

Sheep farming

Introduction

Few countries in the world have no sheep. They are found in tropical countries and in the arctic, in hot climates and in the cold, on the desert and in humid areas. There are over 800 breeds of sheep in the world, in a variety of sizes, shapes, types and colours.

Sheep were domesticated long before the dawn of recorded history. Wool fibres have been found in remains of primitive villages of Switzerland that date back an estimated 20000 years. Egyptian sculpture dating 4000-5000 B.C. portrays the importance of this species to people. Much mention is made in the Bible of flocks, shepherds, sacrificial lambs, and garments made of wool. The Roman empire prized sheep, anointed them with special oils, and combed their fleece to produce fine quality fibres that were woven into fabric for the togas of the elite.

Perhaps the first ruminants domesticated by man along with goats, sheep are a very valuable and important asset to mankind.

Domesticated sheep : phylum *Chordata* (backbone), class *Mammalia* (suckle their young), order *Artiodactyla* (hooved, even-toed), family *Bovidae* (ruminants), genus *Ovis* (domestic and wild sheep), and species *Ovisaries*

Domestication:-

"It is hard to imagine a wild animal more readily tamed than wild sheep"

Little is known about the original selection and domestication of sheep, but they are thought to have descended from wild types like the Moufflon, a short-tailed sheep. Wild varieties in Europe and Asia probably served as foundation stock to produce wool, meat, skins and milk. It appears that selection practices not only removed most of the wild instincts, leaving the species completely dependant on people for management and protection, but the tail also lengthened. Nearly all domestic sheep today have long tails before docking.

As weaving and felting began to develop as an important element in the advancement of civilization, more definite types and breeds of sheep began to emerge to produce quality fibres at the expense of other traits. The Merino breed of Spain developed into one of the first recognizable fine wool breeds. It was so prized that the King of Spain made it a crime punishable by death to send any out of the country without his permission.

The English also developed many breeds very early that would adapt to their varying climate. Domestic sheep were foreign to the New World and were first introduced by Columbus on his second voyage in 1493 to the West Indies. Cortez brought sheep into Mexico in 1519, and Spanish missionaries contributed to their popularity through the teaching of weaving arts to the Indians.

The taxonomy and nomenclature of sheep and goats is very complicated, esp. that of sheep where altogether at least 40 wild races have been described. There are, however, eight basic taxonomic groups of sheep that may be summarized as follows:

- Ovisnivicola (Siberian snow sheep)
- Ovisaries (domestic sheep)
- Ovismusimon (European mouflon)
- Ovisorientalis (Asiatic mouflon)
- Ovisdalli (dall or thin-horned sheep)
- Oviscanadensis (bighorn sheep)
- Ovisammon (arkhar-argali / Marco Polo sheep)
- Ovisvignei (urial)

Sheep in India and Arabia have originated from their wild ancestor *Ovisorientalevignei* ... domesticated in the mountains of Iran, Turkistan & Balochistan. Reference to their role in the economy of mankind is found in the history of civilization of Mesopotamia, Mohenjodaro and Harappa.

Wild sheep of various races have similar social behaviour. Males older than two years are normally found in groups of their own, segregated from the females and juveniles. They follow the largest horned ram in their band and females follow one of the mature lambed females.

Advantages of sheep farming:-

1. Multi-faceted utility : meat, wool, skin, manure, and to some extent milk & transport ... helps it to play an important role in the Indian agrarian economy
2. The production of wool, meat and manure provides three different sources of income per year
3. Since the two major products of sheep (wool and mutton) are entirely different in their production and utilization, the price of one may not necessarily have a bearing on the other. Wool may be stored and held for higher prices or sold at shearing time. A crop of lambs may be marketed from 5-6 months onwards (preferably before one year), bringing rather a quick return.
4. Mutton is one kind of meat towards which there is no prejudice by any community in India
5. In addition to wool, mutton and to some extent milk, sheep provide employment to about 3 million people in the form of self-employment, as hired labour for tending flocks during migration, and persons engaged in wool shearing and in wool and skin processing. Furthermore, sheep farming is a logical source of livelihood in arid zones where crop production is an uncertainty and thus it suitably fits into desert development programmes in vogue by protecting them from the vagaries of drought and famine.
6. Most suitable of the small ruminants to utilize the sparse vegetation in dryland areas through rangeland management and developed (reseeded) pasture
7. Unlike goats, sheep hardly damage any tree

8. Better adapted to arid and semi-arid tropics with marginal and sub-marginal lands, otherwise unfit for crops, due to their superior water & feed (esp. protein) economy
9. Since sheep eat more different type of plants than any other kind of livestock, they can turn waste into profit and at the same time improve the appearance of many farms (i.e. excellent weed destroyer).
10. Sheep dung is a valuable fertilizer, and since they are grazed on sub-marginal lands, their droppings are the only means of improving the growth of plants in such areas

Unique characteristics of sheep:-

1. Strong herd instincts of sheep make them excellent ranch animals as they keep together in tight and easily managed flocks and do not disperse widely all over the available land, which would make it difficult to protect them from predators and difficult to round up.
2. Excellent ability to survive over a prolonged period of drought and semi-starvation
3. Sheep have the ability to produce prime carcasses on roughage alone, thus they are well adapted to many areas unable to produce grain profitably.
4. The structure of their lips helps them to clean grains lost at harvest time, and thus convert waste feed into profitable products
5. Less prone to extreme weather conditions, ectoparasites as well as other diseases
6. Unique ever-growing fibre which allows ventilation and also protects the skin from the hot sun, rain and abrasions
7. Sheep can also constrict or relax blood vessels in the face, legs and ear for control of heat loss
8. Their visual sense is exceedingly well-developed they can discern movement far better than humans, but cannot distinguish shapes as well as man
9. Sheep do not need expensive buildings to house them
10. Sheep require less labour than other kinds of livestock

Because of their hardiness and adaptability to dry conditions, the north-western and southern peninsular regions of the country have a large concentration of sheep. In the tropics, they are non-seasonal breeders and can be made to lamb throughout the year.

Because of their close grazing nature and ability to utilize very low-set vegetation which no other animal can utilize and their capacity to cover long distances in search of forage and water, they have often been generally associated with desertification. In reality, it is not the sheep but the man who owns the sheep, who is to be blamed for the misconceived management of the grazing lands, leading to desertification. Rather, a controlled and judicious grazing on the non-cultivable

land could prevent soil erosion and make it fertile and suitable for crop production through sheep dropping collected over the years.

There is great variation in the external characteristics of sheep, manifested in the number and form of horns in the shape and size of ears, in an arching of nasal bones in some types, in length of tail and in the development of great masses of fat at the base of the tail and other posterior parts of the body. There are extreme variations too in colour of the face and other parts not covered with wool. Great variations exist in the quality and colour of the fleece. These variations have provided the basis for improving sheep for different products viz. wool, mutton and pelt. Variations in wool were pronounced with respect to colour, staple length, fineness and other characteristics. The wool on the shoulder is finer than that grows on the thigh, belly and around the tail. Wool that grows on the folds in the skin is likely to be considerably coarser than that which grows between the folds.

IMPORTANCE OF SHEEP PRODUCTION IN NATIONAL ECONOMY

Sheep is a important livestock species of India. They contribute greatly to the agrarian economy, especially in the arid/semi-arid and mountainous areas where crop and /or dairy farming are not economical. They play an important role in the livelihood of a large percentage of small and marginal farmers and landless labourers engaged in sheep rearing. A number of rural-based industries use wool and sheep skins as raw material. Sheep manure is an important source of soil fertility, especially in southern states.

Sheep in India are mostly maintained on natural vegetation on common grazing lands, wastelands and uncultivated (fallow) lands, stubbles of cultivated crops and top feeds (tree loppings). Rarely are they kept on grain, cultivated fodder or crop residue.

Sheep are mostly reared for wool and meat. Sheep skins and manure constitute important sources of earning, the latter particularly in southern India. Milk from sheep is of limited importance and that too in very limited areas of Jammu and Kashmir, Rajasthan and Gujarat. Indian sheep are not regarded as dairy sheep.

The productivity of Indian sheep is lower than those of agriculturally more advanced countries. Yet considering their nutritional and physical environment, their productivity cannot be considered as inefficient. The major reasons for low productivity are inadequate grazing resources, diseases causing high mortality, morbidity and consequent reduced production, and serious lack of organized effort for bringing genetic improvement.

Sheep production regions of India

Sl. No.	Particulars	Northern temperate	North-western arid & semi-arid	Southern Peninsular	Eastern
1	States	J&K, Himachal Pradesh and hilly regions of UP	P&H, plains of UP, Rajasthan, Gujarat and MP	Maharashtra, AP, Karnataka, TN & Kerala	Bihar, W.B., Orissa, Assam and other eastern states

2	Population (millions)	3.99	15.42	19.64	4.87
3	Population (%)	9.64	40.25	40.2	9.96
4	Wool prodn (million kg)	4.52	28.12	8.6	1.76
5	Wool prodn (%)	12.33	64	28	3.67
6	Meat prodn (million kg)	12.72	49.15	62.59	15.54
7	Skin prodn (million kg)	2.82	10.88	13.86	3.44
8	Remarks	Sizeable proportion of sheep in this region, esp. J&K, consists of crosses between indigenous breeds and exotic fine wool breeds Kashmir Merino has evolved from higher crosses of indigenous and exotic fine wool breeds	Hissardale evolved at Govt. Livestock Farm, Hissar through interbreeding Merino x Bikaneri (3/4) crossbreds Mostly coarse carpet quality wool except Chokla&Patanwadi (which produce fine quality carpet/medium quality apparel wool)	Deccani/Bellary, Mandya& Coimbatore produce extremely coarse and hairy fleeces Nilgiris (produced by crossing indigenous hairy breeds with exotic breeds like Cape Merino, Southdown, Cheviot etc) produce fine wool Other breeds do not produce any wool and are primarily used for meat production	Wool is extremely coarse and hairy, except in Arunachal Pradesh where a small number of better wool quality sheep are available
9	Staple length (cm)	5.33-10.27	3.80-8.66	6.11-6.95	4.60-4.70
10	Fibre diameter (μ)	25.14-33.11	28.00-52.00	26.88-55.00	66.40-66.66
11	Medullation (%)	5.47-17.59	18.31-85.14	11.37-64.10	88.00-99.00
12	Wool quality (counts)	36-58/80	36-54	34.5-36	<36

Productivity

Sheep in the Northern temperate region produce wool of good apparel quality. Similarly, in climatically alike areas of southern hills, the Nilgiri sheep also produce wool of similar quality. This, however, goes down as we move from Northern temperate to North-western region where sheep produce wool of

superior to coarse quality. Sheep of Southern peninsular region either produce no wool or very little of 36s quality and are primarily used for meat production. Same is the position in Eastern region as the area is of very high humidity and is not suitable for extensive sheep raising, especially for wool.

Colour of fleece is generally white in the North-western hilly region, though black is not uncommon. Black and brown colour appears in greater proportion as we move towards North-west. In North-western plains containing arid and semi-arid sub-tropical conditions, fleece colour is again predominantly white with black and brown mostly on non-fleece points such as head and neck. In this region, problems of canary colouration of wool (non-scourable golden yellow colour) is usually observed in the autumn season. This results in almost 82% canary staining of the autumn clip which fetches 8-20% lower price resulting into a loss of about 1.5 crores per annum. A biological phenomenon of this colouration is presumed to be a sequel to an adaptive thermo-regulatory mechanism in hot and humid climatic conditions which requires dissipation of body heat through cutaneous evaporative cooling. The alkaline sweat under the conditions of high temperature and humidity reacts with wool fibres and thus causes the yellow colouration.

Grazing management and Migratory patterns

In spite of a number of sheep development activities in operation in different states of the country, sheep rearing still continues to be a nomadic/backward proposition and thus mostly concerned to poor and landless people. For scanty suitable grazing lands in most of the states, the shepherds keep on migrating their flocks over extensive areas within or even in the neighbouring states. Sheep rearing is thus practiced in a diversified form depending upon the region and the location. In Rajasthan, around 5 lakh sheep are in permanent migration where the flocks do not return to their home tract at any time of the year. The shepherds, however, keep on relieving one another and return home in turn. These sheep are mainly grazed in MP, UP and parts of Rajasthan.

Generally there are two types of migratory flocks:-

- a) Truly nomadic flocks with no fixed centres but following seasonal migratory routes to grazing areas; they are largely governed by the availability of foraging and drinking water resources.
- b) Flocks on the fallow land, but following definite migratory routes to the season pastures and returning to their permanent abodes during other seasons.
 - Sheep are grazed on fallow lands during monsoon and after the Kharif crops are harvested on stubbles in the harvested fields
 - During the later part of the year starting from Sep-Oct, they are mostly grazed on uncultivated areas where the flocks are non-migratory
 - In the case of migratory flocks, the animals are grazed on the harvested fields and the reserve forests in their migratory tracts on nominal fees from Nov-Feb
 - Shepherds also book harvested fields where the cost of grazing on stubbles and gram husk is minimal
 - In both the migratory and non-migratory flocks, top feeding by lopping tree branches and shaking of pods is also common

- During extreme summer months of the year, the flocks are grazed in the cooler hours of the day; grazing starts in the late hours of the day and the animals are brought to the water points some time in the noon hours of the following day. Animals are rested during the hotter part of the day between noon to around 4-5 PM.
 - About 5 million households in the country are engaged in the rearing of small ruminants (sheep, goats & rabbits) and other allied activities. (2003 census)
 - The main reasons for low productivity are poor exploitation of genetic potential of indigenous animals, low absorption of available technology, inadequate resource of feed and fodder, insufficient health cover, inadequate marketing and credit support etc.

Common terms used in Sheep:-

Adult male	Ram/Tup
Adult female	Ewe
New born	Lamb
Young male	Ram lamb/Tup lamb
Young female	Ewe lamb/Gimmer lamb
Castrated male	Wether/Wedder
Castrated female	Spayed
Yearlings	Hogget
Female with offspring	Suckling
Act of parturition	Lambing
Act of mating	Tupping
Pregnancy	Gestation
Sound produced	Bleating
Group	Flock/herd/mob
Species called as	Ovine
Meat	Mutton

Sheep breeds

The country has about 40 breeds of sheep out of which 24 are distinct. They vary from the non-woolly breeds of sheep in the Southern Peninsular region mainly kept for mutton and manure to the reasonably fair apparel wool breeds of the Northern temperate region.

If we follow the breed classification in strict sense, there are no specific breeds, as majority of them lack characteristics of a fixed nature. Neither are there breeding societies nor agencies to register animals of particular breeds, maintain flock books and ensure purity of the breeds. Animals with distinct characters localized to a place and different from those of other places are termed as breeds and give some local name. There have been little efforts to conserve and improve the native breeds except for some Govt farms. Some important breeds of sheep are maintained for pure-breeding and producing stud rams for distribution to the farmers. Most of the breeds of sheep in India have evolved through natural adaptation to agro-ecological conditions, followed by some limited artificial selection for particular requirements. Most of the breeds have generally been named after their place of origin and on the basis of prominent characters. Among the most widely distributed native sheep breeds, Marwari and Deccani are most prevalent.

Based on utility, Indian breeds of sheep can be classified into the following:-

- a) Apparel wool breeds :Hissardale, Nilgiri, Kashmir Merino, Avivastra, Bharat Merino. These are crossbreeds of native sheep with exotic fine wool/dual-purpose/mutton breeds.
- b) Superior carpet wool breeds :Chokla, Nali, Magra, Jaisalmeri, Pugal, Patanwadi, Tibetan, Bonpala, Gaddi, Rampur Bushair, Poonchi, Karnah, Gurez, Changthangi, Avikalin.
- c) Coarse carpet wool breeds :Malpura, Sonadi, Muzaffaranagari, Jalauni, Deccani, Bellary, Coimbatore, Chhotanagpuri, Balangiri, Ganjam, Bhakarwal, Shahabadi
- d) Hairy meat breeds : Nellore, Hassan, Mecheri, Kilakarsal, Vembur, Ramnad White, Madras Red, Tiruchi Black, Kenguri. These sheep are maintained primarily for meat almost in the whole of Southern Peninsular region. The wool produced is very coarse, hairy and coloured; below 36s quality; and suitable only for extremely rough carpets, barrack blankets and kambliies.

Based on various agro-climatic conditions and type of sheep found in them, the following four different regions regrouped from 15 agro-climatic zones are distinguishable over the country:-

a) North-Western, Central Arid & Semi-Arid region

The region comprises the states of Punjab, Haryana, Rajasthan and Gujarat and the plains of UP and MP. This region is important in the country for carpet wool production.

(1) Chokla (Chapper, Shekhawati)

Churu, Jhunjhunu, Sikar & border areas of Bikaner, Jaipur & Nagaur districts of Rajasthan.

Light to medium-sized; Face is generally devoid of wool and is reddish-brown/dark brown in colour; Skin is pink; Ears are small to medium in length and tubular; Coat is dense; Both sexes are polled

Although Chokla is perhaps the finest carpet-wool breed, its wool is being diverted to the worsted sector due to scarcity in fine apparel wool in the country.

(2) Nali

Ganganagar, Churu & Jhunjhunun districts of Rajasthan and southern parts of Hissar & Rohtak districts of Haryana.

Medium-sized; Face is light brown in colour; Skin is pink; Ears are large and leafy; Both sexes are polled; Tail is short to medium in length and thin;

Fleece is white, coarse, dense and long-stapled; Forehead, legs and belly are covered with wool; March clip is yellow but September clip is golden brown

(3) Marwari

Marwar region including Jodhpur, Jalore, Nagaur, Pali, & Barmer districts extending upto Ajmer and Udaipur districts of Rajasthan and Heoria region of Gujarat.

Medium-sized; Black face with colour extending upto the lower part of the neck; Ears are extremely small and tubular; Both sexes are polled; Tail is short, medium & thin.

Fleece is white and not very dense.

(4) Magra (Bikaneri, Bikaneri Chokla, Chakri)

Although the breed is largely found in Bikaner, Jaisalmer and Churu districts of Rajasthan, animals true to breed type are found only in the eastern and southern parts of Bikaner district.

Medium-to large in size; White face with brown patches around the eyes are characteristic; Skin colour is pink; Ears are small to medium and tubular; Both sexes are polled; Tail is medium in length and thin.

Fleece is of medium carpet quality, extremely white and lustrous and not very dense; Bikaneri Chokla strains have extremely white and lustrous fleeces and are suitable for good quality carpets.

(5) Jaisalmeri

Jaisalmer, Barmer and Jodhpur districts of Rajasthan.

Tall, well-built, largest breed in Rajasthan; Black or dark brown face with the colour extending upto the neck; Typical Roman nose, long drooping ears generally with a cartilaginous appendage; Both sexes are polled; Tail is medium to long.

Fleece colour is white, of medium carpet quality and not very dense.

(6) Pugal

Home tract is Pugal area of Bikaner district; also distributed over Bikaner & Jaisalmer districts.

Fairly well-built; Black face with small light brown strips on either side above the eyes; lower jaws are typically light brown in colour; black colour may extend to neck; Ears are short and tubular; Both sexes are polled; Tail is short to medium and thin.

Fleece is of medium carpet quality but not very dense.

(7) Malpura

Jaipur, Tonk, Sawaimadhopur and adjacent areas of Ajmer, Bhilwara and Bundi districts of Rajasthan.

Fairly well-built with long legs; Light brown face; Ears are short and tubular, with a small cartilaginous appendage on the upper side; Both sexes are polled; Tail is medium to long and thin.

Fleece is white, extremely coarse and hairy. Belly and legs are devoid of wool.

(8) Sonadi

Mainly found in Udaipur and Dungarpur districts of Rajasthan, it also extends to northern Gujarat.

Fairly well-built but somewhat smaller to Malpura; Long legs; Light brown face with colour extending to the middle of the neck; ears are large, flat and drooping and generally have a cartilaginous appendage; Tail is long and thin; Both sexes are polled; Udder is fairly well-developed.

Fleece is white, extremely coarse and hairy. Belly and legs are devoid of wool.

(9) Patanwadi(Desi, Kutchi, Kathiawari, Vadhiyari, Charotari)

The breed includes three distinct strains

- non-migratory, red-faced animals with small bodies, yielding relatively finer fleeces; these are typical Patanwadis and are located in north-eastern Saurashtra.
- migratory type with larger body and long legs, typical Roman nose and long tubular ears; produces coarser fleece; found in western and northern Gujarat.
- meat type, with big body, low stature and coarser fleeces, found in Saurashtra, Kutch and Mehsana districts of Gujarat.

(10) Muzaffarnagri (Bulandshahri)

Muzaffaranagar, Bulandshahr, Saharanpur, Meerut, Bijnor & Dehradun districts of UP and parts of Delhi & Haryana.

Medium to large in size; The breed is one of the largest and very well adapted to irrigated areas. Face lines are slightly convex; Face and body are white with occasional patches of brown or black; ears and face are occasionally black; Both sexes are polled; males sometimes contain rudimentary horns; Ears are long and drooping; Tail is extremely long and reaches fetlock.

Fleece is white, coarse and open. Belly and legs are devoid of wool.

(11) Jalauni

Jalaun, Jhansi and Lalitpur districts of UP.

Medium-sized; Straight nose line; Both sexes are polled; Ears are large, flat and drooping; Tail is thin and medium in length; Belly and legs are devoid of wool.

Fleece is coarse, short-stapled and open, generally white.

(12) Hissardale

The breed was synthesized in the earlier part of the century at The Government Livestock Farm, Hissar (Haryana) through crossing Australian Merino rams with Bikaneri (Magra) ewes by stabilizing the exotic inheritance to about 75%.

Small, with short legs, giving them a low-set appearance; Leaf-like medium-sized ears. Most animals are polled; colour is predominantly white, although some brown or black patches can also be observed.

(13) Avivastra

This fine-wool breed was evolved at the CSWRI, Avikanagar through interbreeding and selection of Rambouillet x Chokla (halfbred and 5/8th) base. Wool obtained is 2.3 kg, 21-22 μ dia and 4.5 cm staple length.

(14) Bharat Merino

This fine-wool breed was evolved by crosses of indigenous breeds with Rambouillet and Merino. Wool obtained is 4.2 kg, 21 μ dia and 7.3 cm staple length.

(15) Avikalin

This superior carpet wool breed was evolved at the CSWRI, Avikanagar through interbreeding and selection of Rambouillet x Malpurahalfbreds.

b) Southern region

This region (semi-arid in central peninsular and hot humid along the coast) comprises of Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala. Majority of wool produced is below 36s (the exception being Nilgiri sheep which produce wool above 48s). About 50% of the population of sheep in this region does not produce any wool and the rest produce very coarse, hairy and coloured fleeces.

(1) Deccani

The breed is spread over the greater part of the Central Peninsular region, comprising the semi-arid areas of Maharashtra, Andhra Pradesh and Karnataka. It covers the major part of Maharashtra, esp. the Pune Division; parts of Kurnool, Medak, Hyderabad, Mehboobnagar, Nalgonda, Nizamabad, Anantpur & Warangal districts in AP; Bidar, Bijapur, Gulbarga & Raichur districts in Karnataka.

Medium-sized, predominantly black with white markings; White and brown/fawn animals are also seen. Rams are horned but ewes are polled; Ears are medium, long, flat and drooping; Tail is short and thin.

Fleece is extremely coarse, hairy and open. Belly and legs are devoid of wool.

(2) Bellary

Mostly found in Bellary district. This breed is not very different from the Deccani. Animals found to the north of the Tungabhadra river are called "Deccani" and those to the south of it "Bellary".

Medium-sized; Body colour ranging from white to black with various combinations; One-third of the males are horned, females are generally polled; Ears are medium, long, flat and drooping.

Fleece is extremely coarse, hairy and open. Belly and legs are devoid of wool.

(3) Nellore

Nellore district and neighbouring areas of Prakasam and Ongole districts of AP.

Based on the coat colour, three varieties of the breed are : "Palla" – completely white or white with light brown spots on head, neck, back and legs; "Jodipi/Jodimpu" – white with black spots, particularly around the lips, eyes and lower jaw, but also on belly and legs; and "Dora" – completely brown.

Animals are relatively tall with little hair except at brisket, withers and breech; Rams are horned but ewes are almost always polled; Ears are long and drooping; Tail is short and thin; 86% of the animals carry wattles.

(4) Mandya (Bannur, Bandur)

Mandya district and bordering Mysore district of Karnataka.

Relatively small in size; White in colour, but in some cases, the face is light brown, which may extend upto the neck; Possess a compact body with a typical reversed U-shaped wedge from the rear. Ears are long, leaf-like and drooping; Tail is short and thin; A large percentage of the animals carry wattles; Slightly Roman nose; Both sexes are polled; Coat is extremely coarse and hairy.

It is the best meat breed of the country. There is a high incidence of cryptorchidism.

(5) Hassan

Hassan district of Karnataka.

Small-sized; White body with light brown or black spots; Ears are medium long and drooping; 39% of males are horned; females are usually polled.

Fleece is white, extremely coarse and open. Belly and legs are generally devoid of wool.

(6) Mecheri (Maiylambadi, Thuvarambali)

Salem and Coimbatore districts of TN.

Medium-sized; Light brown in colour; Ears are medium sized; Both sexes are polled; Tail is short and thin. Body is covered with very short hair which is not shorn.

(7) Kilakarsal (Keezhakkaraisal, Karuvai, Keezhakaruvai, Ramnadkaruvi, Adikaraisal)

Ramnathpuram, Madurai, Thanjavur&ramand districts of TN

(8) Vembur (Karnadhai)

Tirunelveli district of TN

Tall; Colour is white with irregular red and fawn patches all over the body; Ears are medium-sized and drooping; Tail is short and thin; Males are horned but ewes are polled; Body is covered with very short hair which is not shorn.

(9) Coimbatore (Kurumbai)

Coimbatore and Madurai districts of TN and bordering areas of Kerala and Karnataka.

Medium-sized; White colour with black or brown spots; Ears are medium in size and directed outward and backward; Tail is short and thin; 38% males are horned but females are polled.

Fleece is white, coarse, hairy and open.

(10) Nilgiri

Nilgiri hills of TN.

Evolved during the 19th Century, the breed has originated from a crossbred base and contains an unknown level of inheritance of Coimbatore, Tasmanian Merino, Cheviot and South Down.

Medium-sized; Body colour is generally white with exceptions having brown patches on face and body; Face line is convex, giving a typical Roman nose. Ears are broad, flat and drooping; Males have horn buds and scurs but the females are polled. Tail is medium and thin.

Fleece is fine and dense. The breed produces fine fleece but there is little organized shearing and marketing of wool. The breed is mostly maintained for manure by tea planters and other flock owners.

(11) Ramand White

Ramand district and adjoining areas of Tirunelveli district of TN.

Medium-sized. Predominantly white, though some animals have fawn or black markings over the body. Ears are medium-sized and directed outward and downward. Males have twisted horns but females are polled. Tail is short and thin.

(12) Madras Red

Chingalpet and Madras districts of TN.

Medium-sized. Body colour is predominantly brown and its intensity varies from light tan to dark brown. Some animals have white markings on the forehead, inside the thighs and on the lower abdomen. Ears are medium-long. Males have twisted horns but females are polled. Body is covered with very short hair which is not shorn.

(13) Tiruchi Black (TiruchiKarungurmbai)

Parts of Tiruchi, South Arcot, North Arcot and Dharmapuri districts of TN.

Small-sized. Completely black body. Males are horned but ewes are polled. Ears are short and directed downward and forward. Tail is short and thin.

Fleece is extremely coarse, hairy and open.

(14) Kenguri (Tenguri)

Hilly tracts of Raichur district (esp. Lingsugur, Sethanur&Gangavatitaluks) of Karnataka.

Medium-sized. Body colour is mostly dark brown, but colours ranging from white to black with spots of different shades are also not uncommon. Males are horned but the females are generally polled.

c) Eastern region

This region, which is predominantly hot and humid, includes Bihar, WB, Orissa, Assam and other eastern states. Sheep primarily produce wool of below 36s quality. Sheep of this region are primarily of meat type with the exception of Arunachal Pradesh which has a small number of better wool-type sheep. The wool produced by the sheep of this region is extremely coarse, coloured and of hairy quality.

(1) Chottanagpuri

Chottanagpur, Ranchi, Palamau, Hazaribagh, Singhbhum, Dhanbad&SanthalParganas of Bihar, and Bankura district of WB.

Small, light-weight animals. Light grey and brown in colour. Ears are small and parallel to the head. Tail is short and thin. Both sexes are polled.

Fleece is coarse, hairy and open and is generally not clipped.

(2) Shahabadi

Shahabad, Patna & Gaya districts of Bihar.

Medium-sized, leggy animals. Fleece colour is mostly grey, sometimes with black spots. Ears are medium sized and drooping. Tail is extremely long and thin. Both sexes are polled. Fleece is extremely coarse, hairy and open. Belly and legs are devoid of wool.

(3) Balangir

North-western districts of Orissa i.e. Balangir, Sambalpur and Sundargarh.

Medium-sized. White or light brown or of mixed colours; few animals are black. Ears are small and stumpy. Males are horned and females polled. Tail is medium long and thin. Fleece is extremely coarse, hairy and open. Belly and legs are devoid of wool.

(4) Ganjam

Koraput, Phulbani and part of Puri district of Orissa.

Medium-sized. Coat colour ranging from brown to dark tan; some have white spots on the face and body. Ears are medium-sized and drooping. Nose line is slightly convex. Tail is medium long and thin. Males are horned but females polled. Fleece is short and hairy and is not shorn.

(5) Tibetan

Northern Sikkim and Kameng district of Arunachal Pradesh. Medium-sized. Mostly white with black or brown face, and brown and white spots on the body. Both sexes are horned. Roman nose. Ears are small, broad and drooping.

Fleece is relatively fine and dense. Belly, legs and face are devoid of wool. Produce excellent, lustrous, carpet-quality wool.

(6) Bonpala

Southern Sikkim.

Tall, leggy and well-built. Fleece colour ranges from complete white to complete black with a number of intermediary tones. Ears are small and tubular. Both sexes are horned. Tail is short and thin. Fleece is coarse, hairy and open. Belly and legs are devoid of wool.

d) Northern Temperate region

This region comprises J&K, HP and hilly parts of UP. About 25% of the wool produced in this region is of 36-48s quality, suitable for carpets and the rest is above 48s and is suitable for apparel and superior quality carpets. Around 1/3rd of the sheep in J&K and about 15-20% in other parts of this region are crosses of native breeds with exotic fine wool breeds.

(1) Gaddi (Bhadarwah)

Kishtwar & Bhadarwah tehsils of Jammu; Hamirpur, Ramnagar, Udhampur and Kulu & Kangra valleys of HP; Dehradun, Nainital, Tehri Garhwal and Chamoli districts of UP.

Medium-sized. Usually white, although tan, brown and black and mixtures of these are also seen. All males and 10-15% females are horned. Tail is short and thin.

Fleece is relatively fine and dense.

(2) Rampur Bushair

Shimla, Kinnaur, Nahan, Bilaspur, Sohan, Lahul & Spiti districts of HP; dehradun, Rishikesh, Chakrota and Nainital districts of UP.

Medium-sized. Fleece colour is predominantly white, but brown, black and tan colour are also seen in varying proportions. Ears are long and drooping. Roman nose. Males are horned but most of the females are polled.

Fleece is of medium quality and dense. Legs, belly and face are devoid of wool.

(3) Bhakarwal

The breed has derived its name from a nomadic tribe which rears these sheep. Due to its entirely migratory nature, there is no distinct home tract of this breed.

Medium-sized. Roman nose. Generally white, although coloured fleeces are occasionally observed; all animals are spotted, fawn or grey. Rams are horned and ewes polled. Ears are long and drooping. Tail is short and thin. Fleece is coarse and open.

(4) Poonchi

Poonch and part of Rajouri district of Jammu.

Animals are similar in appearance to Gaddi except being lighter in weight. Predominantly white in colour but spotted sheep varying from brown to light black are also seen. Ears are medium long. Tail is short and thin. Legs are short giving a low-set conformation.

Wool is of medium to fine quality, mostly white in colour.

(5) Karnah

Distributed in Karnah, a mountainous tehsil in N. Kashmir.

Large animals. Rams have large, curved horns and a prominent nose line.

Wool is generally white in colour.

(6) Gurez

Gurez area of N. Kashmir.

Largest sheep breed of J&K. Generally white in colour, although some animals are brown or black or have brown or black spots. A small proportion of animals have small, pointed horns. Tail is short and thin. Ears are long, thin and pointed.

Fleece is generally coarse and hairy.

(7) Kashmir Merino

This breed has originated from crosses of different Merino types (at first Delaine Merinos, and subsequently Rambouillet and Soviet Merinos) with predominantly migratory native sheep breeds, viz. Gaddi, Bhakarwal and Poonchi. The level of inheritance in the crossbred animals included in Kashmir Merino predominantly varied from 50-75% but may vary from very low to almost 100% Merino. As the animals are highly diversified because of a number of native breeds involved, no definite descriptions of the breed can be given.

(8) Changthangi

Changthang region of Ladakh in J&K.

Strongly built, large framed. Good fleece cover of an extraordinarily long staple.

Wool is of a good carpet/medium apparel quality. Animals are usually shorn twice a year, generally in May/June and Sep/Oct.

Exotic Breeds of Sheep

Over the years, many exotic breeds of sheep of fine wool, mutton, dual-purpose and pelt have been introduced in India for improving/grading-up indigenous sheep.

(a) Fine Wool breeds

These produce fine and crimped wool. Their fleece is heavy, dense and of good quality. It contains a large amount of yolk. These have a strong banding instinct and the ability to graze on poor quality range. Of the exotic fine wool breeds imported in India, Rambouillet and Soviet Merinos have done well as purebreds. Their crosses with indigenous breeds have shown improvement in wool quality and also in production.

(1) Merino

The origin of various strains and breeds of fine wool sheep of the present time traces to sheep of Spain. Selection within the Merino group has resulted in large varieties of breeds and strains. In addition, Merino has been widely used in the development of many other crossbred wool breeds.

Merino is a thin-tailed, fine wool breed that is adapted to arid environment. Because of their banding instinct, they are easy to herd. They are good grazers and are able to forage over large areas of poor and sparse rangelands. Merinos have a strong constitution and are known for hardiness and longevity. Their face and legs are white and skin is pink. Rams mostly have heavy, spiral horns, whereas ewes are polled. Head and legs are generally covered with wool. They have long been bred for wool production and do not carry the straight line and compactness of mutton breeds.

Mature rams weigh about 75 kg and ewes about 65 kg. Height of ram and ewe is about 70 cm and 60 cm, respectively. Fleece production varies widely depending on the environmental conditions and time of breeding, but average is 4-5 kg for rams and 3-4 kg for ewes. The staple length is 5-10 cm. Merino tends to be a seasonal breeder and this results in low prolificacy and poor lamb crop.

India has imported Stavriopol and Grossney strains of Soviet Merino from USSR. These have more grease in the fleece, large skin folds and close face (excessive wool on face resulting in wool blindness) which are not desirable characters.

(2) Rambouillet

This breed has descended from the old Spanish Merino. It was developed as a breed in France. There are two types B & C, depending upon the skin folds. The C-type has been consistently improved for both meat and fleece, whereas the B-type has largely disappeared.

Modern Rambouillet are large, rugged and fast growing sheep. They are hardy and apparently adapted to a wide range of climatic and soil conditions. They are almost free from skin folds, with acceptable mutton conformation, and are good wool producers. The wool is of long staple, fair density, uniformity and moderate shrinkage. The rams may have large, spiral horns or are polled. Ewes are polled. They have a large head with white hair around nose and ears. Face and legs are white and skin is pink. Ewes are good mothers, quite prolific and are unequalled for range qualities.

Mature rams and ewes weigh 100-125 kg and 60-90 kg, respectively. Wool has good uniformity and fineness. India has imported the majority of Rambouillets from Texas, USA. The Rambouillet as purebreds and in crosses with Indian breeds have generally performed better than Soviet Merinos.

(3) Polwarth

This breed originated at Tarndwarncoort in Victoria. It was evolved by mating first cross Lincoln Merino ewes with Merino rams. The sheep resembles a plain-bodied extra-long stapled wool Merino. They have fairly level frame, clear eyes, soft face, pink nose and are free from skin folds. They may be horned or polled. Although the animals are bulky in appearance, they are neat and have symmetrical lines. Their fleece is of even quality of about 58s count and average length of the staple is not less than 10 cm. The value of the fleece is almost the same as that of Merino and produced is of desirable quality.

(b) Mutton breeds

Mutton production is largely based upon the appearance of the animal. Specialized mutton breeds mature fast, have high prolificacy, higher body weight gains, high feed conversion efficiency, high carcass yield and produce good quality mutton. They are usually maintained under more intensive management as compared to wool breeds. In India, mutton breeds have been imported from time to time from UK, Australia and other countries for bringing about improvement in mutton production in indigenous breeds.

(1) Suffolk

It is a medium-wool type which is native of Suffolk and surrounding counties of England and has a long reputation as a superior quality of meat. It was developed through the use of Southdown rams on an old strain known as Norfolk.

They have straight legs and are large in size. Face is black. Ears are long and pointed and are generally carried at a very slight droop or horizontally. The head and ears are entirely free of wool and the black hair extends to a line on the back base of the ears. There is no wool below the knees and hocks. Both rams and ewes are polled although males frequently have scurs.

Fleece is moderately short, dense and fine with 50-58s count. Greasy wool yield is 2.75-3.25 kg. The breed is the foremost mutton breed. The carcass is full of lean meat evenly marbled and with no waste fat and the flavour is excellent. Purebred or graded Suffolks have the capacity of rapid growth because of abundant milk of their mothers. As a grazer, Suffolk is among the best because of its activeness and rustling qualities. Suffolk ewes are prolific. Mature rams and ewes weigh 100-135 and 70-100 kg, respectively.

Suffolk imported in India have performed relatively poorly as producers, especially in reproduction and survivability as compared to Polled Dorsets.

(2) Dorset

The breed is native of southern England, especially to the counties of Dorset and Somerset. The origin of the breed is clouded in obscurity, but it has largely developed through selection. There are horned and polled strains of Dorset, named Dorset Horn (both sexes horned) and Polled Dorset (both sexes polled)

Medium-sized. Body is moderately low-set, compact and of medium degree of smoothness and quality. Back is generally strong and the breed is generally deep-bodied. Face, ears and legs are white in colour and practically free from wool. Ears of medium size, thin, silky and carried well forward. Nostrils, lips and skin are pink. Hooves are white.

Carcass is medium weight, fine-boned and of superior quality meat. Fleece weight is 2.75-3.25 kg and the wool is short, close, fine and of 52-58s quality. Mature rams and ewes weigh 80-100 and 50-80 kg, respectively. The breed is prolific, hardy and capable of doing well under most conditions.

(3) Southdown

This is one of the oldest breeds of sheep. The native place in the Southdown chalk hills in south-east England. The best specimens closely approach the ideal mutton type in form. The body is compactly made and there is exceptional fullness of the hind quarters together with a smoothness of outline few specimens of other breeds equal. The body is oval or rounded on top, wide, deep and covered with firm flesh. Legs are short. This is one of the smallest breeds.

Face, ears and legs are mouse coloured or light brown and the skin is bright pink. The breed is polled, although scurs are found sometimes on rams. Eyes are large, bright and prominent and ears are of medium size and covered with short wool. The ewes are not too prolific with 125-150 lambs per 100 ewes and produce only average milk. The animals mature early.

Fleece is short, close, fairly dense and of fine quality. Annual greasy fleece weight is around 2.25-3.25 kg. Mature rams and ewes weigh 80-100 and 55-70 kg.

(c) Dual-Purpose breeds

The dual-purpose breeds combine meat production with wool production qualities. Corriedale is the only important dual-purpose breed imported in India.

(1) Corriedale

This breed had its origin in New Zealand and Australia where both mutton and wool production are sought for in a single animal. By interbreeding Merinos and Lincolns and careful selection, a uniform type was established that produced a good balance of mutton and wool. These sheep were named after the Corriedale estate of Otago where the experimental crossbreeding was done. Corriedales are known for their outstanding efficiency to produce more kg of lamb and wool per kg of body weight as compared to other range breeds. In India, Corriedales have mostly been imported from Australia.

Mature rams and ewes weigh 80-100 and 55-80 kg, respectively. On an average, they produce 4.5-5.5 kg greasy wool of 56-58s quality annually. The face, ears and legs are covered with white hair, although black spots are sometimes present. Both sexes are polled although rams sometimes have horns. Ewes are fair in prolificacy and milking ability.

(d) Pelt breeds

Pelt breeds are reared for the lamb pelts used for the manufacture of garments. These sheep are generally poor in mutton quality and the fleece from mature animal is of coarse carpet type fetching relatively lower price. Karakul is the chief pelt type of sheep.

(1) Karakul

These sheep are bred primarily for lamb pelts used for garments. At birth and for a few days thereafter, the lamb pelts have characters that make them suitable for use as furs. Karakul is often spoken of as a "fur-bearing sheep". This property of the lamb pelts and the hardiness of the sheep are the two most useful features. The majority of karakul lamb pelts are produced in Bokhara (USSR), Afghanistan, South-

west Africa, Iran and Iraq. The best pelts come from Bokhara, where the sheep is a fat-tailed, coarse carpet wool type of breed.

Karakul is very well adapted to the extreme climatic conditions and sparse vegetation resources. The lamb pelts are produced through the slaughter of lambs within 24-48 hrs of birth or through killing of unborn lambs removed by slaughter/abortion of mothers at around 130-140 days of pregnancy. The latter type of pelts, known as "broad (fat) tailed Persian" are twice more valuable than the best type produced by the former method. The quality of the pelt is determined by the ornamental type of curls, size and tightness of curls, lustre and weight of pelt.

Mature Karakuls are angular, upstanding and of very poor mutton conformation. Mature rams and ewes weigh 90 kg and 65 kg, respectively. Rams have horns whereas ewes are polled. Face, ears and legs are black or brown. Ears are drooping.

In India, lamb pelts are in good demand in J&K for the manufacture of caps, collars, ladies and children's coats and other garments for indigenous use as well as for export. Karakuls were first imported in India in 1975. They have done well under both pure-breeding and cross-breeding programmes with indigenous breeds (Malpura, Sonadi and Marwari), and have shown a good adaptation to hot and cold arid conditions.

Genetic improvement of sheep in India

The production characteristics of Indian sheep with respect to quality and quantity of wool and mutton are very poor in comparison to improved breeds in the advanced countries.

	<u>India</u>	<u>Advanced countries</u>
- average annual wool production (kg)	0.7	5.4-6.7
- mutton (kg)	9.6	22.0
- lamb crop per 100 ewes	60-70	120-140

Thus it is evident that the sheep rearing industry in this country still remains in its primitive stage, and there is tremendous scope for improvement through the application of breeding principles. Sheep research and development activity was taken up as early as in the early 19th century by the East India Company, which imported exotic breeds of sheep for crossbreeding with indigenous breeds. Subsequently, the Imperial (now Indian) Council of Agricultural Research took up selective breeding with indigenous breeds and cross-breeding them with exotic fine wool breeds. Major emphasis on sheep R&D was, however, given after the country started the Five Year Development Plans. During the Third Five Year Plan, a large number of sheep and wool extension centres were established. Wool grading and marketing programme was initiated in Rajasthan which was subsequently taken up in a number of other states.

Realizing the importance of sheep in agrarian economy, the central Govt. established the Central Sheep & Wool Research Institute (CSWRI) at Avikanagar, Rajasthan along with its regional stations in 1962

under an UNDP & GOI project to take up fundamental and applied research in sheep production and wool utilization and imparting post-graduate training in sheep and wool sciences.

During the Fourth Plan, a large Sheep Breeding Farm in collaboration with the Australian Govt. was established at Hissar for pure-breeding Corriedale sheep. Corriedale stud rams are being distributed from this farm to a number of states for cross-breeding for improving wool and mutton production. Another seven large sheep breeding farms were established in J&K, UP, MP, Bihar, AP and Karnataka for producing exotic pure-bred or cross-bred rams.

The ICAR started two All India Coordinated Research Projects on Sheep for Fine Wool with centres at Sheep Breeding Farm, Tal, Hamirpur (HP), Sheep Breeding Research Station, Sandynallah (TN) Gujarat Agricultural University, Dantiwada, CSWRI Avikanagar (Rajasthan); and for Mutton with centres at Livestock Research Station, APAU, Palamner, National Goat Research Institute, Makhdoom, Mahatma PhuleKrishiVidyapeeth, Raturi and CSWRI Avikanagar. These projects aim at evolving (i) new fine wool breeds for different agro-climatic regions capable of producing 2.5 kg of greasy wool annually of 58-64s count, (ii) new mutton breeds capable of attaining 30 kg live weight at 6 months under intensive feeding conditions.

During the Fifth Five Year Plan, a large number of breeding farms were envisaged to be established in the Central and State sectors for producing genetically superior breeding stock. Setting up of wool boards in important wool producing states was also envisaged and states of Rajasthan, Gujarat and Karnataka have already set up these boards.

A centrally sponsored scheme for conservation of threatened breeds was started during Tenth Five Year Plan, which included Bannur and Bonpala breeds of sheep.

Important traits of sheep

Selection and judging of the breeding stock are the first and foremost steps to start with any breeding programme. Appearance of the animal alone is not always a reliable guide to its breeding value as its appearance depends on the inheritance it has received from its parents and on the environment in which it grows up. It is, therefore, necessary to correctly estimate the breeding value of the individual which depends on the accuracy in selecting the animals as per the defined objectives.

a) Selection and judging of sheep for fine wool production

1. Body type and conformation

It should be true to the characteristics of the breed chosen. examples of fine wool breeds : Hissardale, Deccani-Merino, Avivastra, Nali and Chokla synthetics, Bharat Merino, Nilgiri synthetic and other crossbred types available in J&K, HP and hilly regions of UP.

2. Quantity of wool

- i) Density of fleece (no. of fibres/sq.cm of skin surface)
- ii) Staple length (>75mm is superior quality)
- iii) Completeness of the covering (i.e. uniformity)

3. Quality of wool

i) **Fineness of fibre (diameter)** :measured only under protein microscope/lanometer; at the field level, one can differentiate between coarse and fine wool by spreading the fleece on the body of the sheep.

ISI standards :	≤ 34.4μ	:	A grade
34.4-37.0 μ	:	B grade	
37.1-40.0 μ	:	C grade	
≥ 40.0 μ	:	D grade	

ii) **Medullationpercentage** : can only be adjudged under a lanometer; no field-level visual method

Fine wool : no medullation

Carpet wool : 10-20% medullation

iii) Staple/fibrelength : ≥ 3.5 cm can successfully be processed on the worsted system

iv) Soundness : healthy and uniform growth of wool on the skin surface

4. Condition of wool

i) **Purity** : judged by the absence of hair, kemp, black and dark fibres; in selection of sheep for fine wool production, due care should be taken to ascertain presence of only pure fibres, esp. in breeding stock

ii) **Presence of foreign matter** : this is a disqualification in grading of wool. Classification based on the extent of vegetable matter content:-

< 3%	:	Light burr
3-5%	:	Medium burr
>15%	:	Heavy burr

Apart from vegetable matter, fleece may be contaminated with dust and other matter. Though the contamination is mostly related to faulty management practices, but all the same, these are to be kept in view while selecting the animals.

iii) **Amount and distribution of yolk** : A yellow wool fat "yolk" which accumulates on the wool fibres as a protective layer making the wool more resistant to water and snow, is important in determining the condition of wool.

iv) **Colour of the fleece** : The colour of the wool should be white and any deviation from it is regarded as disqualification except for the entire colours which are required for some specific purposes. In grading of wool, the colour is given the weightage as tinged white (TW), light yellow (LY), heavy yellow (HY) and other colours in order of merit.

The method of selection to be applied directly depends on the genetic parameters of the characters and the population concerned. As most of the characters related to fleece characterization are highly heritable, their weighted heritability estimates in Indian breeds of sheep are as follows:-

Greasy fleece weight	:	0.210 ± .050
Average fibrediameter	:	0.453 ± .447

Medullation percentage : 0.661 ± .556
Staple length : 0.400 ± .050

☐ Since the heritability of these traits are moderate to very high, individual selection of sheep based on their own performance should result into their genetic improvement.

☐ Open-faced ewes have been reported to produce more lambs than ewes whose faces are covered with wool

☐ Selection of open-faced ewes adds to their productivity

☐ Based on the estimates of heritability and genetic and phenotypic correlations among body weights at different ages, six months body weight perhaps seems to be the best selection criteria for improving market weight (9-12 months body weight) and adult body size.

☐ For improving the quantity and quality of wool, an emphasis on combining the greasy fleece weight with a positive weightage and medullation percentage with a negative weightage would improve both the yield and quality of carpet wool.

☐ At the Central Sheep & Wool Research Institute, Avikanagar, emphasis was laid on selecting animals with greasy fleece weight of 2.5 kg, 22 μ diameter & no medullation for Avivastra, and 2.0 kg, 27 μ diameter & upto 20% medullation for Avikalin.

☐ Under the project on improvement of indigenous breeds of sheep for carpet wool by selection at the Division of Carpet Wool & Karakul Pelt Production, Bikaner, emphasis was laid on improving the Marwari breed to produce 2.0 kg greasy fleece weight per annum of 30 μ diameter and 20% medullation.

☐ Since the body and fleece weights are positively genetically correlated, the selection for the former should also improve the latter. The same stands true for staple length and fleece weight.

b) Selection and judging of sheep for mutton

The mutton type is characterized by a deep, wide, blocky body with symmetry, balance, breed character, thick fleshing, a strong constitution and quality. In selection of the mutton quality animal one should actually look for the carcass characteristics which are defined by the tenderness and juiciness of the mutton, high proportion of lean to fat, higher proportion of meat to bone ratio etc. Since these characteristics may not be known till the animals are slaughtered, the animal breeder has to depend on indirect measurements of such qualities.

Breed type : refers to the breed chosen for the mutton production

Fleece and skin : these are of minor importance. Pink skin is supposed to be a sign of good health, quality and a good feeder. A long, clean, bright and dense fleece with a medium amount of crimp and pink skin is usually an acceptable type among most medium wool breeds.

Constitution : It is evidenced by strong head with breed characters, strong back and loin, and by all four evenly placed legs.

Natural fleshing and finish : While fleshing is an inherited character, finish is the result of proper feeding. A lamb should have a deep covering of natural fleshing and fat which spreads firmly and fully over the shoulder, ribs, back, loin, rump and legs.

Quality : includes:-

- clean-cut, well-shaped head covered with fine wool
- bone of ample size and clean joints
- firm and evenly distributed flesh
- good, light, dense fleece
- symmetrically balanced body

Sex characteristics : Rams with masculine characters should have strong, bold head and neck, massive and powerful appearance, and bold carriage for being a potent sire. A sheep with feminine characters should throughout have fineness of features with maternal instinct.

Balance : It is defined as blending together of all the components of an individual in harmonious fashion which should be uniform in width, depth, fleshing, character and quality.

Type : It is manifested by an erect and well-set head and neck alert action and pleasing disposition

Size : It should be proper as per age, sex and breed

The breeder should supplement the information by indirect judging with the information on full-sibs, for utilization in selection. Progeny testing of rams may also be useful. As mutton traits are highly heritable, individual selection should be used for fat lamb production.

c) Selection and judging of sheep for pelt production

Till 1975, there was no organized programme for lamb pelt production in the country. After the import of 250 Karakul sheep in 1975, experimental work under hot and cold arid conditions was initiated at CSWRI, Bikaner and Kumbhathang, near Kargil in Ladakh Dist. (J&K). The $\frac{3}{4}$ crossbreds of Malpura, Sonadi and Marwari with Karakul have produced pelts comparable with those of purebred Karakuls. Mature purebred Karakul lambs weigh 80-105 kg and ewes 60-75 kg. Wool is of low quality, coarse, brown/black in colour, and grades as carpet wool. The pelts taken from the lambs are usually classified as Broad tail, Persian and Caucasian.

Grades of the pelt should be given a primary weight in selection.

Traits of economic importance

a) Prolificacy : includes both regularity of lambing and the frequency of twinning. Twinning in sheep is generally more desirable because ewes that wean twins produce 15-18 kgs more lambs than ewes that wean only one lamb. But in areas where grazing conditions are very poor, twins may be a disadvantage.

b) Birth weight : As such birth weight is of little value except that it is related to vigour at birth and rate of gain.

c) Weaning weight : The age at weaning can vary according to the conditions under which the animals are reared, but 120 days has been taken as the standard. This measure, though taken individually, can also be used to express lamb production of ewes on a per head basis or per 100 kg ewe-weight basis, depending on conditions. Lambs can be weighed at 120 days age or in case they are

weaned earlier, the weaning weights are corrected to 120 days age. This is done by multiplying the daily average weight gain with 120 and adding the product to the birth weight. Similarly, adjustment has to be made for twins and triplets as their weaning weights are likely to be less than that of singles, due to less availability of milk and maternal care. Weaning weight may be adjusted to single-lamb-basis by for the purpose of valid genetic studies by multiplying the adjusted 120 day weight by the factors 1.0529 for twins and 1.0923 for triplets. Ram lambs and lambs of mature dams have been observed to have higher weaning weight.

d) Post-weaning gain in body weight : This is medium to highly heritable. Therefore, mass selection based on this trait can be effective. Annual or semi-annual weights of breeding stock will be quite useful if they are used to evaluate productivity in relation to body weight.

e) Type and conformation : Type and finish of lambs at weaning reflect market value to a great extent. With sheep, attention should be given to wool characteristics in addition to mutton production and rate and efficiency of gains. Subjective appraisals of type through a system of scoring remains still the most popular means of evaluating these traits. Animals with defects such as wool blindness, skin folds, over-shot jaws, under-shot jaws, black wool shallow bodies etc. should be culled from the flock.

f) Carcass traits : Tenderness juiciness and good flavour are traits relished universally. In advanced countries, there is a preference for greater proportion of lean to fat. As carcass quality can be tested at present only by slaughtering the animal (thus making it unusable for breeding), the next-best method will be to measure these traits in close relatives like twins, full-sibs or half-sibs.

Fleece characteristics : Roughly 20% of the income from sheep enterprise is from wool. Thus, wool production is an important component from the economic standpoint. Fleece with high wool weight, long staple length and uniformly fine fibres will be most valuable. Increase in staple length has been associated with increase in fleece weight. For every 1cm increase in staple length, approx. 0.27 kg increase in grease wool and 0.18 kg increase in clean wool has been observed. Selection of heavy fleece weights has been found to improve ability of feed consumption and feed efficiency for wool production. Excessive growth of wool on the face covers the eyes, causing wool blindness, which affects an animal's grazing ability. Wool-blind sheep have been found to produce less number of lambs and wean less kilograms of lamb than open-faced sheep.

Management of lambs

CARE OF YOUNG STOCK

Purpose : Young lambs and kids should be taken care of to the maximum extent during the early period of life. Efforts should be made to have maximum care for optimum growth during early period of life of lamb. This will ensure better survival and future growth.

1. Ensure proper suckling of the lambs. Examine udders for blindness of teats or mastitis.
2. Take care of indifferent mothers and arrange suckling of lambs by restraining such types of ewes.
3. Provide creep feed (good quality hay with or without concentrate mixture) to suckling lambs in addition to suckling of milk from tenth day to weaning age.
4. If possible, make available green leguminous fodder or fresh tree leaves to lambs to nibble during suckling period.

5. Perform 'lamb marking' operation (comprising ear tagging/tattooing, tail docking and castration of male lambs) at the age of 2-4 weeks.
6. Weaning should preferably be done at 90 days, although in breeds with low milk production or where re-breeding is desired, it can be done around 60 days.
7. Supplementary feeding and good clean pastures must be provided.
8. Weaned lambs should be drenched against gastro-intestinal parasites by the first month, and vaccinated against enterotoxaemia and sheep pox.
9. Weaners should not be grazed on poor, burry and thorny types of pasture since it could cause skin irritation, injury to the eyes and damage to the wool.
10. They should be protected against predation and the vagaries of climate.

Castration : Surplus males are castrated to check indiscriminate mating, to make the males more docile and to make mutton of superior quality. However, in India, the market demand most often favours the intact male. Castration is usually done by using a castrating knife, Burdizzo castrator/emasculatome or elastrator.

1. Burdizzo/emasculatome method

- ☒ Secure the lamb and place it on its rumps with tail placed along the floor.
- ☒ Manipulate the testes and slightly pull out the scrotum.
- ☒ Hold the spermatic cords tightly on both sides making sure that it does not slip.
- ☒ Apply tincture iodine at the site.
- ☒ Place the jaws of the emasculatome over the spermatic cords and press the handles completely; hold for a few moments before releasing.
- ☒ Repeat the process about 1 cm below the first crush.
- ☒ Apply additional antiseptic and watch the animal for infection for a few days.
- ☒ Precautions : The emasculatome must be clean and disinfected, and its jaws must be clean and smooth. The testes must be protected from injury. The scrotal skin folds must not be crushed.

2. Elastrator method

- ☒ As this method is bloodless and painless, it is the most preferred.
- ☒ Secure the lamb and make it lie down on one side.
- ☒ Place the rubber ring with the help of the elastrator over the spermatic cord, a little above the testes.
- ☒ The constant pressure shuts off the blood supply to the testes and causes testicular atrophy and sloughing off in about 2-3 weeks.

3. Incision method

- ☒ Secure the lamb on a clean floor and make it lie down on one side.
- ☒ Disinfect the surgical site and make an incision on the lower side of the scrotum with a sharp knife.
- ☒ Remove the testes and as much of the spermatic cord as possible.
- ☒ Disinfect thoroughly and take adequate post-operative care.

Docking : Docking or removal of the tail is not common in India. That part of the tail remaining on the body is referred to as the dock. This process is necessary in most sheep breeds for the following reasons:-

- a) To improve sanitary conditions, since the long wool on the tail will become saturated with feces and urine and become a target for fly strikes or screwworm infestation.

- b) To increase productivity in ewes, in which the tail may interfere with breeding and lambing.
- c) To improve the appearance of sheep for exhibition in the show ring.
- d) To increase the value of market lambs.

For best results, lambs should be docked before they are 2 weeks of age. Docking is accomplished by severing the tail, preferably between the vertebrae. The tail should be removed at the end of the caudal folds on the underside of the tail, one inch from the body. Docking can be done in a number of different ways viz. a sharp pocket knife, an emasculator, emasculatome (Burdizzo), elastrator (rubber rings), hot docking irons and "All-in-one" pliers and pruning shears.

1. **Elastrator method**

It is best if practiced within 2-3 days of birth.

Place the rubber ring about 2-3 cm from the root of the tail.

The resultant lack of blood supply causes drying off and falling of the tail within a fortnight.

2. **Surgical method**

It should preferably be performed at about 10 days of age of the lamb.

Secure the lamb and hold its dorsal side on the floor/table.

Push the tail skin towards the body so that some surplus skin will be left over to cover the stub.

Mark the tail at a point about 1-1½" from the body as measured on the underside.

Disinfect the surgical site and cut the tail quickly.

Use cautery or ligation in case of excessive bleeding.

Apply antiseptic powder and bandage the wound.

FEEDING MANAGEMENT

The feeding and grazing conditions vary from place to place. The most favorable grazing time is soon after the onset of monsoon till the onset of winter. Grazing resources become extremely poor during summer months. During this period supplementary feeding should be done. Sheep generally thrive well on pasture. Attention should be paid on pasture improvement and management. Rotational grazing should be followed to avoid worm infection and unthriftiness, and to ensure availability of good pasture all the time. The fodder should be conserved in the form of hay and silage for the lean period. Fodder trees should be planted in the pasture to provide shade and fodder during the lean period to the grazing flocks. Supplementary feeding of concentrate should be done depending upon the physiological status and availability of grazing resource in the pasture.

Water : Water requirement of sheep very depending upon its physiological status and ambient temperature in different seasons. The sheep should be watered at least once a day at the rate of 2-3 litres per head per day. The requirement of water for crossbreds during summer months will be slightly more and may range between 5-6 litres. The younger ones may require 1-2 litres of water every day. Sheep breeds in arid regions have good adaptation to water restriction upto 48 hrs. Watering should be done in metallic troughs or cements channels.

The flock should be weighed at least once in a week to the extent of at least 10% prior to being turned out for grazing. This work may be distributed over the week.

- 1) **Feeding lambs up to two weeks :** There is no feed equal to the ewe's milk for putting rapid gains on young lamb because dam's milk yield is closely related to early growth of lamb. Lambs depend entirely on dam's milk upto 2 weeks. Colostrum is rich in fat, protein, vitamins etc. and contains

antibodies to protect the lamb from infections. If the ewes are fed good ration during the last six weeks of gestation, it enhances milk production.

2) **Feeding lambs beyond two weeks** : The recommended rations are given below:-

	Feed ingredients (%)	Pre-weaning period (upto 3 months)	Growing period (3-6 months)	Finisher ration
1.	Ground maize	65	27	25
2.	Groundnut cake	10	35	20
3.	Wheat bran	12	35	52
4.	Fish meal	10	-	-
5.	Common salt	1	1	1
6.	Min. mix.	2	2	2
	Expected growth rate per day (gms)	110-125	100-120	100-120

Rate of feeding/day (approx) :-

	Body weight (kgs)	Concentrate (gms)		Roughages (kgs)
		when leguminous fodder is available	when leguminous fodder is not available	
1	12-15	50	300	ad lib.
2	15-25	100	400	ad lib.
3	25-35	150	600	ad lib.

3) **Feeding suckling ewes** : During suckling period, ewes should be fed good milk producing ration. She should be fed good legume hay or oat hay with little or no grain for a week. After she's milking freely and her bowels are functioning normally with no sign of constipation, the amount of grains may be increased. If pasture is available, hay is not needed. The following rations can be used :-

	Feed ingredients	Ration – I	Ration – II
1	Grain mixture	400gm	400gm
2	Legume hay	700gm	1400gm
3	Green fodder/silage	1400gm	-

4) **Feeding adult sheep** : Roughage part may be taken care by grazing, but 150 gm of concentrate (as for suckling ewes) with mineral mixture and salt must be fed. The nutritional requirements of various categories of sheep are as under :-

Body wt. (kg)	Dry matter intake (as % of live wt.)	DCP (gm)	TDN (gm)	Ca (gm)	P (gm)
Growing lambs					
5	4.0	38.0	180	2.4	2.0
10	3.3	33.0	230	2.5	2.2
15	3.3	44.1	320	2.6	2.4
20	3.3	52.8	400	2.8	2.5
25	3.4	59.5	510	2.8	2.6
30	3.3	65.0	550	2.9	2.5
35	3.2	67.2	670	3.0	2.7
40	3.0	66.0	720	3.0	2.7
Ewes – non lactating and in first 15 weeks of pregnancy					
20	3.0	27.0	300	2.8	2.2
30	3.0	36.0	450	2.9	2.3
40	2.8	44.8	560	3.0	2.4
50	2.6	52.0	650	3.2	2.5
60	2.5	60.0	750	3.3	2.6
Ewes – during last 6 weeks of pregnancy					
20	5.0	54.0	600	3.8	2.8
30	4.0	58.5	720	3.9	2.9
40	3.7	68.4	760	4.0	3.0
50	3.4	74.8	850	4.2	3.1
60	3.0	81.7	950	4.3	3.2
Ewes – during last first 10 weeks of lactation					
20	5.2	57.8	680	5.8	4.3
30	4.6	69.0	900	5.9	4.4
40	4.3	77.4	1030	6.0	4.5
50	4.0	90.0	1100	6.2	4.6
60	3.6	97.2	1190	6.3	4.7
Ewes – during last 14 weeks of lactation					
20	5.0	56.0	600	4.2	3.1
30	4.0	65.0	720	4.3	3.2
40	3.7	68.4	760	4.4	3.3
50	3.4	76.5	850	4.6	3.4
60	3.2	85.5	950	4.7	3.5

Ram lambs					
20	3.6	46.8	470	2.9	2.6

30	3.5	63.0	650	2.9	2.6
40	3.5	79.8	840	3.0	2.7
50	3.5	80.5	960	3.0	2.7
60	3.3	79.2	990	3.0	2.7
70	3.0	79.8	1050	3.0	2.7
Fattening lambs					
15	5.0	51.8	410	2.6	1.4
20	5.0	70.0	560	2.9	2.6
25	4.5	78.8	680	3.0	2.7
30	4.5	81.0	810	3.0	2.7
35	4.3	90.0	900	3.0	2.7

Note : Daily requirement of common salt is 2-8 gm, and carotene is 2-8 mg.

Flushing : Ewes which are to be bred should be underfed for about 45 days prior to breeding in order to prevent fat accumulation which reduces fertility. Two weeks prior to breeding, the ewes should be fed about 150-200 gm concentrate mixture daily along with good quality forages (cowpea, oat, doob grass, berseem). It conditions the animal and induces maturation of more number of follicles, and thus improves conception and twinning rate.

5) **Feeding breeding rams :** Good quality green fodders like maize, cowpea, oat, doob grass, lucerne, berseem etc. would meet all requirements of breeding rams. If forages fed are of poor quality like straw or sorghum hay, then 150-200 gms concentrate should be fed daily.

GRAZING MANAGEMENT OF SHEEP

Purpose : As pasture is a valuable fodder for sheep and the cheapest source of nutrients necessary for maintenance and production, proper grazing management and care of pastures is essential for ensuring higher yields.

Characteristics of sheep feeding under range conditions:-

1. Sheep have a small muzzle and split upper-lip which enables them to nibble tiny blades of vegetation which cannot be eaten by larger animals.
2. Sheep prefer small, tender grass and chew food more thoroughly than cattle.
3. The capacity of the sheep stomach is 15-16 litres and excess feeding can cause indigestion.
4. In general, sheep do not relish ripe grass.
5. Sheep on pastures may consume 10-15 % more dry matter compared to stall feeding.
6. Daily grazing for 10-12 hours should be permitted to meet the dry matter requirements.
7. Sheep usually relish leguminous fodder such as lucerne, cowpea, berseem etc.
8. Sheep should preferably be grazed in different small flocks.
9. Lambs should be grazed separately from adults to prevent parasitic infestation.
10. Rotation of pastures should be adopted to prevent under- or over-grazing.

11. Growing lambs should be allowed to graze first, followed by pregnant and lactating ewes, and dry stock at the last. (If cattle, sheep and goats are to graze on the same pasture, it will be desirable to allow goats first, followed by cattle and sheep, in that order).
12. Avoid grazing until the dew has dried off.
13. During grazing, sheep should have free access to clean water.
14. Sheep kept entirely on roughage may suffer from trace mineral deficiency and should be supplemented with mineral mixture containing salt, copper sulphate & cobalt chloride.
15. Even a good pasture does not meet the dietary requirements of advanced pregnant and lactating ewes, and hence additional concentrate feed of 250-300 gm/day should be given.

Pasture improvement and management:-

1. Pasture lands in India are poor and meager and need to be improved by protecting them from biotic factors, conserving good natural grasses, choosing the best fodder trees and shrubs, removing non-edible grasses, weeds and shrubs, and re-seeding with nutritious and perennial grasses and legumes.
2. Natural legumes like *Rhynchosia minima*, *Indigofera endecaphylla* and *Tribulus terrestris* are very useful and should be preserved.
3. Grazing lands should be re-seeded with nutritious perennial grasses like *Cenchrus ciliaris*, *Cenchrus setigerus*, *Lasiurus indicus* and *Dichanthium annulatum* in arid and semi-arid plains; *Setaria nervosa* in sub-humid plains; and fescue, rye grass and kikuyu grass in the temperate and sub-temperate regions.
4. Perennial legumes like *Dolichos lablab*, *Clitoria ternatea*, *Macroptelium atropurpureum*, *Alysicarpus scaberrimus* and *Stylosanthes* species should be incorporated in the regenerated or reseeded pastures.
5. Combined production of grass and legumes can increase forage production by 20-30 per cent as compared to that of grass alone. The legumes, besides being rich in protein content, are more palatable and digestible, enrich the soil by nitrogen fixation, and help in checking soil erosion.
6. During the first year of pasture establishment, grazing should not be allowed; the fodder must be harvested, conserved as hay, and fed during the lean period.
7. Rotational grazing, i.e. dividing the pasture into four equal compartments and allowing grazing sequentially, helps the grasses to regenerate, checks soil erosion caused by over-grazing and allows agricultural operations to be carried out.
8. Pastures should be top dressed with sufficient quantities of farmyard and inorganic fertilizers at regular intervals.
9. Pest control by means of spraying and dusting with pesticides should be done as and when required. Sheep should not be allowed to graze for 2-3 weeks after spraying.
10. Timely hoeing and weeding operations will not only improve the forage yield but will also help in checking the growth of undesired bushes and weeds, and prevent worm infestations.
11. Protection of pasture, removal of undesirable bushes and weeds, soil and water conservation, application of fertilizers, proper stocking rate and grazing system (rotational or deferred rotational) are essential components of good pasture management.

Silviculture:-

1. Fodder trees serve as a potential source of feed for sheep during December to June when the grazing resources become scarce.
2. Fodder trees also provide shade during summer, check soil erosion and improve soil texture.
3. Fodder trees should be planted in well-managed pastures after the first monsoon rains at a spacing of 20 x 10 metres (approx. 50 trees/hectare).
4. Lopping can be done twice a year in Oct-Nov (conserved) and May-Jun (fed green) in such a manner that the top branches are left in situ; yielding about 8-10 quintals of good quality green fodder/hectare.

5. The pods of many trees, esp. babool (*Acacia arabica*) and khejri (*Prosopis cineraria*) are very nutritious and palatable, and serve as a good source of feed for flushing ewes.

REPRODUCTIVE MANAGEMENT IN SHEEP

Purpose : Reproductive management, comprising of detection of estrus, mating, identifying pregnant animals, care of pregnant animals, care at parturition and care of the male, plays a major role in the profitability of a sheep or goat farm. Effective managerial interventions can increase reproductive health, incidence of twinning/triplets and lamb/kid livability.

Age at mating : Sheep normally attain good growth at about 24 months (range 18-36) of age. Breeding too young ewes results in more weaklings and higher lamb losses. It is desirable to use rams for mating from the age of 2 years till the age of 7 years.

Mating season and estrus cycle : Sheep are seasonally polyestrous. In India, there are three main breeding seasons viz. summer (Mar-Apr), autumn (Jun-Jul) and post-monsoon (Sep-Oct). In general, higher fertility is observed in autumn season in the plains and in summer season in the hilly areas. The ewes usually come in heat about 2 months after lambing. The duration of the estrus cycle is 17 days (range 14-19) and heat period lasts for 27 hours (2-60). Ovulation occurs about 12 hours before the end of heat period.

Preparations for breeding :-

1. Flushing : Feeding extra grain or lush pasture 2-3 weeks prior to the breeding season for the purpose of increasing the number of ova shed from the ovary and increase the incidence of twinning. Feeding about 250 gms grains daily to each ewe results in an increase in the lamb crop by about 10-20 per cent.
2. Tagging : This refers to the shearing the locks of wool and dirt from the dock of the ewes, thus facilitating mating by the ram.
3. Eyeing : This refers to the clipping of excess wool around the eyes to prevent wool blindness in some breeds.
4. Ringing : This refers to shearing of wool from the body of the ram, especially in the neck, belly and sheath region prior to the breeding season.

Detection of estrus : As sheep in heat show few external indications of estrus other than standing to be mounted, heat is generally detected with the help of a teaser. Wet paint (dye mixed in grease or linseed oil) can be smeared on the brisket of the teaser ram to spot the ewes in estrus. The colour of the dye should be changed every 16-18 days so that the repeaters can be discovered. Other indications of estrus are vulvar swelling, frequent urination, restlessness and reduced appetite.

Mating : As far as possible, rams should be kept away from the ewes and the two should be brought together only for breeding. Natural breeding is done either by flock mating, pen mating or hand mating.

- ☒ In flock mating, breeding rams are usually turned out in the flock during the mating season at the rate of 2-3 per cent of the ewes all through day and night.
- ☒ In semi-flock breeding or pen mating, rams are turned out for service with the flock in the pen during night, and confined and stall-fed or grazed separately during the day time in order to conserve their energy and give them rest.
- ☒ Hand mating is practiced when exotic purebred sires are used, or when it is considered desirable to extend the services of the ram over much larger flocks.

Identifying pregnant ewes : Identification of pregnant ewes is essential for the re-breeding of empty ewes and efficient management of pregnant ewes. Pregnancy can be diagnosed by observing for cessation of estrus cycle, abdominal ballotment (from third month onwards) and by means of a chemical test.

Procedure : Mix 5 ml of urine sample and 5 ml of 1% Barium chloride solution. Turbidity indicates pregnancy whereas clear solution indicates non-pregnant condition.

Care of pregnant ewes :

Careful management of pregnant ewes will have a marked influence on the percentage of lambs dropped.

- ☒ Do not handle the pregnant animals too frequently.
- ☒ House the pregnant ewes in separate enclosures and protect from inclement weather and extremes of temperature.
- ☒ Crutching is done 7-10 days prior to lambing to avoid lambs suckling dung.
- ☒ Separate the advanced pregnant animals from the main flock and take effective care in their feeding and management.
- ☒ Extra feed during the later part of pregnancy (3-4 weeks before parturition) will be beneficial for the condition of pre-parturient ewes, thus improving milk production of ewes, and birth weight and growth of lambs. Inadequate and poor nutrition may result in pregnancy toxemia, abortions and premature births of weak lambs.
- ☒ Bring lambing ewes into lambing corrals 4-6 days before parturition and provide soft, clean bedding, individual lambing pens and maximum comfort.
- ☒ Watch gestation length which ranges from 142-150 (avg. 147) days.

Care at lambing :

An ewe about to lamb prefers to leave the flock. She is restless, the udder is often distended and external genitals are in a flushed and flaccid condition. Normally there is no necessity of assisting the ewes at the time of lambing except in the case of dystokia. The following precautions may be taken at lambing:-

- ☒ Maiden ewes in poor condition or small-framed ewes mated to big rams will generally have difficulty in parturition and will have to be assisted.
- ☒ Ensure that the nose and mouth are free of membranes and mucoid fluid immediately after birth.
- ☒ Ligate, sever and antiseptically dress the navel cord of the lamb.
- ☒ Do not handle lambs too frequently immediately after birth and let the dams lick and recognize them properly.
- ☒ Newborn lambs, after being licked by their mother, generally stand on their legs and start seeking for teats and suckle milk. In case they are not able to do so, assist them in suckling colostrum.

- ☒ Take up artificial milk feeding or arrange foster mother for disowned or orphan lambs. These lambs can either be reared on goat milk or by foster mothers. To aid the adoption of the orphan lambs by the foster mother, rub its milk on the rump of the orphan and the nose of the foster mother, keep both animals in close proximity to each other. Orphan lambs can also be reared by hand using a clean bottle and nipples, feeding about 30 gm milk at two hourly intervals for the first two days, and increasing the quantity and decreasing the frequency subsequently.
- ☒ Give a teaspoonful of castor oil or liquid paraffin to the lamb to facilitate defecation and easy passing out of meconium.
- ☒ Allow newborn lambs to be with their dams all day long during the first week.
- ☒ Protect newborn lambs from adverse climatic conditions.
- ☒ Feed sufficient quantity of good quality hay and concentrates to the lactating ewes for meeting the nutritional requirements of early lactation.
- ☒ Provide plenty of clean, fresh drinking water as the lactating ewes drink higher amounts of water.

Routine operations in sheep farms

Purpose

The study of farm routines enables proper scheduling of various farm activities on a sheep and goat farm. It also aids in the optimum utilization of labour and resources, and higher returns through efficient management practices.

Daily schedule of activities on a sheep / goat farm:-

Approx. time	Farm operations
0700	<ol style="list-style-type: none"> 1. Turning out the animals for grazing. This can be delayed during the winter months. 2. Observe and isolate sick animals.
0800	<ol style="list-style-type: none"> 1. Feed half of the daily concentrate ration to nursing females and fattening lambs/kids 2. Watering of the animals on the grazing lands
0830	<ol style="list-style-type: none"> 1. Feed chopped green and dry fodder to penned sheep/goats 2. Cleaning of all the sheds and disposal of manure
0900-1500	Special activities like record keeping, weighing and marketing of lambs and kids, shearing, vaccination and preventive health care, disbudding; grading, sorting, storage and marketing of wool etc.
1600	<ol style="list-style-type: none"> 1. Return of sheep and goats to their pens 2. Feeding the other half of the daily concentrate ration to nursing females and fattening lambs/kids 3. Feeding chopped green and dry fodder to all the animals

Note : On a goat farm, the milch does should be milked twice a day at convenient timings.

Monthly schedule of sheep farm operations:-

The monthly schedule of various sheep farm operations with twice a year lambing or shearing pattern under semi-arid conditions on an organized farm is given below:-

Month	Farm operations
January	Stock verification, protection against cold weather; care, management and supplementary feeding of advanced pregnant ewes; preparation of lambing pens, care at lambing, docking, identification of newborn lambs; supplementary feeding of breeding rams for spring mating; vaccination against clostridial infections
February	Lambing continues, care and supplementary feeding of lactating ewes; creep feeding, ear-tagging, tail docking and growth recording of lambs; flushing of breeding ewes for spring mating, tupping (in later part of February), vaccination against sheep pox
March	Lambing continues, care and supplementary feeding of lactating ewes; creep feeding, ear-tagging, tail docking and growth recording of lambs; washing of sheep, wool sampling, shearing, dipping, vaccination against sheep pox
April	Wool sampling, shearing and dipping continues, creep feeding, growth recording and weaning of lambs; culling of old, infertile and weak animals; deworming, vaccination against FMD
May	Weaning and supplementary feeding of lambs, drenching of weaners, grazing during cooler hours, tree lopping, proper shelter and adequate drinking water
June	Care, management and supplementary feeding of advanced pregnant ewes; supplementary feeding, culling of undesired ram lambs, preparation of lambing pens, vaccination against tetanus, ET & HS.
July	Washing, shearing, dipping, drenching, care of advanced pregnant ewes, autumn lambing starts, care at lambing, flushing of ewes for autumn mating
August	Lambing continues, flushing of ewes for autumn mating continues, supplementary feeding of breeding rams, deworming
September	Selection of breeding rams, autumn breeding starts, creep feeding and management of lambs; drenching
October	Autumn breeding continues, creep feeding of lambs and supplementary feeding, care of weaners, culling of underweight & deformed lambs, vaccination against ET, drenching

November	Winter grazing, deworming continues depending on worm load, penning at night
December	Protection against cold and chilly weather, disposal of surplus lambs, supplementary feeding of advanced pregnant ewes

Diseases of sheep

Purpose : Identification of animals in the early stages of sickness can aid the farm manager in restricting the spread of disease in the flock and initiating treatment at the earliest.

A. Spotting of sick animals

Sl. no.	Parameter	Healthy animal		Sick animal
		Sheep	Goat	
1.	Look of animal	Alert		Dull
2.	Head	Raised		Bent downwards
3.	Eyes	Wide open, bright		Dull with white deposition at the corners
4.	Conjunctivalm.m.	Normal		Pale or congested
5.	Nose	No discharge		Slimy discharge
6.	Movement	Active		Sluggish, lameness
7.	Response	Quick		Slow
8.	Feces	Normal		Hard / loose, mucus/blood-stained, discolouration, dysentery
9.	Pulse (/min)	70-90	70-90	Increased
10.	Body temperature (°F)	102.4	103.8	Increased
11.	Respiration (/min)	12-30	12-30	Increased, difficult
12.	Grazing	Normal		Abnormal
13.	Rumination	Regular		Irregular
14.	Feed and water intake	Normal		Reduced
15.	Udder	Normal		May be swollen
16.	Skin	Healthy		Infected, external parasites

B. Sample collection

Samples include blood (microbiology, immunology, hematology, protozoan parasites), feces (endoparasites and enteric pathogens), urine (urinary tract infections), skin scraping (ectoparasites), ruminal fluid (ruminal dysfunction), vaginal discharge (reproductive tract infections)

C. Administration of medicines

Routes include oral (drenching/feeding bolus), parenteral (intra-muscular, intra-venous, intra-peritoneal, sub-cutaneous) and topical.

COMMON DISEASES AND THEIR CONTROL

Morbidity and mortality are the two important factors resulting in heavy losses in sheep production and improvement programmes. Prevention is always better than cure as it is a lot cheaper. This has special significance with sheep as they seem to respond less to treatment when sick than other livestock species. Diseases in sheep can be broadly classified as non-infectious and infectious.

a) Non-infectious diseases

Approximately 80% of deaths in lambs have been estimated due to non-infectious causes. Starvation, primarily from mismothering and behaviour, nutritional and environmental stress, reproductive problems and predation are the major causes reported.

(1) Pneumonia

It is one of the most common and important pathological conditions in sheep. It is characterized clinically by increased respiration, coughing and abdominal breathing. A toll of 20-40% of the mortality has been reported at organized sheep farms due to pneumonia of bacterial or viral origin. Another type of pneumonia is "aspiration" or "drenching" pneumonia caused to wrong and forceful drenching operations. If some fluid has erroneously entered the animal's respiratory tract, its head should be lowered immediately and slapped a few times.

(2) Ruminal tympany (Bloat)

It is the over-distension of the left flank either due to free gas or froth. This is generally encountered in "greedy feeders" when lush green pasture is available. Tying a bitter (eg. neem) stick in the mouth as a bit to increase secretion of saliva is the most practical and can be done immediately. Oral administration of sweet oil with turpentine oil or at times with formalin is advised.

(3) Rumen acidosis

Ingestion of large amounts of highly fermentable carbohydrate feeds causes an acute illness due to excess production of lactic acid in the rumen. Clinically, the disease is manifested by dehydration, blindness, recumbency, complete rumen stasis and a high mortality rate. Normal saline, sodium bicarbonate and antihistaminics are advised.

(4) Intussusception

It occurs commonly due to nodular worms, change in feed and local intestinal problems. The animal is dull, off-feed, kicking at the belly with no rise of temperature, frequent straining with no defaecation, colic symptoms, and at later stages, recumbency. Emergency surgery is the only rational treatment.

(5) Deficiency diseases

Young sheep grazing on drought-stricken pastures can suffer serious depletion of reserves of minerals and vitamins.

1. **Copper and Cobalt** : Characterized by anorexia and wasting. Growth and wool production are severely retarded. Wool may be tender or broken. Fine wool becomes limp and glossy and loses crimp, developing straight, steely appearance. Anemia, diarrhoea and unthriftiness occur in extreme cases. Copper or cobalt sulphate treatment causes rapid disappearance of the symptoms.

2. **Calcium, Phosphorous & Vit. D** : The daily requirement of Ca, P & Vit. D for an adult sheep is about 2.5 gm, 1.5 gm and 300-500 units, respectively. Deficiency may result in rickets in lambs and osteomalacia in adults. Mineral supplementation in diet is essential to prevent this deficiency.
3. **Vitamin A** : Vit. A deficiency occurs in sheep on dry countryside during periods of drought. Symptoms include night blindness, corneal keratinization, pyriasis, hoof defects, loss of weight and infertility. Congenital defects are common in the offspring of deficient dams. Animals should have access to green pasture and should be supplied with Vit. A in feed to prevent deficiency.

(6) Pregnancy toxaemia (Ketosis)

It is a highly fatal disease caused due to a decline in the plane of nutrition and short periods of starvation (40 hrs) during the last two months of pregnancy. Hypoglycaemia and hyperketonemia are the primary metabolic disturbances. It is primarily a disease of intensive farming systems. Symptoms include separation from the flock, apparent blindness, constipation, grinding of teeth, drowsiness, tremors of the head, twitching of lips, in-coordination, ketonic breath, leading to coma and death. Treatment comprises intravenous administration of 50% glucose. Supply of molasses in the ration and provision of additional concentrate in the last two months of pregnancy helps prevent the condition.

(7) Poisoning

1. **Organochlorine compounds** : This group includes DDT, BHC, lindane, aldrin, dieldrin, chlordane, toxaphane, methocyclor etc. which are used as pesticides on crops and as ectoparasiticides on sheep. Toxicity symptoms include increased excitability and irritability followed by muscle tremors, weakness, paralysis etc. Treatment consists of administering antidote, usually short-acting barbiturates.
2. **Organophosphorous compounds** : This group consists of malathion, darathion, chlorathion, carbophenothion, demton, dasnon, dimethylparathion, trichlorphon, dioxalithion etc. Symptoms of toxicity are profuse salivation, muscle stiffness, dyspnoea with open mouth breathing, tremors. Treatment consists of administering antidote, usually atropine sulphate.
3. **Snake bite** : Sheep are usually bitten on the scrotum or udder. The presence of hair may obscure the typical fang marks. Prolonged pain, muscular weakness, impaired vision, nausea and paralysis are generally exhibited along with symptoms of shock. If anti-venin is not available and the bite is located in an area where a tourniquet cannot be applied, excision of an area of skin and sub-cutaneous tissue can be life-saving.

(8) Wounds

During the monsoon season, a large number of animals suffer from wounds at various sites esp. around the ear, sternum and fore- and hind-legs. The main reason seems to be the awns of *Aristida* and *Heteropogon* species of grasses, which initially break the continuity of the skin, which is then attacked by flies making the wound infected and maggoty. It causes great stress in young lambs, and may also lead to conjunctivitis, corneal opacity and blindness.

(9) Dystokia

The common causes are insufficient opening of the cervical canal, heavy lambs (esp. crossbreds), abnormal fetal position and uterine torsion. The condition can be relieved surgically.

b) Infectious diseases

(1) Blackleg

It is an acute, infectious disease caused by *Clostridium chauvoei* and characterized by inflammation of muscles, severe toxæmia and high mortality (approaching 100%). All age groups are susceptible. Increased protein feeding of sheep increases their susceptibility. The spores are highly resistant to the environment and the portal of entry is through the alimentary mucosa. Infection in sheep generally takes place through skin wounds following shearing and docking. Symptoms include high fever, anorexia, discolouration of skin, crepitation and depression. Penicillin is the drug of choice for treatment.

(2) Enterotoxaemia (pulpy kidney)

It is an acute disease of sheep of all ages, but primarily of lambs. It affects animals in a high state of nutrition on a lush feed, grass or grain. Morbidity rates seldom exceed 10% but mortality rate approximates 100%. It is caused by *Clostridium perfringens* type D which normally inhabits the alimentary tract of sheep. Under certain conditions, the organism proliferated rapidly in the intestines and produces lethal quantity of toxin. In lambs, the course of illness is very short, often less than 2 hours and never more than 12 hours, and many are found dead without manifesting early signs. Symptoms include green, pasty diarrhea, staggering, recumbency, opisthotonus, and acute, clonic convulsions with frothing at the mouth. A history of sudden death of several big lambs justifies a tentative diagnosis of enterotoxaemia. Suphadimidine may be effective for treatment. Two major control measures include reduction in the feed intake and vaccination.

Infection with *Cl. Perfringens* type B (lamb dysentery) and type C (struck, hemorrhagic enterotoxaemia) result in severe enteritis with diarrhea and dysentery in lambs.

(3) Tetanus

It is an acute, infectious disease manifested by tonic convulsions of the voluntary muscles. In sheep, it commonly follows routine operations such as shearing, docking, castration and even vaccination. *Clostridium tetani* form spores which are capable of persisting in soil for a number of years. The portal of entry is usually through deep, puncture wounds. Symptoms include stiffness of limbs, lock jaw, opisthotonus, followed by death due to asphyxiation. Tetanus antitoxin is usually administered but is of little value when the signs have appeared.

(4) Pasteurellosis

It is primarily caused by *Pasteurella haemolytica* in sheep and usually occurs in pneumonic form, although a septicaemic form is not uncommon in lambs. Morbidity and mortality rates may be as high as 40%. Transmission occurs by the inhalation or ingestion of the infected material. Symptoms include pyrexia, mucopurulent discharge from the eyes and nose, coughing, depression and anorexia. Preventive vaccination is recommended, after which the animals should not be sent out for grazing for 2-3 days.

(5) Paratuberculosis (Johne's disease)

It is a chronic, wasting disease caused by *Mycobacterium paratuberculosis* and characterized by progressive emaciation and a thickening and corrugation of the intestinal wall. Mortality rate may be as high as 10%. The disease causes severe economic losses in infected flocks. As the progress of the disease is slow, it is mostly seen in older animals. No treatment is successful.

(6) Sheep pox

It is a highly contagious viral disease characterized by development of vesicles and pustules on the skin and internal lesions. Spread may be by contact with infected animals and contaminated articles, or by inhalation. It often causes death in 50% of affected animals. Infection of the pustules by

secondary organisms may cause pyrexia and other complications. The course of the disease is 3-4 weeks, during which time the sheep becomes emaciated and may shed their wool. Vaccination is the best control.

(7) Foot and mouth disease

It is an extremely contagious, acute viral disease characterized by development of vesicles in the oral cavity and in the interdigital space. Mortality is usually low (3%), but the economic loss is chiefly due to the loss in condition of the affected animal. Transmission is by contact with the diseased animal and incubation period is less than 24 hrs. Antibiotics are recommended to check secondary infections. Vaccination is the best control.

(8) Contagious ecthyma

It is a viral disease characterized by the formation of papules and pustules and the piling up of thick crusts on the lesions. The virus gains entry through unobserved wounds on the lips. The incubation period is dependant on the amount of virus introduced. The lesions are mostly found on the commissures of the lips and are covered by scabs. The course of the disease is 1-4 weeks. Antibiotics are recommended to check secondary infections.

(9) Blue tongue

It is an infectious but non-contagious, exotic disease of sheep. Natural transmission takes place through insect vectors viz. *Culicoides* and *Aedes* species, and sheepked *Melophagus ovinus*. Incubation period is less than a week. Pyrexia upto 106°F is the common initial symptom.. The disease has three clinical forms : abortive, acute and sub-acute. The abortive form mostly goes unnoticed. In the acute form, there is fever lasting for 5-6 days with nasal discharge, frothing, marked salivation, highly congested and cyanotic nasal and oral mucosa, epithelial excoriation in the oral cavity and purplish discolouration of the interdigital space, pasterns and coronets. Symptoms are less severe in the sub-acute form. Morbidity rate may be 50% or more whereas mortality rates very widely. Antibiotics are recommended to check secondary infections.

VACCINATION OF SHEEP AND GOATS

Purpose : Prevention of disease plays a major role in increasing profitability in a sheep or goat farm. Vaccination against infectious diseases is an important component of health management.

Vaccination schedule for sheep:-

Disease	Age and booster doses	Route	Remarks
Foot and mouth disease	6-8 weeks; repeat every 6-9 months	s/c or i/m depending on the vaccine	
Hemorrhagic Septicaemia	3-4 months; repeat annually	1 ml s/c	May/ June
Sheep pox	3 months	s/c	
Tetanus	Tetanus toxoid	0.5 - 1 ml s/c or i/m	
Anthrax	4-6 months; repeat annually	0.5 ml s/c at tail fold	In endemic areas only
Enterotoxaemia	3-4 months, repeat after 15 days and then annually.	2.5 ml s/c	First two doses before august

DIPPING, POURING AND SPRAYING

A. Dipping

Purpose : To eradicate ectoparasites, cure and prevent spread of sheep scab, ward off attacks by sheep blow-flies, remove waste material and dung from the fleece prior to shearing, thus facilitating production of clean wool.

Time : In India, sheep can be dipped immediately before the post-winter shearing and/or before the post-autumn shearing. In addition, they can be dipped 1-4 weeks after shearing, when the fleece has grown long enough to retain dip solution and also allow cuts and scratches incidental to shearing time to heal.

Dipping chemicals : BHC, Lindane (0.25%), DDT (0.5%), Garathion, Malathion (2.0%), Cimathion, Pyrethrin-arsenic sulphide powder (0.2% arsenic), coal tar-cresote (0.76%), nicotine and tobacco dips (0.1% nicotine, 15 kg tobacco leaves in 500 lit water).

Dipping tanks :-

a) Hand bath : In case of small flocks, a tank of galvanized iron (1.2 x 1.0 x 0.5 m) can be used. Sheep can be lifted one by one into the bath and kept for two minutes. The sheep are removed and placed on a drain board to drain off surplus dip back into the dip tank.

b) Swim bath : In large flocks, the dipping tank can be constructed of metal or concrete. It should be 12 feet long at the top and 6 feet long at the bottom, with a incline for the other 6 feet. The tank should be 2 feet wide at the top, sloping to one foot at the bottom, and it should be 6 feet high. The sheep should be completely immersed in the liquid (including their heads and ears).

Precautions :-

- Follow the manufacturer's instructions thoroughly for preparation of the dip as well as its disposal.
- Always water and rest the sheep before dipping to avoid their drinking of dipping solution.
- Choose a bright, sunny day (neither too hot nor too cold) so that the treated animals will dry quickly and the insecticide will not be diluted by rain.
- Avoid dipping of sheep in advanced stage of pregnancy.
- Avoid dipping of sick animals, sheep with wounds, young lambs (less than one month old) and stock being sent for slaughter.
- Avoid dipping of rams in breeding season to guard against injury to penis or scalding of thigh.
- Keep sheep in the holding pen for at least five to ten minutes so that they drain properly, thus avoiding wastage of dip and resultant pollution of the environment.
- Complete each day's dipping by 4 PM so that the sheep will have some hours to dry before nightfall.
- Do not return treated sheep to the shed from which they came until it is completely cleaned.

B. Pouring

When an individual sheep is affected with scab or badly affected with maggots and has open wounds, dipping is not advisable. In such animals, a small quantity of dip is poured into the fleece along the back, sides and belly to achieve the objectives of dipping.

C. Spraying

Spraying sheep with a fly repellent insecticide solution over the backs and sides is an effective method of controlling ectoparasites in tropical countries. In developed countries, fly-repellent solution is sprayed in the form of a fine mist through a series of nozzles into a roomy tunnel through which the sheep are forced to pass. However, spraying can be done with the help of a power sprayer or hand sprayer in case of small flocks. Spraying is not as economical or efficient as dipping and is recommended only for young lambs which cannot be dipped.

Housing systems, layout and design of different buildings for sheep farms

Purpose : Optimal housing enables better care and supervision, enhanced herd efficiency and efficiency of labour, and provides maximum comfort to the animals.

Normally sheep and goats do not require elaborate housing facilities, but minimum provisions will definitely increase productivity, especially protection against inclement weather conditions and predation. Often, the flocks are penned in the open during fair weather and some temporary shelters are made use of in monsoon and winter. Sheep can be economically reared under ranch system. Requirements of building units are more or less the same for sheep and goats, except that additional buildings are required for goats reared for milk.

The shed site should be easily approachable and spacious, dry, elevated, well-drained and protected from strong winds. An East-West orientation ensures cooler environment. A “lean-to” type of shed, located against the side of an existing building, is the cheapest form of building. Loose housing is more advantageous as compared to conventional/stall-fed sheds because it is suitable for semi-arid regions and large-sized flocks, it involves less expenditure, it provides more comfort to the animals, it is less labour-intensive, and it provides freedom of movement and gives the benefit of exercise. Stilted housing is common in areas with heavy rainfall.

Floor space requirements :-

Sl. No.	Type of animal	Minimum floor space (m ²)
1.	Ram or buck in groups	1.8
2.	Ram or buck, individual	3.2
3.	Lamb or kids in groups	0.4
4.	Weaner in groups	0.8
5.	Weaner, individual	0.9
6.	Yearling, individual	0.9
7.	Yearlings in groups	0.9
8.	Ewe or doe in groups	1.0
9.	Ewe or doe, individual	1.2
10.	Ewe with lamb	1.5

Types of sheds :-

Sl. No.	Type of shed	Size (m)	Height (m)	Maximum animals
1.	Ewe/doe shed	15 x 4	3	60
2.	Ram/buck shed	4 x 2.5	3	3

Date	Condition	Treatment	Remarks				Date	Live weight	Ante-mortem features	Dressed weight	Dressing %	Weight of skin	Remarks

2. Ewe record

Ewe no.	Sire no.	Dam no.	Date of birth	Birth weight	Type of birth	Type of rearing	Age and weight at weaning	Shorn fleece weight	Lamb details	Remarks

3. Ram record

Ram no.	Sire no.	Dam no.	Date of birth	Birth weight	Type of birth	Type of rearing	Age and weight at weaning	Shorn fleece weight	Progeny performance	Remarks

4. Lamb crop register

Year	Season	Date ram turned in	Date ram turned out	Ram used	Ewe no.	Date of lambing	Lamb no.	Sex	Birth weight	Type of birth	Nursed by (ewe no.)

5. Wool production register

Year	Season	Date	Sheep no.	Days of growth	Sides		Shoulder		Belly		Thigh		Total staple yield length	Grade	Remarks
					Fine ss	Yield	Fine ss	Yield	Fine ss	Yield	Fine ss	Yield			

6. Health register

Date	Animal no.	Complaint	Treatment	Remarks

7. Roll call register

Date	Rams	Ewes	Ram lambs	Ewe lambs	Total	Reason for variation	Remarks