	3 bags SSP + 1.5 bag urea	3 bags SSP + 1.5 bag urea	3 bags SSP + 1.5 bag urea
Harvest time	Nov – Dec	Jun – Nov	May - Oct	Jun – Nov	May - Oct	Jun – Nov
Production / acre, tons	18 – 20	20 - 25	25 – 60	20 – 25	15 - 18	15 – 18

Maize: Maize is major fodder crop in the irrigated tracts and areas of high rain fall, mostly in Punjab and parts of Sind and NWFP provinces. It thrives in warm and temperate climates, requires a rich, well-manured soil. The fodder is ready after 60-70 days. The DCP (Digestible crude protein) content of maize fodder is 0.6-1.0 per cent with TDN (Total digestible nutrients) value of 8-16 per cent. To get a more nutritious fodder, it is often grown with cowpeas.

Sorghum or Jowar: There are several varieties of sorghum but generally the sweet varieties are cultivated for fodder production. The yield and nutritive value varies according to the type, variety, rainfall or irrigation. The DCP at early to full bloom of the crop is 0.5 -1.0 percent and TDN 8-10 percent.

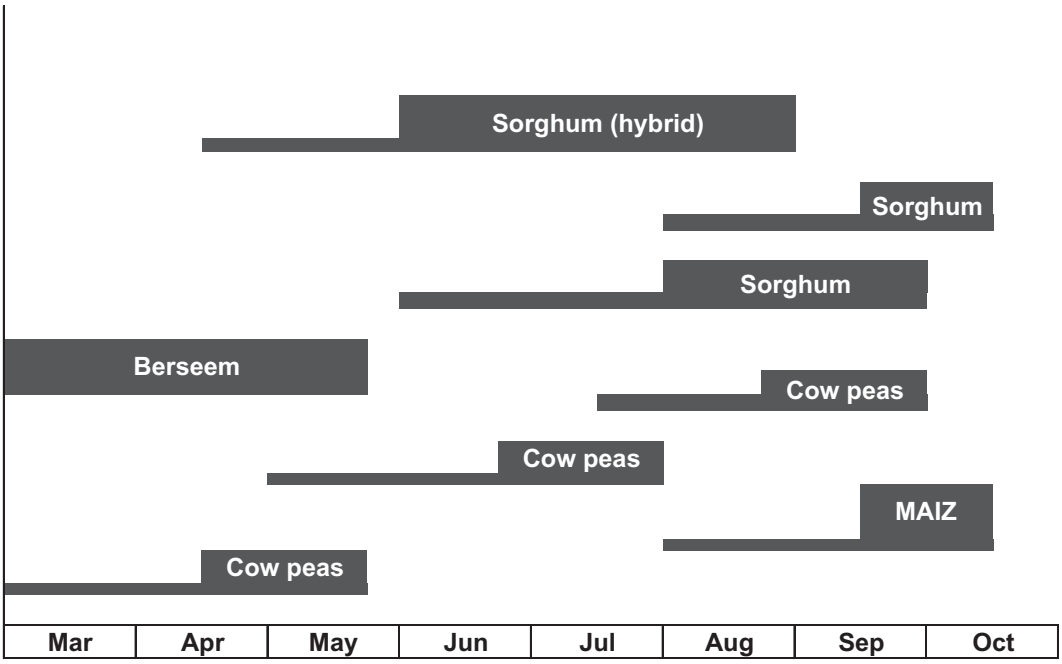
Jumboo or Sorghum (hybrid): This is a hybrid of sorghum and sudan grass, a multi cut fodder available most of the time during summer season. This fodder is excellent quality, and its leafiness makes it very palatable to sheep and goats.

Bajra: It is suitable for sowing in the barani areas as welll as irrigated regions of the country. It is an important crop of the area where rainfall is low, and grows well even on poor soil. It makes excellent green fodder and is cultivated alone or in combination with cowpeas or guara. The DCP contents at early and full bloom stage of the crop are 0.6-0.8 percent and TDN is 8-16 percent.
The cereal fodders are not very palatable for sheep and goats. Whenever they are to be fed they should be chopped first as the full plant will be spoiled by these animals.

Cowpeas: This is a quick growing legume that can be grown on all type of soils, but is susceptible to water logging. This can be grown alone or in combination with non-leguminous fodders like maize or jowar. The green fodder is very nutritious with about 2 percent DCP and 10 percent TDN. When grown mixed with maize the fodder gives about 1.5 percent DCP and 13 percent TDN. This crop is more palatable for sheep and goats and also suitable for grazing by these animals.

Guara: This is an important leguminous crop which is drought resistant and therefore suitable for dry areas, and is generally cultivated with bajra and jowar. It cannot tolerate water logging. It must be harvested before flowering for better palatability and nutritional profile. The average DCP content of the fodder at the early bloom stage is 3 percent and TDN 10-12 percent. This is a suitable crop for gazing of sheep and goats.

Fodder Calendar Summer Crops



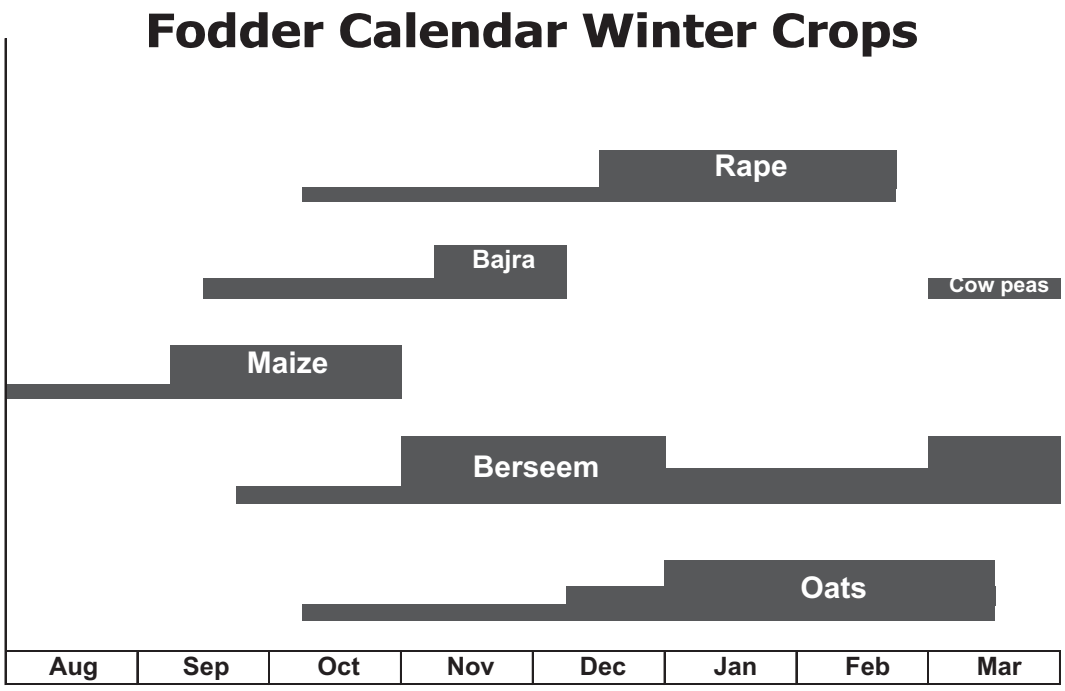
WINTER (RABI) FODDERS

Practices	Barseen	Lucerene	Oats	Matt grass
Preparation of Soil	Heavy loamy soil. Ploughing of field for 3-4 time and planking	Loamy soil. Ploughing of field for 3-4 time and planking	Heavy loamy soil. Ploughing of field for 3-4 time and planking	Fertile soil. Ploughing of field for 3-4 time and planking
Seed / Acre	8 kg	6 kg	30 kg	11000 sticks each having 2 buds
Sowing Time	25 Sep – Oct	15 Sep - Oct	Oct - Dec	Sticks: Feb – Mar Roots : Jul – Aug
Fertilizer / Acre	2 Bags Triple Super Phosphate + 1 bag urea	2 Bags Triple Super Phosphate + 1 bag urea	2 Bags urea + 3 Bags Single Super Phosphate	1 Bag DAP + ½ Bag urea
Harvest Time	Nov – May	Oct – 1 year	Jan - May	May – Nov
Production / Acre, Tons	30 – 35	50 – 60	25- 35	100 – 125

Berseem: This is one of the most important leguminous fodder crop in Pakistan and is abundantly cultivated in irrigated tracts and area of high rainfall, but it can not be grown under drought conditions. Berseem contains 2-3 percent DCP and 9-16 TDN, because of high moisture content berseem is fed with dry roughages like wheat straw to sheep and goats. When fodder is surplus, it can be converted into hay of high nutritional value.

Lucerne: This is valuable perennial leguminous crop which can provide nutritious fodder for 3-4 years. It is grown both as an annual and perennial crop and it has deep roots and can resist drought. The crop is generally grown in irrigated areas and gives better yields in well drained and properly manured loamy soil. The fodder can be converted into hay of high nutritional value about 2 months after sowing. At early to full bloom stage of growth, lucerne has about 4 percent DCP and 16 percent TDN.

Oats: It is cultivated in irrigated tracts and areas of high rainfall. Different varieties of oats are cultivated alone or in combination with berseem. Oats are of high nutritive value when cut at flowering stage and contain 1.3 percent DCP and 10-16 TDN.



Fodder Trees and Shrubs

Fodder trees and shrubs contribute significantly to feed of small ruminants. Even in the irrigated area of Pakistan, vast marginal lands, canal bank, and communal grazing strips are used for grazing of small ruminants. During periods of fodder scarcity, trees are lopped for feeding to sheep and goats.

Some important fodder producing trees and shrubs are discussed below.

Phulai *(Acacia modesta):* This is extremely useful forage species since it is very palatable and nutritious. This is a medium sized leguminous plant found on most of the range areas of the country. New growths take place in March, and the pods ripe in autumn.

Kikar *(Acacia nilotica):* This is a common mostly evergreen tree, but for a short period it drops leaves. Flowering occurs during rainy season (June to September); pods ripen from April to June. The leaves and pods are used as fodder for sheep and goats. The yield of pods and leaves reaches 8-10t/ha.

Khor *(Acacia Senegal):* This is medium size thorny tree, It is widely distributed throughout the arid and semiarid regions of Sindh, Punjab, and Balochistan. It grows well in area of low rainfall. Its foliage is highly palatable and very rich in protein and fed to sheep and goats during periods of fodder scarcity.

Siris *(Albizia lebbek:)* This is a large leguminous tree. It grows on different types of soil and can tolerate salt. The tree sheds leaves in summer, but pods persist for longer time. The foliage is highly palatable and very rich in protein.

Ipil-ipil *(Lucaena leucocephala):* This plant is found widely in Pakistan and can grow into a tall tree, but bush type varieties are also found. Growth is best in humid areas or where plenty of irrigation is available, but it has ability to grow on different types of soils and climatic conditions. The leaves and pods are highly nutritious. During periods of fodder shortage, the leaves and shoots are lopped and fed to sheep and goats.

Mulberry *(Morus alba):* This plant is commonly know as 'Tut'. Tut is a medium sized deciduous plant. Large plantations of this tree are raised in irrigated areas. It grows in plains and low mountainous regions. The leaves are fed to sheep and goats.

Kau *(Olea ferruginea):* This is medium sized ever green tree grown in the foothills of Himalayas, the Pothwar scrub ranges, and several parts of Balochistan. It is fairly drought resistant. The leaves are fed to livestock.

Jand *(Prosopis cineraria):* Jand is a leguminous plant with small thorns. It is widely distributed throughout Thal, Cholistan, Tharparkar, Kohistan, Pothwar, and parts of Balochistan. The plant can grow in low rainfall areas. It is a drought and salt tolerant tree. The pods and leaves are eaten by sheep and goats.

Wan *(Salvadora oleoides):* The small sized evergreen tree with drooping branches. The flowers are yellowish to greenish white. Its fruit ripens in June. It is found in Thal, D.G. Khan, Cholistan, Tharparkar and Salt Range, It grows on different types of soils and is drought resistant. The foliage is eaten by sheep and goats.

Ber *(Ziziphus mauritiana):* This is a shrub like tree and ranges in size from small to fairly large.

The branches are drooping and bear spines as well as sweet fruit. The tree is hardy and needs little water. Deep sandy loam or alkaline soils are suitable. The leaves are fed to sheep and goats and fruits are eaten by humans. The tree grows throughout ranges of Pothwar, Thal, and Cholistan. It is browsed by sheep and goats.

Frash *(Tamarix aphylla):* This is medium fast growing tree found in Indus plains of Sindh and Punjab. It is drought resistant and can grow in salty soils. The leaves are eaten by sheep and goats.

Mesquite *(Prosopis juliflora):* This plant can grow on different types of soils and found throughout Pakistan. It has become a weed in irrigated tracts. Although the leaves and pods have low feeding value, they are consumed by livestock during feed shortages.

HAY MAKING

Hay is forage harvested during the growing period and preserved by drying for subsequent use. Drying or making hay is the most common method of preserving forage for storage, primarily because it is relatively easy to handle and ability in providing roughage feed throughout the year.

The objectives of hay making are to:

1) Harvest the crop at the optimum stage of maturity which will provide maximum yield of nutrients per acre without damage to the next crop.
2) Cure the crop properly by lowering the water content of the green herbage from 65-85% to 20% or less.

Crops Suitable for Hay Making

Berseem and Lucern are most suitable leguminous forage crops for hay making in Pakistan. Naturalized grass pasture in hilly areas can also be harvested for hay making. There is little natural vegetation suited to hay making but in some northern areas hillsides produce enough vegetation to be

worth mowing. These grasses are mostly unpalatable while green but dried grass is eaten well by livestock.

Whether the crop is a grass or a legume, or a combination, the stage of maturity of a plant at the time of harvest affects digestibility, yield, and feeding value. Young immature plants are high in protein and low in fiber or lignin. As hay crops matures, feeding value goes down and fiber contents increase. Digestibility of the forage (TDN) declines about 0.5% each day cutting is delayed beyond the early bloom stage and intake of forage decreases during this same period at more than 0.5% each day. Thus, in total, the feeding value of forage drops more than 1% for each day's delay after early bloom.

Methodology for Hay Making

- A forage crop to be harvested for hay should be mowed just as soon as after reaching an early bloom stage of maturity as circumstance will permit. Undue delay in harvesting will result in low quality hay.

- Every effort should be made to select periods of rain-free weather as about two days of good drying weather are required for curing hay. Weather forecasts can be frequently of great assistance in this regard.

- Windrowing should be practiced, i.e. putting the cut herbage into rows for further handling and collection and sometimes also for protection at night.

- Trussing or putting into cocks (small heaps) are intermediate stages of drying used in some manual systems.

- Turning to allow even drying of swath will help dissipate heat and reduce the danger of mould development and fermentation.
- A forage crop being harvested for hay should be raked before it is completely dry to avoid excessive shattering and over exposure to the sun.
- The drying should be as quickly as possible to minimize losses.
- Carting & storage with or without baling.

The hay which is improperly harvested may suffer losses due to:

Shattering: This is loss of leaves, which are the most nutritious part of hay plant. Legumes tend to shatter badly.

Leaching: Rain on hay during the curing period tends to leach out and causes the loss of the more water soluble nutrients.

Bleaching: While a certain amount of exposure to sun light is essential and desirable for making good quality hay, excessive exposure to sunlight will cause heavy losses of certain nutrients especially carotene. Hay should be stored under the shade to avoid bleaching during storage.

Hay Feeding with Supplement Ration

In order to provide sheep and goats rations with proper bulk, on one hand, and energy density, on the other, 2% of the live weight hay is included in the animal's daily ration. Grains and supplements are then added to meet the requirements for growth/fattening. The rate of roughage feeding should be adjusted so that the total daily consumption of air-dry feed does not exceed 3.5% to 4% of animal's live weight. In balancing rations for fattening, it is very important that such animals be brought on to grain/concentrate ration feeding gradually in order to avoid excessive losses from enterotoxemia or so called “overeating disease”.

STANDARD OPERATING PROCEDURE

i. SELECTION AND PROCUREMENT OF ANIMALS FOR FATTENING

The response of sheep or goats to feedlot fattening may vary in terms of growth rate, feed efficiency and meat quality because of variation in age, breed, previous feeding and/or management. Males grow faster than females and the progeny of large breeds grow faster than progeny of small breeds. Crossbred offsprings of smaller breeds has faster growth rates in the progeny. Castrated males grow faster than entire males, irrespective of the method of castration (open or emasculation).

While purchasing animals for feedlot fattening following points should be kept in mind:

- The animals should be alert and healthy.
- The weight of the animals should be average weight of that age. The emaciated, thin and worm infested sick animals do not give optimum growth rates. The animals those are under size for their particular breed are not recommended.
- The purchase of animals should be on live weight basis rather visual estimates. The weight of the animals should be taken after at least twelve hour fasting.
- The animals having missing teeth and lower jaw not matching upper jaw properly (either overshort or undershot) cannot eat well and should not be purchased.
- Purchase of animals from too distant places results in transportation losses and may have acclimatization problems.
- While purchasing goats and lambs consideration should given to a local predominant breed since it is more likely to be well suited to the climate, helps save transportation costs and a stressful journey for the animal.
- The age of the sheep should be more than six months, and goats more than nine months.
- Limping animal indicates hoof disease and should be avoided.

ii. QUARANTINE

For feedlot fattening of sheep and goats as animals are purchased from different sources / market, these animals are kept in quarantine shed before moving to feedlot fattening shed. The following standard procedures are performed during the quarantine period.

Identification: The proper identification of sheep and goats is necessary for accurate record keeping on the farm. There are different ways of identifying animals. The most commonly practised are: tattooing, neck chains, ear tags and ear notching.

Vaccination: Vaccination is one of the most effective means of controlling diseases on the farm. The vaccination schedule can be finalized in consultation with the local veterinarian based on the threat of diseases in a particular area, season or part of the year when a flock of sheep / goats are being raised under feedlot fattening. The following vaccines are commonly available for sheep and goats. Consult the veterinarian for knowing which vaccines to use.

- Enterotoxamia
- Pleuropneumonia
- Foot and mouth disease
- Peste des petites Ruminants (PPR) should be used particularly for goats
- Contagious Pustural Dermatitis
- Anthrax

Deworming: In sheep and goat farming, the infestation of roundworms, tapeworms, and lungworms can cause heavy financial loss. The most commonly occurring internal parasitic infestations in the area of operation should be identified, then a deworming calendar be designed in consultation with the local veterinarian. For feedlot fattening operation deworming in the beginning should always be carried out.

Dipping: Dipping or spraying for external parasites is one of the most important routine management operations in the sheep production enterprise. Dipping is more effective than spraying. The sheep are made to swim in through a dip filled with insecticide, Normally they do not like to enter into water, so they must be forced to do this. Dipping may be repeated in the case of severe infestations at intervals of 7-14 days. Procedural tips to remember are:

- Dip or spray the week after shearing to allow any cuts from sharing to heal.
- Choose a bright sunny day for dipping.
- Use the insecticide strictly in accordance with the manufacturer's instructions.
- Fill the dipping vat to 1 ft from the top.
- While passing sheep through the dip, make sure to allow enough time to permit the insecticide to be effective.
- Allow only one sheep in the vat at a time.
- After treatment keep sheep in a holding pen for at least five minutes to ensure that the liquid is drained thoroughly.

Use the dipping or spray if external parasites are seen / detected. Consult the veterinarian for the medicines to be used for spray or dip.

iii. ANIMAL PREPARATION FOR FATTENING

After passing the quarantine (normally 5 to 7 days if all animals are healthy), the animals are moved to the feedlot fattening shed, these animals are offered concentrate ration gradually so that they get

used to new feeding regime. The roughages portion in the feed is reduced whereas, concentrate portion is increased in such a manner that animal can switch over to desired level of concentrate feed within one week.

iv. FEEDING SCHEDULE FOR FATTENING

The animals raised for feedlot fattening are offered good quality feedstuff, which are palatable and free from fungus growth and any contaminations. The green roughages are harvested at proper stage of growth i.e. pre-flowering, at this stage the forages has better palatability, intake and maximum amount of desirable nutrients. In the grazing along with supplementation of concentrate ration system, at early hour of the day 50% of the daily requirement of the concentrate i.e. 1% of the body weight ration is offered, thereafter the animals are sent for grazing for few hours so that animals can consume 2% of their body weight green fodder. The duration of the grazing will depends on the availability of the green fodder. Whereas, remaining 1% of the body weight of the concentrate ration is offered in the evening in the shed.

In total mixed ration system, the fodder along with dry and/or green fodder is offered twice a day along with concentrate ration. It is important that all animal raised on feedlot system should have free access to clean drinking water all the time.

v. ANIMAL PERFORMANCE MONITORING

The following data is recorded to evaluate the performance of the animals.

- Initial body weight at zero day of each animal.
- Fortnightly body weight during the period of fattening of each animal.
- Final body weight of each animal at the time of sale.
- Average daily total feed offered.
- Average daily fodder offered.
- Date and dose of deworming and vaccination and health record of animals.

FEASIBILITY STUDY FOR GOAT MEAT PRODUCTION (LEAD FARM)

Size of the Lead Farm

A manageable and yet economically viable size of the farm is of 600 goats raising for mutton production under intensive system of feeding. A batch of 600 animals will be raised for 90 days at the farm, hence 3 to 4 crops per year for total number of 1800 to 2400 animals will be generated. The beginners are recommended to start with lesser number of animals for the first year till they gain sufficient experience for running a farm with full strength.

Land

About 10 acres of land is required for a 600 goats. Most of the land will be used for fodder production and/or for grazing. The remaining will be used for construction of sheds and accessory buildings for providing the animals a comfortable environment and protect them from inclement weather for maximum exploitation of their potential. Leasing this land is a better option for a new investor. Land on lease is available in rural areas for a period of 5-15 years. Good agricultural land is available with an annual rent of Rs. 6,000-10,000 per acre. The sub-soil water should be suitable for irrigation, drinking and other farm use.

Animals

The animals should be purchased as per guidelines provided from the respective goat markets.

Table A: Cost on Animals

Flock No.	Number of Animals	Average Body Wt., kg	Cost Per kg Live Weight	Total cost
1.	600	25	110	16,50,000
2.	600	25	110	16,50,000
3	600	25	110	16,50,000
4.	600	25	110	16,50,000
			Total Cost Per Year	**66,00,000**

Table B: Space Requirements and Estimated Cost of Farm Buildings:

Description	Space/ Animal (sft)	Total space (sft)	Cost/sft Rs.	Total cost Rs.
Shed for 600 goats (covered)	12	7200	200	14,40,000
Open paddock for 600 goats	24	14400	10	1,44,000
Quarantine Pen for 50 goats (covered)	12	600	200	120,000
Open Paddock for 50 goats	24	1200	10	12,000
Isolation Pen for 30 (covered)	12	360	200	72,000
Open Paddock for 30 goats	24	720	10	72,00
Office and Store (12x16)	-	192	240	46,080
Feed grinding and mixing shed (30x50)	-	1500	240	360,000
Hay and chaff cutter shed (20x30)	-	600	100	60,000
Stores for ration & machinery (12x20)	-	240	200	48,000
Misc. store	12X10	120	200	24,000
Attendants room	12X15	180	200	36,000
Dipping vat and gathering facility				50,000
Total Rs.				**24,19,280/-**

Farm Machinery and Equipments

The following machinery and equipments are generally needed on a goat farm for supply of fodder and concentrate ration for feeding of animals, cleaning of buildings, equipment and other accessory structures.

Table C: Cost of Farm Machinery and Equipments:

Farm supplies	Unit Cost, Rs.	Total Cost, Rs.
Feed grinding and mixing unit	498,000	498,000
Concentrate mangers 60	400	24,000
Hay Racks 60	500	30,000
Chaff cutter	25,000	25,000
Water pump	5,000	5,000
Tube well	50,000	50,000
Other farm equipment		50,000
Total Cost		**Rs. 682,000/-**

Feed Requirements

Concentrate

As a thumb rule, about 2 percent body weight dry matter concentrate is required for fattening of goat along with green fodder/grazing. As the average initial body weight is 25kg, the average concentrate requirement is calculated based on average weight of 30kg. Therefore, for 30 kg body weight @ 2 percent dry matter for concentrate having 90 % dry matter the daily allowance per head will be 0.66 kg.

Fodder & forages

Fodder is essentially required for feeding of goats. Average fodder production ranges from 30 to 45 tons per acre depending upon the type of fodder and soil fertility. Daily fodder requirement is about 2% of body weight on dry matter basis. Therefore for a 30kg goat, the fodder dry matter required will be 0.60 kg, if a fodder has an average dry matter of 25% then on an average a goat will consume 2.4kg fodder. If cropping intensity of 150 % is assumed, 10 acres (15 acres cropped area) will provide the required amount of green fodder. Average production cost of different fodders includes cost of seed, fertilizer, land preparation and irrigation cost and is estimated to be Rs. 3000/- per acre. Following table shows the requirements for concentrate and green fodder for goats and its cost.

Table D: Concentrate and Fodder Requirements

Commodity	No. of Animals	Daily Allowance @ 2% B.W., kg	Total Annual Requirement (kg)	Cost, Rs.
Concentrate @ Rs. 7/- per kg	600 - 2% mortality =588	0.66	141649	991544
Fodder @ Rs. 0.12/kg	588	2.4	515088	61810
			Total	**1053354/-**

Requirements of Workers

One worker can generally take care of 75 goats. So a total of 8 workers will be needed for feeding and management along with a supervisor for maintaining records, market supplies and health care of the herd. Details of workers cost are given in the following table.

Table E. Details of expenditure on the farm workers

Description	No.	Salary/month, Rs	Annual cost, Rs.
Supervisor	1	6,000	72,000
Worker	8	3,000	288,000
		Total Rs.	**360000**

Table F. Annual expenditure on health care

Item	Description	Cost, Rs.
Health care	588 x4 animals @ Rs. 50/head	117600
	Total	**Rs. 117600**

SUMMARY OF FARM EXPENDITURE AND INCOME (FARM BUDGET)

Table G. Capital Cost:

Item	Description	Cost, Rs.
Buildings	Table B	24,19,280
Machinery and Equipment	Table C	6,82,000
Total Capital Cost		**Rs. 7901280**

Table H. Recurrent Cost:

Item	Description	Cost, Rs.
Animals	2400 (Table A)	66,00,000
Land Rent	10 acres @ Rs. 8,000/acre	80,000
Feed cost	Concentrate & Green Fodder (Table D)	1053354
Cost of workers	(Table E)	360,000
Health care	(Table F)	117600
Depreciation	Buildings @ 5% (Table B)	120960
	Machinery and Equipment @ 15% (Table C)	102300
Repair	Buildings @ 2% (Table B)	48385
	Machinery and Equipment @ 10% (Table C)	68200
Mortality	Animals @ 2 %	36000
Misc. Utilities	@Rs. 10,000/month	120,000
	Total Rs.	**8706799**

Table I. Farm Income:

Items	Particulars	Amount
Animals sold 2352	average wt. 35.8 kg @ Rs. 120/kg live Wt.	10104192
Skins	48 @ Rs. 500	24000
Farm Yard Manure	20 trolleys @ Rs. 2000 per trolley	40,000
	Total Rs.	**10168192**

Table J. Profit:

Particulars	Amount, Rs
Total Income	10168192
Total Recurring Cost	8706799
Profit	1461393

FEASIBILITY STUDY FOR GOAT MEAT PRODUCTION (SMALL FARM)

Size of the Farm

The minimum of 150 animals are raised under feedlot system having two sheds of 75 animals each. A batch of 150 animals will be raised for 90 days at the farm, hence 4 crops per year for a total number of 600 animals will be generated.

Land

About 3 acres of land is required for a 150 goats. Most of the land will be used for fodder production and/or for grazing. The remaining will be used for construction of sheds and accessory buildings for providing the animals a comfortable environment and protect them from inclement weather for maximum exploitation of their potential. Leasing this land is a better option for a new investor. Land on lease is available in rural areas for a period of 5-15 years. Good agricultural land is available with an annual rent of Rs. 6,000-10,000 per acre. The sub-soil water should be suitable for irrigation, drinking and other farm use.

Animals

The animals should be purchased as per guidelines provided from the respective goat markets.

Table A: Cost on Animals

Flock No.	Number of Animals	Average Body Wt., kg	Cost Per kg Live Weight	Total cost
1.	150	25	110	412500
2.	150	25	110	412500
3	150	25	110	412500
4.	150	25	110	412500
			Total Cost Per Year	16,50,000

Table B: Space Requirements and Estimated Cost of Farm Buildings:

Description	Space/ Animal (sft)	Total space (sft)	Cost/sft Rs.	Total cost Rs.
Shed for 150 goats (covered)	12	1800	200	360000
Open paddock for 150 goats	24	3600	10	36000
Quarantine Pen for 20 goats (covered)	12	240	200	48000
Open Paddock for 20 goats	24	480	10	4800
Office and Store (12x10)	-	120	240	28800
Stores for ration & machinery (12x20)	-	240	200	48,000
Total Rs.				**525600**

Farm Machinery and Equipments:

The following machinery and equipments are generally needed on a goat farm for supply of fodder and concentrate ration for feeding of animals, cleaning of buildings, equipment and other accessory structures.

Table C: Cost of Farm Machinery and Equipments:

Farm supplies	Unit Cost, Rs.	Total Cost, Rs.
Concentrate mangers 15	400	6000
Hay Racks 15	500	7500
Chaff cutter	25,000	25,000
Water pump	5,000	5,000
Other farm equipment		20,000
Total Cost, Rs		**63500**

Feed Requirements

Concentrate

As a thumb rule, about 2 percent body weight dry matter concentrate is required for fattening of goat along with green fodder/grazing. As the average initial body weight is 25kg, the average concentrate requirement is calculated based on average weight of 30kg. Therefore, for 30 kg body weight @ 2 percent dry matter for concentrate having 90 % dry matter, the daily allowance per head will be 0.66 kg.

Fodder & Forages:

Fodder is essentially required for feeding of goats. Average fodder production ranges from 30 to 45 tons per acre depending upon the type of fodder and soil fertility. Daily fodder requirement is about 2% of body weight on dry matter basis. Therefore for a 30kg goat, the fodder dry matter required will be 0.60 kg, if a fodder has an average dry matter of 25% then on an average a goat will consume 2.4kg fodder. If cropping intensity of 150 % is assumed, 2.5 acres (3.75 acres cropped area) will provide the required amount of green fodder. Average production cost of different fodders includes cost of seed, fertilizer, land preparation and irrigation cost and is estimated to be Rs. 3000/- per acre. Following table shows the requirements for concentrate and green fodder for goats and its cost.

Table D: Concentrate and Fodder Requirements

Commodity	No. of Animals	Daily Allowance @ 2% B.W., kg	Total Annual Requirement (kg)	Cost, Rs.
Concentrate @ Rs. 8/- per kg	150 - 2% mortality =147	0.66	35412	283296
Fodder @ Rs. 0.12/kg	147	2.4	128772	15452
			Total	**298748**

Requirements of Workers:

One worker can generally take care of 75 goats. So a total of 2 workers will be needed for feeding and management along with a supervisor (part time) for maintaining records, market supplies and health care of the herd. Details of workers cost are given in the following table.

Table E. Details of expenditure on the farm workers

Description	No.	Salary/month, Rs	Annual cost, Rs.
Supervisor	1	5,000	60,000
Worker	2	3,000	72000
		Total Rs.	**132000**

Table F. Annual expenditure on health care

Item	Description	Cost, Rs.
Health care	143 x4 animals @ Rs. 50/head	28600
	Total, Rs.	**28600**

SUMMARY OF FARM EXPENDITURE AND INCOME (FARM BUDGET)

Table G. Capital Cost:

Item	Description	Cost, Rs.
Buildings	Table B	525600
Machinery and Equipment	Table C	63500
Total Capital Cost, Rs.		**589100**

Table H. Recurrent Cost:

Item	Description	Cost, Rs.
Animals	(Table A)	1650000
Land Rent	3 acres @ Rs. 8,000/acre	24000
Feed cost	Concentrate & Green Fodder (Table D)	298748
Cost of workers	(Table E)	132000
Health care	(Table F)	28600
Depreciation	Buildings @ 5% (Table B)	26280
	Machinery and Equipment @ 15% (Table C)	9525
Repair	Buildings @ 2% (Table B)	10512
	Machinery and Equipment @ 10% (Table C)	6350
Mortality	Animals @ 2 %	33000
Misc. Utilities	@Rs. 2,000/month	24000
	Total Rs.	**2243015**

Table I. Farm Income:

Items	Particulars	Amount
Animals sold 572	average wt. 35.8 kg @ Rs. 120/kg live Wt.	2457312
Skins	12 @ Rs. 500	6000
Farm Yard Manure	5 trolleys @ Rs. 2000 per trolley	10000
	Total Rs.	**2473312**

Table J. Profit:

Particulars	Amount, Rs
Total Income	2473312
Total Recurring Cost	2243015
Profit	230297

FEASIBILITY STUDY FOR LAMB T MEAT PRODUCTION (LEAD FARM)

Size of the Lead Farm

A manageable and yet economically viable size of the farm is of 600 lamb raising for mutton production under intensive system of feeding. A batch of 600 animals will be raised for 90 days at the farm, hence 4 crops per year for total number of 2400 animals will be generated. The beginners are recommended to start with lesser number of animals for the first year, till they gain sufficient experience for running a farm with full strength.

Land

About 10 acres of land is required for a 600 lambs. Most of the land will be used for fodder production and/or for grazing. The remaining will be used for construction of sheds and accessory buildings for providing the animals a comfortable environment and protect them from inclement weather for maximum exploitation of their potential. Leasing this land is a better option for a new investor. Land on lease is available in rural areas for a period of 5-15 years. Good agricultural land is available with an annual rent of Rs. 6,000-10,000 per acre. The sub-soil water should be suitable for irrigation, drinking and other farm use.

Animals

The animals should be purchased as per guidelines provided from the respective sheep markets.

Table A: Cost on Animals

Flock No.	Number of Animals	Average Body Wt., kg	Cost Per kg Live Weight	Total cost
1.	600	25	100	15,00,000
2.	600	25	100	15,00,000
3	600	25	100	15,00,000
4.	600	25	100	15,00,000
			Total Cost Per Year	60,00,000

Table B: Space Requirements and Estimated Cost of Farm Buildings:

Description	Space/ Animal (sft)	Total space (sft)	Cost/sft Rs.	Total cost Rs.
Shed for 600 lambs (covered)	12	7200	200	14,40,000
Open paddock for 600 lambs	24	14400	10	1,44,000
Quarantine Pen for 50 lambs (covered)	12	600	200	120,000
Open Paddock for 50 lambs	24	1200	10	12,000
Isolation Pen for 30 (covered)	12	360	200	72,000
Open Paddock for 30 lambs	24	720	10	72,00
Office and Store (12x16)	-	192	240	46,080
Feed grinding and mixing shed (30x50)	-	1500	240	360,000
Hay and chaff cutter shed (20x30)	-	600	100	60,000
Stores for ration & machinery (12x20)	-	240	200	48,000
Misc. store	12X10	120	200	24,000
Attendants room	12X15	180	200	36,000
Dipping vat and gathering facility				50,000
Total Rs.				**24,19,280/-**

Farm Machinery and Equipments:

The following machinery and equipments are generally needed on a sheep farm for supply of fodder and concentrate ration for feeding of animals, cleaning of buildings, equipment and other accessory structures.

Table C: Cost of Farm Machinery and Equipments:

Farm supplies	Unit Cost, Rs.	Total Cost, Rs.
Feed grinding and mixing unit	498,000	498,000
Concentrate mangers 60	400	24,000
Hay Racks 60	500	30,000
Chaff cutter	25,000	25,000
Water pump	5,000	5,000
Tube well	50,000	50,000
Other farm equipment		50,000
Total Cost		**Rs. 682,000/-**

Feed Requirements
Concentrate

As a thumb rule, about 2 percent body weight dry matter concentrate is required for fattening of lambs along with green fodder/grazing. As the average initial body weight is 25kg, the average concentrate requirement is calculated based on average weight of 34kg. Therefore, for 34 kg body weight @ 2 percent dry matter for concentrate having 90 % dry matter the daily allowance per head will be 0.75 kg.

Fodder & Forages

Fodder is essentially required for feeding of sheep. Average fodder production ranges from 30 to 45 tons per acre depending upon the type of fodder and soil fertility. Daily fodder requirement is about 2% of body weight on dry matter basis. Therefore for a 34kg lamb the fodder dry matter required will be 0.68 kg, if a fodder has an average dry matter of 25% then on an average a lamb will consume 2.72kg fodder. If cropping intensity of 150 % is assumed, 10 acres (15 acres cropped area) will provide the required amount of green fodder. Average production cost of different fodders includes cost of seed, fertilizer, land preparation and irrigation cost and is estimated to be Rs. 3000/- per acre. Following table shows the requirements for concentrate and green fodder for goats and its cost.

Table D: Concentrate and Fodder Requirements

Commodity	No. of Animals	Daily Allowance @ 2% B.W., kg	Total Annual Requirement (kg)	Cost, Rs.
Concentrate @ Rs. 7/- per kg	600 - 2% mortality =588	0.75	160965	1126755
Fodder @ Rs. 0.12/kg	588	2.72	583766	70052
			Total	**1196807/-**

Requirements of Workers

One worker can generally take care of 75 lambs. So a total of 8 workers will be needed for feeding and management along with a supervisor for maintaining records, market supplies and health care of the herd. Details of workers cost are given in the following table.

Table E. Details of expenditure on the farm workers

Description	No.	Salary/month, Rs	Annual cost, Rs.
Supervisor	1	6,000	72,000
Worker	8	3,000	288,000
		Total Rs.	**360000**

Table F. Annual expenditure on health care

Item	Description	Cost, Rs.
Health care	588 x4 animals @ Rs. 50/head	117600
	Total	**Rs. 117600**

SUMMARY OF FARM EXPENDITURE AND INCOME (FARM BUDGET)

Table G. Capital Cost:

Item	Description	Cost, Rs.
Buildings	Table B	24,19,280
Machinery and Equipment	Table C	6,82,000
Total Capital Cost		**Rs. 31,01,280**

Table H. Recurrent Cost:

Item	Description	Cost, Rs.
Animals	2400 (Table A)	60,00,000
Land Rent	10 acres @ Rs. 8,000/acre	80,000
Feed cost	Concentrate & Green Fodder (Table D)	1196807
Cost of workers	(Table E)	360,000
Health care	(Table F)	117600
Depreciation	Buildings @ 5% (Table B)	120960
	Machinery and Equipment @ 15% (Table C)	102300
Repair	Buildings @ 2% (Table B)	48385
	Machinery and Equipment @ 10% (Table C)	68200
Mortality	Animals @ 2 %	36000
Misc. Utilities	@Rs. 10,000/month	120,000
	Total Rs.	**8250252**

Table I. Farm Income:

Items	Particulars	Amount
Animals sold 2352	average wt. 43 kg @ Rs. 110/kg live Wt.	11124960
Skins	48 @ Rs. 500	24000
Farm Yard Manure	20 trolleys @ Rs. 2000 per trolley	40,000
	Total Rs.	**11188960**

Table J. Profit:

Particulars	Amount, Rs
Total Income	11188960
Total Recurring Cost	8250252
Profit	2938708

FEASIBILITY STUDY FOR LAMB MEAT PRODUCTION (SMALL FARM)

Size of the Farm

The minimum of 150 animals are raised under feedlot system having two sheds of 75 animals each. A batch of 150 animals will be raised for 90 days at the farm hence 4 crops per year for total number of 600 animals will be generated.

Land

About 3 acres of land is required for a 150 lambs. Most of the land will be used for fodder production and/or for grazing. The remaining will be used for construction of sheds and accessory buildings for providing the animals a comfortable environment and protect them from inclement weather for maximum exploitation of their potential. Leasing this land is a better option for a new investor. Land on lease is available in rural areas for a period of 5-15 years. Good agricultural land is available with an annual rent of Rs. 6,000-10,000 per acre. The sub-soil water should be suitable for irrigation, drinking and other farm use.

Animals

The animals should be purchased as per guidelines provided from the respective sheep markets.

Table A: Cost on Animals

Flock No.	Number of Animals	Average Body Wt., kg	Cost Per kg Live Weight	Total cost
1.	150	25	100	375000
2.	150	25	100	375000
3	150	25	100	375000
4.	150	25	100	375000
			Total Cost Per Year	1500000

Table B: Space Requirements and Estimated Cost of Farm Buildings:

Description	Space/ Animal (sft)	Total space (sft)	Cost/sft Rs.	Total cost Rs.
Shed for 150 lambs (covered)	12	1800	200	360000
Open paddock for 150 lambs	24	3600	10	36000
Quarantine Pen for 20 lambs (covered)	12	240	200	48000
Open Paddock for 20 lambs	24	480	10	4800
Office and Store (12x10)	-	120	240	28800
Stores for ration & machinery (12x20)	-	240	200	48,000
Total Rs.				**525600/-**

Farm Machinery and Equipments:

The following machinery and equipments are generally needed on a sheep farm for supply of fodder and concentrate ration for feeding of animals, cleaning of buildings, equipment and other accessory structures.

Table C: Cost of Farm Machinery and Equipments:

Farm supplies	Unit Cost, Rs.	Total Cost, Rs.
Concentrate mangers 15	400	6000
Hay Racks 15	500	7500
Chaff cutter	25,000	25,000
Water pump	5,000	5,000
Other farm equipment		20,000
Total Cost, Rs		**63500**

Feed Requirements

Concentrate

As a thumb rule, about 2 percent body weight dry matter concentrate is required for fattening of lambs along with green fodder/grazing. As the average initial body weight is 25kg, the average concentrate requirement is calculated based on average weight of 34kg. Therefore, for 34 kg body weight @ 2 percent dry matter for concentrate having 90 % dry matter, the daily allowance per head will be 0.75 kg.

Fodder & Forages

Fodder is essentially required for feeding of sheep. Average fodder production ranges from 30 to 45 tons per acre depending upon the type of fodder and soil fertility. Daily fodder requirement is about 2% of body weight on dry matter basis. Therefore for a 34kg lamb the fodder dry matter required will be 0.68 kg, if a fodder has an average dry matter of 25% then on an average a lamb will consume 2.72kg fodder. If cropping intensity of 150 % is assumed, 2.5 acres (3.75 acres cropped area) will provide the required amount of green fodder. Average production cost of different fodders includes cost of seed, fertilizer, land preparation and irrigation cost and is estimated to be Rs. 3000/- per acre. Following table shows the requirements for concentrate and green fodder for goats and its cost.

Table D: Concentrate and Fodder Requirements

Commodity	No. of Animals	Daily Allowance @ 2% B.W., kg	Total Annual Requirement (kg)	Cost, Rs.
Concentrate @ Rs. 8/- per kg	150 - 2% mortality =147	0.75	40241	321928
Fodder @ Rs. 0.12/kg	147	2.72	145941	17513
			Total, Rs.	**339441**

Requirements of Workers

One worker can generally take care of 75 lambs. So a total of 2 workers will be needed for feeding and management along with a supervisor for maintaining records, market supplies and health care of the herd. Details of workers cost are given in the following table.

Table E. Details of expenditure on the farm workers

Description	No.	Salary/month, Rs	Annual cost, Rs.
Supervisor	1	5,000	60000
Worker	2	3,000	72000
		Total Rs.	**132000**

Table F. Annual expenditure on health care

Item	Description	Cost, Rs.
Health care	147 x4 animals @ Rs. 50/head	29400
	Total, Rs	**29400**

SUMMARY OF FARM EXPENDITURE AND INCOME (FARM BUDGET)

Table G. Capital Cost:

Item	Description	Cost, Rs.
Buildings	Table B	525600
Machinery and Equipment	Table C	63500
Total Capital Cost, Rs.		**589100**

Table H. Recurrent Cost:

Item	Description	Cost, Rs.
Animals	600 (Table A)	15,00,000
Land Rent	3 acres @ Rs. 8,000/acre	24000
Feed cost	Concentrate & Green Fodder (Table D)	339441
Cost of workers	(Table E)	132000
Health care	(Table F)	29400
Depreciation	Buildings @ 5% (Table B)	26280
	Machinery and Equipment @ 15% (Table C)	9525
Repair	Buildings @ 2% (Table B)	10512
	Machinery and Equipment @ 10% (Table C)	6350
Mortality	Animals @ 2 %	30000
Misc. Utilities	@Rs. 2,000/month	24000
	Total Rs.	**2131508**

Table I. Farm Income:

Items	Particulars	Amount
Animals sold 588	average wt. 43 kg @ Rs. 110/kg live Wt.	2781240
Skins	12 @ Rs. 500	6000
Farm Yard Manure	5 trolleys @ Rs. 2000 per trolley	10000
	Total Rs.	**2797240**

Table J. Profit:

Particulars	Amount, Rs
Total Income	2797240
Total Recurring Cost	2131508
Profit	665732